Theory Book

COMPUTER APPLICATIONS TECHNOLOGY

11

basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

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As an organisation rooted in technology, we believe in providing a new bold digital world to communities we operate in. This unique digital book provides the fundamental knowledge necessary for a sound grounding from which to make practical use of the complete and indispensable application-oriented information regarding Computer Applications Technology (CAT) and Information Technology (IT). It is a foundational reference for today's secondary school learners and teachers alike – as well as for the next generation of CAT and IT students.

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Contents

Dear learner

Welcome to the *Theory Book for Computer Applications Technology Grade 11*. Please read the information below about the book before you start using it. This book provides you with all the information you need to cover the Grade 11 Computer Applications Technology curriculum. It will also help you develop the skills, attitudes and values you need to be successful in your studies.

Each chapter in the book has the following features, which are meant to help you learn:

- **Overview**
  This is an overview of the contents and the units of the chapter.
- **Learning outcomes**
  These are the objectives that are addressed in the chapter. It states what you should be able to do by the end of the chapter and gives you an idea of what will be expected of you as a learner. After completing each chapter, ask yourself, 'Am I able to do everything stated in the learning outcomes?'. If not, you should revise the content covered in the chapter.
- **Introduction**
  The introduction is a brief summary of why you will be learning the content that is covered in the chapter. Sometimes it will give you a brief background of how far technology has come, while at other times it will just give you a short summary that introduces the content that will follow in the chapter.
- **New words**
  These are difficult words that you may not have encountered before.
- **Activities**
  These cover questions you have to answer based on the content presented before them. Activities will help you check whether you have understood the content presented in the book or not.
- **'Something to know', 'Take note' and 'Tip' boxes**
  The boxes provide extra, interesting content that might caution you to 'take note' of something important; or give you additional information. Note that the content in these boxes will not be part of your exams.
- **QR Codes, Videos and Screen captures**
  These will link you to online content. When you are in the eBook, you can easily access the links.
- **Revision activities**
  This is a revision activity based on what you have covered in the chapter. Take time to answer the questions on your own. You teacher may also use these to assess your performance during class.
- **At the end of the chapter**
  This is a checklist to ensure you understand all the content cover in the chapters. These criteria are linked to the learning outcomes at the beginning of the chapter.
- **Glossary**
  Brief explanations for new words are given in the glossary at the back of the book.

Before getting started, watch the video in the QR code in the margin.

INTRODUCTION

Before getting started, watch the video in the QR code.

https://www.youtube.com/watch?v=nKlu9yen5nc

You can use the QR codes on these pages to link to online content for further information on these topics.

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TERM 1

GENERAL CONCEPTS OF COMPUTING

CHAPTER 1

CHAPTER OVERVIEW	
Unit 1.1	Information processing cycle: input, processing, storage, output and communication
Unit 1.2	Computer features and classification
Unit 1.3	The role of ICTs in the workplace
Unit 1.4	The value of CAT

By the end of this chapter, you will be able to:

- Describe the information processing cycle
- Discuss different types of computers and their typical features
- Categorise computers
- Elaborate on the role of ICT in the workplace
- Discuss the value of CAT as a subject

INTRODUCTION

In Grade 10, you learned about the basics of computers. You were shown that all computers use the same basic process to function, namely the input, processing, storage, output and communication process. This is called the **information processing cycle**.

This chapter will refresh your knowledge on the basics of how computers work, the different types of computers there are and their typical features. You will then learn about how computers are categorised and how ICT has made the workplace faster and more efficient.

UNIT

1.1 Information processing cycle

Before you can start to learn about the different types of computers that you will come across, you need to understand the basics of how computers work. All computers, whether they are the smartphone in your hand or large, powerful servers, operate on the same five basic principles. These are input, processing, storage, output and communication. Each component of a computer performs one of these functions, but they all work together to make the computer work.

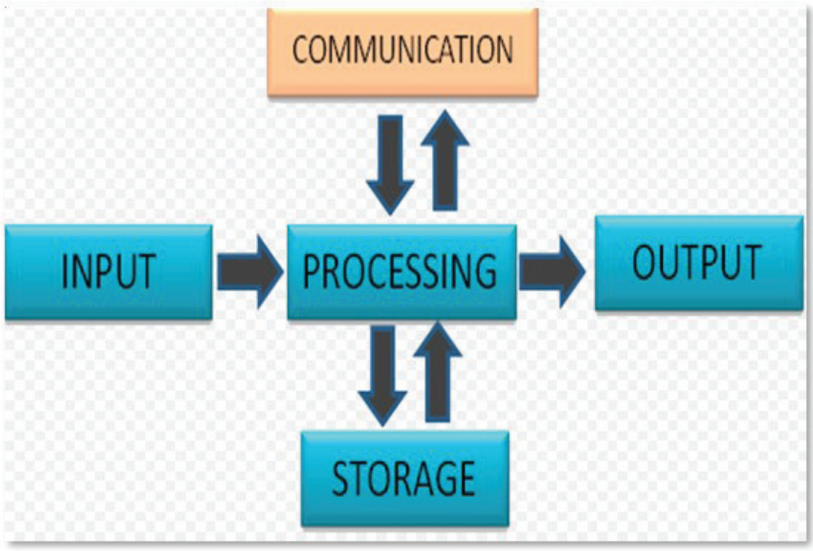


Figure 1.1: *The stages of the information processing cycle*

In this section we will look at each of these stages and how they work together. We will also look at how these processes can get one computer to communicate with users and other computers. The five main steps are input, processing, storage, output and communication.

INPUT

In the input stage, the data is entered into the computer. There are many ways to do this. In fact, there are as many ways to input data as there are input devices. You would have learned about input devices in Grade 10 but just to refresh your memory, input devices are things such as keyboards, touchscreens and microphones. The user inputs the data (for example, by typing on a keyboard or speaking into a microphone) into the computer. The device takes this data and converts it into a series of 1s and 0s (this is called **binary code**).

PROCESSING

The central processing unit (CPU) inside the computer then takes that binary code and does the calculations needed to get that data to display in a way that makes sense to the user. The CPU works with the computer's memory to get instructions on how to display the information from the input device and stores it as pixels in the computer's memory. This information is sent to the output device to be translated and displayed in a way that is useful. All of this takes a fraction of a second to do.

STORAGE

Storage is where the computer takes the input and stores it in its memory banks. There are many ways to store the data, but the basic process is as follows:

1. The CPU writes the data to the computer's temporary storage, or random access memory (RAM).
2. The computer then waits for the user's command to move the data from the RAM to more permanent storage. If that command is given, the computer writes the data to the disk drive.
3. Lastly, the computer saves the data in a location on the drive, either the default storage location or a location set by the user. The user can then recall this stored information at any time.

You can also store information using external storage devices (for example USB drives or external hard drives).

OUTPUT

Output is where the computer takes the pixels from the processing stage and displays them in a way that the user can see them. There are many kinds of output devices, such as printers, screens, video and audio devices.

These devices make the raw data usable and visible, allowing human users to interpret the data, turning it into information. This could be the sound waves of a song or the letters in a document.

COMMUNICATION

Communication is linked to the other stages in the information processing cycle. Each part of the cycle happens because one of the other steps came before it, meaning that they are linked. This link is the communication aspect of the information processing cycle. The most visible aspect of this is the relationship between input and output. Input and output happen almost immediately (for example typing a letter on a keyboard makes it appear almost immediately on a screen). This is communication between the user and the computer.

Communication can then further be sent across a network to other computers. Think about browsing the internet. The internet is basically a huge network of computers linked across the world. Opening your browser connects you to those other computers and these computers communicate with each other to give you what you are looking for. Computers that are linked in a network also communicate with each other. Examples of this are computers linked on a company's **intranet** or those linked to a server.

SENDING A WHATSAPP MESSAGE

To see how this works, think about sending a WhatsApp message from your smartphone. To start the process, you open WhatsApp and use the touch keyboard to enter your message (this is input, output and communication). Once you press SEND, your WhatsApp application communicates with the servers to send the message and displays it in the current conversation (this is communication, processing and output). The app keeps a record of the conversation on your phone, your friend's phone and the WhatsApp server (this is storage).

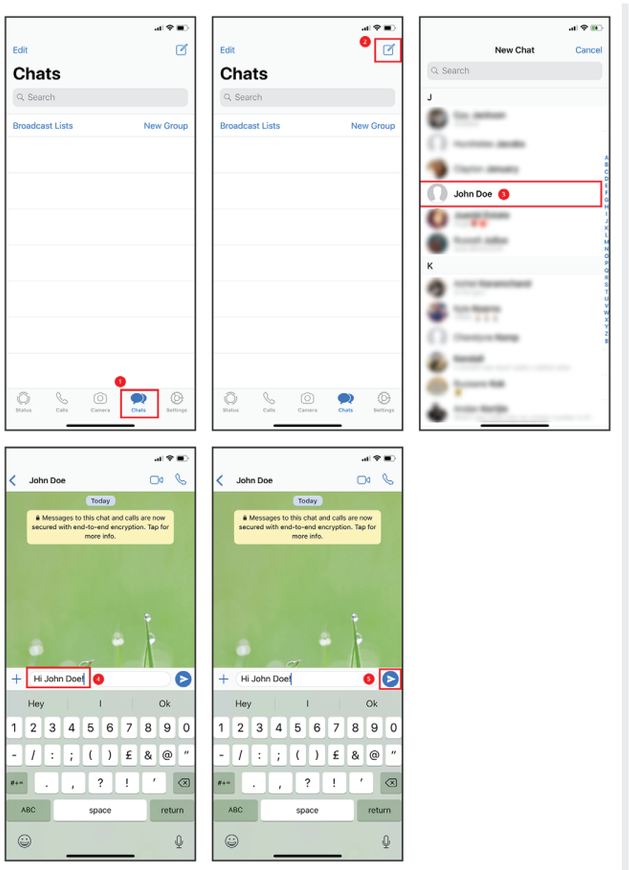


Figure 1.2: *How sending a WhatsApp message works*

As you can see, these processes are interlinked at every step of the way.

HOW COMPUTERS WORK

https://www.youtube.com/watch?v=0Ax_6-wdslM

Activity 1.1

Do the following activity on your own.

1. Usually Mpumi uses the computers in her school's computer lab to do her homework. Mpumi's parents recently decided to get her a computer so that she can do more of her work at home.
   a. What kind of computer should Mpumi use? Give two reasons for your answer.
   b. List two types of input devices she would need.
   c. List two types of output devices she would need.
   d. List two types of storage devices she would need.
   e. Mpumi wants to save a Microsoft Word document on her computer as "Geography.docx". Explain the basic process of how she will create and save this file on her computer. NOTE: Consider what happens during each stage of the information processing cycle.

UNIT

1.2 Computer features and classification

Now that we understand how computers work, we can look at what types of computers there are and their typical components. Computers can be broadly separated into three categories, namely:

1. **Non-portable:** server, desktop
2. **Portable:** laptop, tablets, smartphones
3. **Dedicated devices:** ATM, smart fridge

These devices are classified according to how portable they are, what their processing power is and what they are used for.

This unit will look at these types of computers and their typical components, as well as look at how each type of computer can be classified.

COMPUTER CLASSIFICATION

Table 1.1 lists the different kinds of computers, what they are used for and their processing power.

Table 1.1: *Computing device classification*

DEVICE	USES	PROCESSING POWER	PORTABILITY	IMAGE
Servers	Their primary purpose is to serve information to users. They usually focus on one type of information.	They are designed to process massive amounts of data quickly, so have an extremely high processing power.	Not at all portable, since they are connected to each other in a network. Removing one means that it no longer functions as a server.	
Desktop PCs	General office and household use, including gaming, photo and video editing, budgeting and web browsing.	They can be extremely powerful, especially those designed for heavy use. In general, the processing power ranges from medium to very high.	Not very portable, since they are large and heavy. The internal components can be quite delicate and the PC will need an external power source.	
Laptops/ notebooks (portable devices)	Generally used for office work or personal use.	They are referred to as mid-range devices, meaning that they are suitable for normal use (document creation and editing, web browsing, etc.).	These devices are portable. They contain a battery, so do not always need an external power source. Most are lightweight with some, such as the Asus Zenbook, being extremely light.	
Tablets (portable devices)	Mainly used for entertainment or web browsing.	Their processing power is not very high.	Tablets are also portable as they are designed to be mobile. Tablets play an important role in the rise of mobile computing, which is the idea that you can take your computer anywhere.	
Smartphones (portable devices)	Designed mainly as a communication device and come with pre-installed messaging and voice-call apps.	They are not designed to be high-powered computing devices, although some do have quite a lot of processing power.	Smartphones are extremely portable since they are a blend of ultra-portable computing devices and mobile technology.	

DEDICATED DEVICES

Computers are everywhere around you, even in places that you least expect. It might surprise you to learn that computers are in **ATMs**, point-of-sale devices (that is, tills and card machines) and even fridges and air-conditioners.

These computers are called dedicated or embedded devices and their components will differ depending on what they are installed in, but they will most often consist of a display of some kind (either a screen or **light emitting diode (LED)** display) and some form of input device (such as a keypad or remote control).

They are usually limited in what they can and cannot do, as they are designed to perform very specific functions.

In recent years, so-called "smart devices" have become more popular and available. These devices are designed to interact with each other and the internet to make life easier for their users.

Table 1.2 lists different examples of dedicated and embedded devices.

Table 1.2: *Dedicated and embedded devices*

DEVICE	DESCRIPTION	IMAGE
ATM	ATMs are electronic banks that allow customers to draw and deposit money, pay bills and apply for loans without needing to visit a branch of the bank. ATMs are designed to only perform banking functions, so they are called dedicated devices. With the popularity of cryptocurrencies such as Bitcoin on the rise, there is now a new generation of ATMs that can handle cryptocurrency transactions. These Bitcoin ATMs can be used to buy and sell Bitcoin and other selected cryptocurrencies.	
Smart fridges	Smart fridges have touchscreens and are able to connect to the internet using Wi-Fi. Smart fridges can customise temperatures inside different compartments, track the expiry dates of food and alert you to when to use that food before it expires, and create grocery lists that sync with your smartphone. Different brands of smart fridges have different features. The computers inside smart fridges are called embedded devices.	

Activity 1.2

Do the following activity on your own.

1. Briefly describe what a dedicated device is.
2. Give five examples of a dedicated device.
3. Place the following devices in order of most portable to least portable.
   - A. Mainframe
   - B. Smartphone
   - C. Laptop computer
   - D. Desktop computer
4. Place the following devices in order of most processing power to least processing power.
   - A. Mainframe
   - B. Smartphone
   - C. Laptop computer
   - D. Desktop computer
   - E. Server
5. Determine which of the following computing devices are used in the following examples:
   - Desktop PC
   - Laptop
   - Tablet
   - Smartphone
   - Server

EXAMPLE	TYPE OF COMPUTING DEVICE
1. David works for a bank and needs to store petabytes of data on a computer system.	
2. Maseko wants to create a small graphic design company and needs 10 computers suited for this purpose.	
3. Mary-Anne travels a lot for business. During these business trips she needs a device she can use to create and edit documents.	
4. Darwin has a food blog on which he posts pictures of different locations where he has eaten. He needs to be able to take photos whenever he eats somewhere new.	
5. Carmen is very artistic and wants a computer that she can easily draw sketches on whenever she explores the countryside and beach.	
6. Emmanuel wants a simple and affordable computer that he and his family can use at home.	
7. Akshara is a college student who needs a computer she can practice programming on in-between lectures.	
8. Bongi needs a device she can use to socialise with her friends on Facebook, Twitter and WhatsApp.	
9. Minke has decided to launch a website so that she can sell her designer clothing online. This requires a computer that can store and manage information on her products, clients, orders, etc.	
10. Oliver is a game developer who works from home and needs a very powerful computer that he can easily upgrade over time.	

1.3 The role of ICTs in the workplace

COMPUTERS REPLACING HUMANS IN THE WORKPLACE?

ICT is changing the workplace in South Africa:

https://www.youtube.com/watch?v=iULC9wHu1qc

As you learned in Grade 10, **information and communications technologies (ICTs)** have an impact on every aspect of what people do at home, at school or at work. By looking at what you have learned so far in this chapter, you can see how ICTs have become a major component of daily life. This section will look at the role that ICTs play in the workplace.

The main reason ICTs are used in the workplace is that they allow humans to do their work faster, more efficiently and with fewer wasted resources. Companies no longer need staff to handle physical mail as email is faster and more effective than an employee sorting through post and delivering it to the correct people.

HOW ICTS IMPACT THE WORKPLACE

ICTs have also changed how workplaces are organised. ICTs allow employees to be more flexible in where, when and how they work, giving rise to the concept of mobile or virtual offices. Mobile offices are usually built for temporary purposes, usually within moveable, temporary buildings (such as an old shipping container). They can be completely virtual, with employees using mobile computing devices (such as laptops, tablets and smartphones) to create an office space outside of the business environment. Virtual offices can also be rented spaces that give businesses a physical address and office-related services (such as a telephone exchange) without the business needing to sign business leases or hire administration staff.

Figure 1.3: *ICTs connect staff working in different locations and aid communication between them*

Virtual offices are especially popular with new businesses, as there are lower starting and administrative costs, and a higher degree of flexibility and efficiency, since staff members do not have to handle day-to-day administrative tasks.

This has led to a change in how companies employ staff. The rise in flexi-time schedules (where staff work hours that suit them and not according to rigid timetables) and mobile offices has led to something called the decentralisation of labour. In the past, employees all worked at a central location according to a fixed time schedule (for example, at an office from 9 am to 5 pm). Now, employees can be scattered across the globe, all working at different times (that may or may not overlap with others) and in different places. Employers and employees are able to keep in touch using the internet and various software programs (such as Skype or email).

ICTs have also led to the rise of office automation. In some companies, ICTs have completely replaced the need for reception staff to answer telephones and take messages, due to messaging services and cellular technology.

OFFICES THEN AND NOW

A job that is slowly being phased out of existence due to ICTs is the receptionist or switchboard operator. Their job was to take calls and direct those calls to the correct department or person in a company. This is now handled by automated responses, like those used by large service providers such as MTN or Vodacom. When you dial their customer support number from your smartphone, an automated message plays, asking you to select a number to be put through to the correct department to help you with your query. In some cases, you might not even need to speak to a person, since there may be a computer on the other side of the line that is programmed to answer your questions with a series of automated responses.

Another change that ICTs have brought to the workplace has been the rise of **bring your own device (BYOD)** policies. As smartphones and tablets have become more cost-effective to buy, there has been a rise in the number of companies adopting a BYOD policy. BYOD means that businesses can avoid the costs of purchasing computing equipment for new staff members, as staff are encouraged to bring their own computers. Staff can also tailor their computers to their needs. However, BYOD is mostly only cost-effective for small to medium businesses, as larger businesses have the buying power to make arrangements with ICT providers to get the best devices for their staff.

BYOD polices also allow staff to take their devices home, meaning that businesses have a lower insurance risk as they do not need to keep expensive technology on their premises.

Activity 1.3

Do the following activity on your own.

1. As technology is always changing and improving, people are finding more ways to use technology to make certain processes in the workplace more efficient.
   a. What are ICTs and why are they used in the workplace?
   b. In the workplace, how are ICTs used to improve the way employees are paid?
   c. In the workplace, how are ICTs used to improve the way employees communicate with each other? Also mention TWO software programs that employees can communicate with.
2. Give TWO examples of how ICTs can be used to improve a school environment.
3. Name TWO jobs, which currently exist, that you think will be replaced by ICTs in the future. Give a reason for each of your answers.

WANT A JOB IN 2020?

https://www.youtube.com/watch?v=Y9FOyoS3Fag

1.4 The value of CAT

We are living in the information age so it is important for people to understand the value of computers and how to use them. This is where CAT as a subject comes in. By understanding computers and their basic components, programs and applications, you will be able to adapt to new developments in computing quickly, easily and with less training. CAT teaches you the basic skills you will need to prosper in any career, even those that use specialised software and equipment.

COMPUTER LITERACY AND EMPLOYMENT

Apart from using your computer to finish your schoolwork or do research for projects, knowing how to use a computer is a requirement for almost any job today. From obvious jobs, such as computer programmers and graphic designers, to less obvious jobs, such as truck drivers and carpenters, each person entering the job market must know how to use a computer with some degree of skill.

With computers and the internet becoming more accessible, an entirely new workspace has opened up, where digitally savvy people are using computers and computing technology to advertise, promote and build businesses online. Online marketing (or digital marketing) is one of the fastest growing job sectors in the world and skilled digital marketers are in high demand.

It is not only people who will be working in ICT-related fields who will need to be computer literate. In 2017, a News Corp Australia article found that by 2020, about 90% of the Australian workforce would need to have basic computer skills to communicate with others and to find information about their tasks and daily duties.

CAT is also an incredibly powerful tool when it comes to managing information. By knowing how you can use a computer to manage large amounts of data and information, you will be able to work quickly and more efficiently in your future career. CAT teaches you how to use programs and systems to manage data and information.

CAREER OPTIONS AND THE IMPACT ON CAREERS AND FIELDS OF STUDY

Taking CAT at school level opens the door to many possibilities and career options once you have completed your schooling. Almost all careers available to you use computers in some part of their daily operations. From fashion, web and graphic design to accounting, law and medicine, having CAT as a subject will allow you to use the technologies associated with these careers. A good understanding of computer applications technologies also opens up Information Technology and Management to you as a field of study and work.

Studying CAT will also give you insight into how the internet and the World Wide Web function and how they can be used to enhance your knowledge and life.

Activity 1.4

Do the following activity on your own.

1. Bernes is a learner who dreams of becoming a doctor when he grows up. Bernes has decided that he does not need to take CAT because it is not relevant to his dream job.
   a. What job would you like to do in the future? Mention three ways in which CAT can prepare you for this job.
   b. Name three ways in which CAT could improve Bernes' study life as a university medical student.
   c. Do you think that people in the medical field need to know how to work with computers? Give a reason for your answer.
   d. While taking a tour of one of the best medical universities, Bernes discovers that a lot of the medical equipment makes use of computers.
      i. What type of computer is used in medical equipment such as heart rate monitors?
      ii. Give two reasons why you think a lot of medical equipment makes use of computers.
2. Do you know of a job that cannot benefit from CAT? If yes, mention it and give a reason for your answer. If no, explain your answer.

REVISION ACTIVITY

QUESTION 1: MULTIPLE CHOICE

1.1 Which of the following is not part of the information processing cycle? (1)
- **A.** Communication
- **B.** Output
- **C.** Storage
- **D.** Memory

1.2 Which of the following can be used for storage? (1)
- **A.** CPU
- **B.** HDD
- **C.** GPU
- **D.** ICT

1.3 Which of the following computers is not portable? (1)
- **A.** Laptop
- **B.** Tablet
- **C.** Smartphone
- **D.** Server

1.4 Which of the following computers can be used to process large amounts of data quickly? (1)
- **A.** Mainframe
- **B.** Workstation
- **C.** Tablet
- **D.** Notebook

1.5 Which of the following is not a "smart device"? (1)
- **A.** ATM
- **B.** Smart light bulb
- **C.** Calculator
- **D.** Xbox 360

... continued

REVISION ACTIVITY

QUESTION 2: TRUE OR FALSE?

Choose the answer and write True or False next to the question number. Correct the statement if it is FALSE. Change the underlined word(s) to make the statement TRUE. (You may not simply use the word NOT to change the statement.)

a. Taking CAT at university level opens up many career possibilities. (1)
b. New businesses can lower their administrative costs by using a centralised office. (1)
c. Printed statements have been mostly replaced by electronic statements sent via email. (1)
d. CAT as a subject teaches us how to use computers so that we can become digitally savvy. (1)
e. Networking is part of the communication stage. (1)

QUESTION 3: MATCHING ITEMS

Choose a concept from Column B that matches a description in Column A. Write only the letter next to the question number (e.g. 1J). (5)

COLUMN A	COLUMN B
1. A device that connects a computer to other computers in a network.	**A.** Laptop
2. A device with medium processing power that uses miniaturised parts.	**B.** Smart fridge
3. A device that stores large amounts of data and processes data at extremely high processing speeds.	**C.** Smart light bulb
4. A device that reduces the amount of energy that a household consumes.	**D.** Smartphone
5. An extremely portable device that mainly makes use of mobile technologies.	**E.** ATM
	F. CPU
	G. Server
	H. NIC

QUESTION 4: SHORT AND MEDIUM QUESTIONS

4.1 Briefly explain what happens during the following stages of the information processing cycle.
  a. Processing stage (2)
  b. Storage stage (2)
4.2 Compare the functions of input and output devices. (4)
4.3 Name a device that can be used to electronically transfer money. (1)
4.4 What is the relationship between CAT and ICTs? (2)
4.5 Give the name of a non-portable device that is suitable for creating documents and web browsing. (1)

... continued

REVISION ACTIVITY

QUESTION 5: SCENARIO-BASED QUESTIONS

Adam and his family have decided to open a sweet shop called the Sweet Company. As his shop starts to grow, he decides to open a second Sweet Company at a different location. In order to keep track of both shops, he decides to start integrating ICTs and computers into his business.

a. Name TWO computing devices Adam and his employees can use to better run and manage his shops. Give a reason for each of your answers. (4)
b. Mention THREE ways in which ICTs can improve the way that Adam's sweet shop is run. (3)
c. Mention TWO instances where CAT skills can be used to improve the running of Adam's sweet shops. (2)
d. Give TWO reasons why Adam should consider purchasing a UPS for both shops. (2)
e. Adam can now work on a flexi-time schedule. Explain what it means to work flexi time. (2)

TOTAL: [40]

AT THE END OF THE CHAPTER

NO	CAN YOU ...	YES	NO
1.	Describe the information processing cycle and how it relates to how computers work?		
2.	Distinguish between the different types of computers in terms of their processing power, uses and portability?		
3.	Describe how to categorise computers?		
4.	Define the role of ICTs in the workplace?		
5.	Discuss the value of CAT as a subject and how CAT can influence your future career?		

TERM 1

CHAPTER 2

INPUT, OUTPUT AND OTHER DEVICES

CHAPTER OVERVIEW	
Unit 2.1	Input devices
Unit 2.2	Output devices
Unit 2.3	Devices, software and equipment

By the end of this chapter, you will be able to:

- Describe various types of input devices, including scanners, digital cameras, biometric input devices and others
- Discuss the advantages, disadvantages and limitations of various input devices
- Explain how the quality of scanners and digital cameras is measured
- Describe various types of output devices, including display devices and interactive whiteboards
- Discuss the advantages, disadvantages and limitations of various output devices
- Explain what criteria are used to measure the quality of display devices
- List and describe the software and equipment needed to operate input and output devices
- Discuss the purpose of optical character recognition (OCR) and hand-held OCR devices

INTRODUCTION

In Grade 10, you learned that hardware is the physical components of a computer. This includes items such as the monitor (or screen), keyboard and mouse.

An input device is any device that allows you to enter data into a computer and interact with it. Common input devices include keyboards, computer mice, touchpads and touchscreens. You also learned about the basics of digital cameras, scanners and readers such as radio-frequency identification (RFID), magnetic strip and OCR readers. Other input devices are video and audio input devices such as webcams and microphones, and biometric input devices such as fingerprint scanners.

Output devices take the processed input from a computer and display it in a way that is easy for humans to understand. Screens are the main output devices of any computer. Liquid crystal displays (LCDs) and LED screens are the most popular types. Printers are another common type of output device. There are two main printer types, namely inkjet and laser printers.

Headsets and speakers are designed for audio output, with other output devices being fax machines, multifunction devices (which combine faxing, emailing and printing) and data projectors.

Processing components include hardware such as the:

- Motherboard, which connects the components in a computer and houses the ports, such as the universal serial bus (USB), video graphics array (VGA) and **high-definition multimedia interface (HDMI)** ports to connect input and output devices.
- Central processing unit (CPU), which receives and carries out the instructions inputted by the user.
- Graphics processing unit (GPU), which makes the calculations and follows the instructions necessary to display images on a screen.

Storage devices are the computer components designed to keep (or store) data. This data can be the information needed to make the computer function, such as the operating system or **basic input/output system (BIOS)**, or data created by the user, such as images, documents, text files and so on.

These components, called storage media or storage devices, are any piece of computing hardware used to keep or store data files. They can hold and store information permanently or temporarily and can be internal or external.

Internal storage media, such as hard drives and RAM, are inside a computer and part of it, while external hard drives and USB drives are outside a computer and can be removed easily and quickly.

UNIT

2.1 Input devices

As you learned in Chapter 1, a computer works using the information processing cycle. Input devices are the key components of the first stage of the cycle, the input stage. Input devices are what we use to interact with a computer. These can be things such as keyboards and computer mice, touchpads and scanners. The combination of keyboard and mouse used to be the most common input device, but the rise of the smartphone has made the touchscreen the most popular and common input device in the modern age.

There has also been a rise in the use of alternative input devices, such as fingerprint and face recognition to unlock your smartphone, and speech-to-type devices that are used by people with physical challenges.

This unit focuses on input devices other than the mouse and the keyboard as they were covered in Grade 10.

VARIOUS INPUT DEVICES

There are a number of input devices that you can use with computers. Table 2.1 lists these devices, their uses, and their advantages and disadvantages.

Table 2.1: *Input devices*

NAME AND IMAGE	PURPOSE	WHEN TO USE	ADVANTAGES	DISADVANTAGES
Scanners 	Convert physical data (documents or photographs) into electronic data.	• Scanners are used whenever you need a digital copy of a physical (hard copy) document.	• Produce accurate and high-resolution images. • Scanned images can be added to electronic documents or edited easily.	• Scanned images can lose clarity and quality. • Image files can be very large and take up space. • The quality of the original affects the quality of the scanned image.
Digital cameras 	Digital cameras are used to capture digital images and input them directly into a computing device.	• Digital cameras can be used to capture images. • The digital cameras found in smartphones can also be used to record video.	• You can view your images immediately and discard any that you do not want. • Digital cameras are more environmentally friendly because you do not need to use toxic chemicals to develop the film.	• The quality of the image will be limited to the maximum resolution of the digital camera. • Digital cameras have certain limitations for nighttime photography.
Biometric input devices 	Biometric input devices use the unique measurements and characteristics of your body to interact with a computing device.	• Fingerprint and face scanners in smartphones. • Eye and iris scanners. • Voice recognition software.	• Faster to use than passwords. • Biometric input is harder to hack.	• It is influenced by disease and substances. • Some people's fingerprints cannot be read. • Biometrics are for life and cannot be changed. • There are some privacy concerns about collecting biometric data.

… continued

NAME AND IMAGE	PURPOSE	WHEN TO USE	ADVANTAGES	DISADVANTAGES
ATMs and point-of-sale (POS) terminals  	ATMs and POS terminals are specialised input devices.	• ATMs are used in the banking industry to deposit or withdraw cash and get statements. • POS terminals are used in the retail and restaurant industries to track stock and orders.	• ATMs make basic banking faster and easier. These features are available 24/7. • POS terminals can keep accurate track of stock and can provide reports on sales and stock movement.	• ATMs can be targets of card-skimming scams and using ATMs to draw cash can make you a target for criminals. • POS systems also need to have their software updated and staff must be trained to use them.
Wireless input devices 	These are usually keyboards and computer mice that do not use cables to connect to a computer.	• Wireless devices can be used with almost any computing device.	• Wireless devices are not limited by cables and can be used anywhere.	• Distance can affect the functionality of these devices; issues may be experienced the further away they are. • They have limited by battery life.
Handheld devices 	These devices include smartphones and tablets.	• Handheld devices such as smartphones and tablets can be used to make calls and send instant messages. They can also be used if you do not have access to a traditional computer.	• Handheld devices can connect you to the world.	• Their performance is limited by battery life. • Potential for information to be leaked. • Increased risk of damage to device.
Touchscreens 	Touchscreens are used as the primary input devices for smartphones and tablets. They are also used on laptops and PCs, ATMs, POS terminals and in biometrics.	• The most common use for touchscreens is as the input method for smartphones and tablets.	• Touchscreens are more versatile and compact.	• Touchscreens have to be kept clean to function optimally. • Limited by battery life. • Increased risk of damage.
Alternative input devices 	These devices are used as alternative input methods.	• The most common use for alternative input devices is the **virtual keyboard**.	• Virtual keyboards are extremely reliable.	• It does not offer tactile feedback.

WHAT DETERMINES THE QUALITY OF THE IMAGE TAKEN BY A SCANNER OR CAMERA?

There are three main factors that determine the quality of the image taken by a scanner. These are:

1. Colour depth
2. **Resolution**
3. Dynamic range

Colour depth is also known as **bit** depth and refers to the number of bits used to indicate the colours of a single pixel. The higher the bit number, the better the colour depth. You can see this in Figure 2.1.

Figure 2.1: *32-bit (left) versus 8-bit (right) colour depth.*

The image on the left is in 32-bit colour while the image on the right is in 8-bit colour. In the image on the left, the details in the background are sharper and the colour of the leaf is deeper and more vibrant compared to the image on the right.

Resolution is the amount of detail an image can hold and it is measured in **pixels per inch (ppi)** or **dots per inch (dpi)**. These measurements show you how many dots or pixels are in a one-inch square (an inch is about 2,5 cm). The higher the ppi or dpi, the more information there is in the square. This means that the image will be of higher quality.

The final quality factor is the *dynamic range*. This measures the range of light the scanner can read and use to produce a range of **tones** and colours.

Camera quality is determined by three factors:

1. Resolution
2. Lens aperture
3. Focal length

Resolution is the amount of detail that a camera can capture. In digital cameras, resolution is measured in **megapixels**.

The *lens aperture* is the maximum amount that the lens can open. The wider it opens, the more light it can take in, which means that you need less light to take a good picture.

How much a camera can zoom is determined by its *focal length*. The focal length is shown by a number and the times symbol (×). A zoom of 3× means that the longest focal length is 3× the distance of the shortest focal length.

Activity 2.1

1. Multiple choice:
   a. Which of the following does NOT determine the quality of a digital camera?
      A. Resolution
      B. Focal length
      C. Price
      D. Lens aperture
   b. Which of the following is NOT an example of biometric input devices?
      A. Voice recognition
      B. DNA tester
      C. Fingerprint scanner
      D. Facial recognition
   c. Which device CANNOT be used when you need to convert a physical copy of a document into a digital copy?
      A. Digital camera
      B. Scanner
      C. Smartphone
      D. Laser keyboard
2. Match Column B with Column A:

COLUMN A	COLUMN B
2.1. The amount of detail that a camera can capture, measured in megapixels.	A. Pixels per inch
2.2. The category of devices used to interact with a computer.	B. Bluetooth keyboard
2.3. Another name for a wireless keyboard.	C. Resolution
2.4. Devices that link to video-calling applications using the internet.	D. Lens aperture
2.5. Used in the retail and restaurant industries to track stock and orders.	E. Touchscreens
2.6. The primary input devices for smartphones and tablets.	F. Webcams
2.7. The maximum amount a camera lens can open.	G. Input devices
2.8. The measurement for scanner resolution.	H. Point-of-sale terminals

3. Write True or False next to the question number. Correct the statement if it is FALSE. Change the underlined word(s) to make the statement TRUE. (You may not simply use the word NOT to change the statement.)
   a. It is <u>good practice</u> to regularly back up your files.
   b. A POS system <u>does not</u> need to be maintained after installation.
   c. Touchscreens <u>can be</u> used for biometric scanning.
   d. Resolution is the amount of <u>colour</u> an image can show.
   e. Dynamic range measures the range of <u>light</u> a scanner can read.

... continued

Activity 2.1

… continued

4. Answer the following questions in your own words:
   a. What factor determines how much a camera can zoom?
   b. Give three advantages and three disadvantages of scanners as input devices.
   c. Briefly describe the factors that determine a scanner's quality.
   d. Why would a Nikon Coolpix B500 or a Canon 4000D camera not be considered an input device?
   e. Describe why digital cameras in smartphones become outdated very quickly.
   f. Describe the factors that determine a camera's quality.
   g. How would you use fingerprint scanners at a school?
   h. Describe why a criminal might clone your fingerprints.
   i. What are the advantages of POS systems and ATMs?
   j. Why are touchscreens becoming more common?
   k. Give two types of wireless input devices.
   l. Give one disadvantage of laser keyboards.

UNIT

2.2 Output devices

Output devices form the last stage of the information processing cycle. These are devices that translate the information from the internal processing components of the computer and display them in a way that makes sense to a human user. This could be text, images, sounds or videos.

There are as many output devices as there are input devices and there will certainly be more in the future as the way we interact with computers changes. When you think about output devices, you no doubt think about screens and displays, printers (including 3D printers), speakers and headphones. But interactive whiteboards, data projectors and GPS devices are also output devices.

In this unit you will focus on interactive whiteboards and displays and the advantages, disadvantages and limitations of each of them. You will also learn about the factors determining the quality of display devices and printers, as well as the wireless technology needed for these devices to operate correctly.

DISPLAY DEVICES

Display devices are a broad category of output devices that includes monitors (computer screens), smartphone screens and data projectors.

Figure 2.2: *Examples of display devices*

The main function of a display device is to display the input you have given the computer to allow you to make choices and interact with programs and the operating system.

There are some display devices that act as both input and output devices; touchscreens and interactive whiteboards are examples of these types of devices.

Display devices have several advantages, for example:

- The user gets immediate feedback about what is being processed.
- The interaction between the user and the computer is easier.

- Content can be displayed and changed quickly (think of switching between applications on a smartphone or programs on a computer).
- Displays can be customised to suit the user (for example, making the text size larger or lowering the brightness to make things easier to read).

Display devices also have several key disadvantages:

- The content that is displayed is not private. Anyone behind you can see what you are doing on your computer. This is less of a problem with smartphones, as the screens are easier to hide.
- Displayed output is not permanent and you would need to print or save the data to have a permanent record of what you see.
- Display devices are the one component that consumes the most power. Screens are usually the biggest drain on a smartphone, tablet or laptop's battery.
- They are usually the most expensive item to replace when they break.

WHAT DETERMINES A DISPLAY DEVICE'S QUALITY?

Several factors determine a display device's quality. These include resolution, aspect and contrast ratios and response time, as well as other factors. Less expensive devices usually have very high specifications in one area and low specifications in another. Devices that have a good balance of specifications are usually more expensive.

Table 2.2 lists the quality specifications you should look for when buying a new display device and gives a brief explanation of each specification.

Table 2.2: *Quality specifications for display devices*

SPECIFICATION	DESCRIPTION
Resolution	In the case of display devices, resolution is the number of pixels that can be displayed horizontally and vertically. For example, a monitor with a resolution of 1 920 x 1 440 can display 1 920 pixels horizontally and 1 440 pixels vertically.
Aspect ratio	This is the basic shape of the screen based on the ratio of the width to the height measured in inches. For example, if a screen is 16 inches (40,6 cm) wide and 10 inches (25,4 cm) tall, the aspect ratio is 16:10.
Contrast ratio or colour depth	This is a measure of the number of shades the display device can show between its blackest black and brightest white. The higher the number of shades, the clearer and sharper the images will be. This will also mean that the colours will be brighter and truer to life.
Response time or frequency	Response time measures how quickly the pixels on a screen refresh. Faster response times mean that fast-moving scenes on a video will be smoother and less blurry. This is especially important when the screen is used to watch movies or play games.

PRINTER QUALITY

There are many factors that can affect the quality of the prints that come out of a printer. The most important factor is the resolution, which is measured in dots per inch (dpi). As you learned in the section on scanners, dpi measures how many dots there are in a square inch of an image and the higher the dpi is, the better the image quality will be.

In printers, dpi measures how well the printer can match the pixels per inch (ppi) of a digital image or text. If the printer can match the ppi exactly, the image will come out crisp and clear and will look the same when it is printed and when it is on screen. The problem comes in when the printer cannot match the ppi, so the image quality goes down.

How quickly a printer can print is another indicator of the quality of a printer. This is measured in pages per minute (or ppm) and the higher the ppm, the faster the printer prints. Laser printers will always have a higher ppm than inkjet printers because of the different ways that they print.

Lastly, the duty cycle also shows the printer's quality. The monthly duty cycle indicates the maximum number of pages a printer can print in a month without it failing. A typical home printer will have a duty cycle of around 5 000 pages, while large business printers will have a duty cycle of around 200 000 pages per month.

INTERACTIVE WHITEBOARDS

At first glance, interactive whiteboards look exactly the same as normal whiteboards. But looking closer reveals that they are unique and an exciting tool to use in the classroom and in business. Interactive whiteboards can be seen as input and output devices.

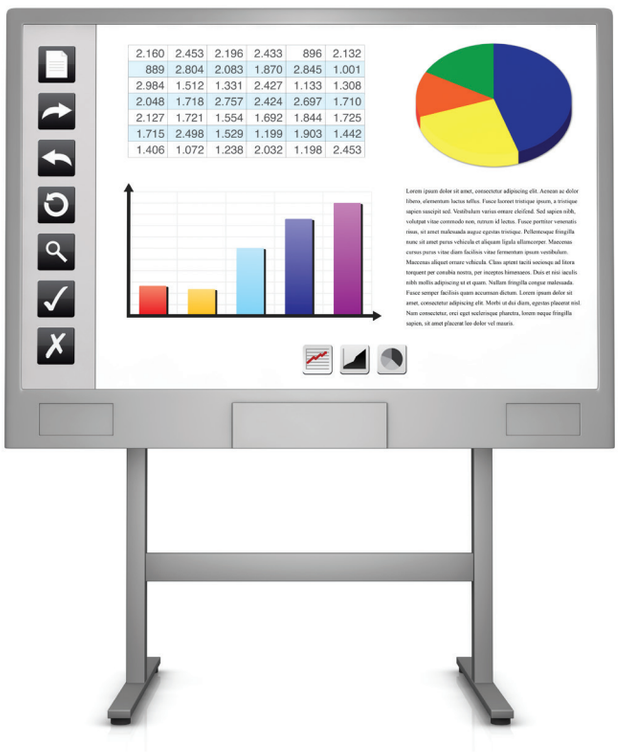


Figure 2.3: *Example of an interactive whiteboard*

Something to know

A printer's dpi is usually shown just like a screen's resolution is shown, since it is a measure of how many dots can be made horizontally and vertically. For example, a printer's dpi may be shown as 1 600 × 2 000.

HOW PRINTERS WORK

Ink printer:

https://www.youtube.com/watch?v=9yeZSaigBj4&t=10s

Laser printer:

https://www.youtube.com/watch?v=WB0HnXcW8qQ

Interactive whiteboards can be used like traditional whiteboards but you need to use special pens (that contain no ink) to write or draw on them. What makes interactive whiteboards so special is that they can be linked directly to a computer and can display what is on the computer. The clue to what sets these apart from normal data projectors is given in the name.

Interactive whiteboards allow users to interact with the data that is displayed. By using a mouse or even your finger, you can drag, click and copy items. You can use your finger or the special pens to write notes, highlight sections or make comments. Anything that is done on the whiteboard can then be saved and shared.

Interactive whiteboards are an incredible tool for teaching and have three key advantages when used in a classroom:

1. Interactive whiteboards allow teachers to combine visual and **auditory** learning styles into one. This allows learners to absorb information in multiple formats.
2. Because the notes made on the whiteboard can be saved and shared, learners do not need to take notes during a lesson. This allows them to focus more on participation during the lesson.
3. Interactive whiteboards allow learners to become part of the learning process by making them active participants in their lessons.

Something to know

A normal non-magnetic whiteboard (2 000 mm × 1 200 mm) cost about R1 750 in 2018. This is one of the biggest whiteboards available.

Some of the notable disadvantages of interactive whiteboards include the cost, training and time requirements. Most interactive whiteboards are incredibly expensive (in 2018, an interactive whiteboard cost about R6 100) and they need special equipment to work correctly.

Teachers and other users also need to be trained in how to use interactive whiteboards correctly and teachers may have to spend extra time preparing proper interactive lessons to get the most out of them.

WIRELESS TECHNOLOGY

Wireless output devices use Wi-Fi, **Bluetooth** or **near-field communication (NFC)** to communicate with the computer. Wireless devices reduce the number of cables you need to connect them to each other. Some examples of wireless output devices are wireless printers and wireless headphones or speakers.

Wireless printers can be connected to multiple devices on the same wireless network, meaning that all the people in a specific area have access to the printer. Wireless printers can also connect to smartphones and tablets, so users can connect to them directly. However, since anyone can access a wireless printer, there are some safety and privacy concerns surrounding them.

Wireless audio devices, such as speakers and headphones, use Bluetooth to connect to the computer. These output devices give users more freedom of movement as they are not physically attached to their computers.

Activity 2.2

1. Multiple choice:
   a. Which of the following cannot be a wireless output device?
      A. Monitors
      B. Printers
      C. Headphones
      D. Speakers
   b. Which of the following is NOT a wireless communication medium?
      A. Wi-Fi
      B. Bluetooth
      C. NFC
      D. RSS
   c. Which of the following is the duty cycle of a home printer?
      A. Around 500 pages
      B. Around 5 000 pages
      C. Around 10 000 pages
      D. Around 1 000 pages
2. Match Column B with Column A:

COLUMN A	COLUMN B
2.1 An indication of a printer's resolution.	A. Touchscreen
2.2 The basic shape of the screen based on the ratio of the width to the height measured in inches.	B. Interactive whiteboard
2.3 A device that is both an input and output device.	C. Contrast ratio
2.4 A measure of the number of shades the display device can show between its blackest black and brightest white.	D. dpi
2.5 You need to use special pens (that contain no ink) to write or draw on this device.	E. Aspect ratio

3. Write True or False next to the question number. Correct the statement if it is FALSE. Change the underlined word(s) to make the statement TRUE. (You may not simply use the word NOT to change the statement.)
   a. Most wireless audio devices, such as speakers and headphones, use Bluetooth to connect to the computer.
   b. A printer's dpi can be shown in the same way a screen's resolution is shown.
   c. Interactive whiteboards allow teachers to combine different visual learning styles into one.
   d. Interactive whiteboards are the same as traditional whiteboards.
4. Answer the following questions in your own words:
   a. What would the aspect ratio be of a monitor that is 20 inches wide and 15 inches tall?
   b. Name two extra features that determine the quality of a display device.
   c. What are the three key advantages of interactive whiteboards in the classroom?
   d. Explain why every school in South Africa does not have interactive whiteboards.
   e. Give two advantages of wireless printers.

2.3 Devices, software and equipment

Often you will need additional software or hardware to make sure that your input and output devices can communicate with your computer. In most cases, your hardware will require a device driver to make sure that the commands it sends to and receives from your computer will be interpreted correctly.

In this unit, you will learn more about device drivers that you need to install yourself and **plug-and-play devices**. You will also look at the physical ways devices connect to your computer. Lastly, you will look at what OCR is and where it is used.

DEVICE DRIVERS

Device drivers are software programs that are separate from the device. They are either given on a disk or downloaded from the manufacturers' websites. Your OS will use a device's driver to communicate with the device. The driver will help the OS understand the information you give it through an input device or translate the information the computer sends to an output device so that it can display the information correctly.

Most operating systems also have a set of standard device drivers installed for things such as computer mice, keyboards and hard drives (internal and external). These devices are often referred to as plug-and-play devices.

PLUG-AND-PLAY

Plug-and-play devices are usually external devices but can also be some internal components of the computer (such as graphics cards). Examples of plug-and-play devices are headphones and speakers, computer mice, keyboards and USB storage devices.

OTHER EQUIPMENT

Most input and output devices need to be connected to the computer in some way for them to work. Keyboards and computer mice need to be connected either with a wireless USB dongle or a wired USB connector. Monitors will need power cables as well as display connectors (such as HDMI or VGA cables). Printers and projectors can be connected to the computer with cables, USB dongles or Bluetooth connections.

OCR

OCR stands for optical character recognition and it is a software program designed to convert printed characters (such as those on a hard copy document) into digital text. This means that you can edit and search in a scanned document in a word-processing program.

OCR is most commonly found in specialised scanners used for archiving or document management. You can also get handheld OCR scanners that allow you to quickly scan printed text into a digital format. OCR enhances traditional scanning, since it saves the documents as text and not as an image.

OCR can also be used to improve accessibility for physically challenged users. OCR scanners can work alongside text-to-speech devices to read printed text aloud. OCR scanners are also used in handheld barcode scanners.

Activity 2.3

1. Multiple choice:
   a. Which of the following is not a plug-and-play device?
      A. Speakers
      B. Keyboard
      C. Motherboard
      D. Headphones
   b. Which of the following is not a connection method for a monitor?
      A. HDMI
      B. Bluetooth
      C. VGA
      D. Power cable
2. Match Column B with Column A:

COLUMN A	COLUMN B
2.1. A software program designed to convert printed characters into digital text.	A. Device driver
2.2. The software that allows the hardware to work.	B. Monitors
2.3. Devices that can be connected to a computer and used immediately.	C. OCR
2.4. These devices will need power cables and display connections to work correctly.	D. USB
2.5. A type of connection for wired input and output devices.	E. Plug-and-play

3. Answer the following questions in your own words:
   a. Where can you get device drivers?
   b. Explain how device drivers work.
   c. How can OCR be used to improve accessibility for physically challenged users?

REVISION ACTIVITY

QUESTION 1: MULTIPLE CHOICE

1.1 Which of the following is a disadvantage of biometrics? (1)

- **A.** It cannot be changed.
- **B.** It is expensive to implement.
- **C.** It is easy to use and requires little training.
- **D.** It is difficult to lose.

1.2 Colour depth is _____. (1)

- **A.** The number of bits used to indicate the colours of a pixel.
- **B.** The amount of detail an image can hold.
- **C.** The range of light that can be read and used to produce a range of tones and colours.
- **D.** The number of pixels used in a 1-inch square.

1.3 Which of the following does not use device drivers? (1)

- **A.** Mouse
- **B.** Touchscreen
- **C.** Windows Defender
- **D.** Printer

1.4 Which of the following is NOT usually a plug-and-play device? (1)

- **A.** Mouse
- **B.** Speaker
- **C.** Keyboard
- **D.** Graphics card

1.5 The signals from wireless devices cannot be interrupted by _____? (1)

- **A.** Bluetooth
- **B.** Radio waves
- **C.** Microwaves
- **D.** Fridges

QUESTION 2: TRUE OR FALSE

Write True or False next to the question number. Correct the statement if it is FALSE. Change the underlined word(s) to make the statement TRUE. (You may not simply use the word NOT to change the statement.)

a. Voice recognition can be used to help people with hearing disabilities. (1)

b. Fingerprint scanners use biometrics to identify people. (1)

c. Scanners use OCR to convert digital text to printed text. (1)

d. Printed images can become corrupted so you will need to back them up regularly. (1)

e. A POS system is not an example of an output device. (1)

… continued

REVISION ACTIVITY

... continued

QUESTION 3: MATCHING ITEMS

Choose a term/concept from Column B that matches a description in Column A. Write only the letter next to the question number (e.g. 1–J). (5)

COLUMN A	COLUMN B
1. An input device that can only be used in dim light.	A. Aspect ratio B. Scanner C. Focal length D. Resolution E. Frequency F. Display device G. Laser keyboard H. Printer I. Biometrics
2. Devices that use the unique measurements and characteristics of your body to interact with a computing device.	
3. The ratio of a screen's width and height in inches.	
4. The refresh rate of the pixels on a screen.	
5. A device that converts digital data to printed data.	

QUESTION 4: SHORT AND MEDIUM QUESTIONS

4.1 Look at the following image and answer the questions that follow.

a. What type of input device does the image show? (1)
b. Name two other types of input devices that make use this type of device. (2)
c. Mention one disadvantage of this device. (1)
d. Give two reasons why this input method is the most natural way of interacting with a computer. (2)

4.2 Provide two advantages of display devices. (2)

4.3 Mention two jobs that can benefit from using interactive whiteboards. Give an explanation for each of your answers. (4)

... continued

REVISION ACTIVITY

… continued

QUESTION 5: SCENARIO-BASED QUESTIONS

Thomas is a high-school teacher who teaches a small class of 15 learners. Some of Thomas's learners have physical challenges that would make it difficult for them to interact with a traditional computer. Thomas therefore has to think of what types of extra input and output devices he will need to make this class project work.

5.1 Name two input devices that Thomas can use for a learner who cannot use their hands. (2)

5.2 List two output devices that Thomas's learners can use for their class projects. Also mention what equipment Thomas would need to connect each of these devices to a computer. (4)

5.3 Explain one way in which physically challenged learners can benefit from OCR technology. Also mention what type of input and output device will be used. NOTE: Mention the benefit and the related physical challenge. (4)

5.4 Thomas needs to order a printer. He wants to use it to print out pictures of his class and the best class projects.

a. What kind of printer should he order? (1)

b. What specifications should he look for to get good quality prints. (2)

TOTAL: [40]

AT THE END OF THE CHAPTER

NO	CAN YOU ...	YES	NO
1.	Describe various types of input devices, including scanners, digital cameras, biometric input devices and others?		
2.	Discuss the advantages, disadvantages and limitations of various input devices?		
3.	Explain how the quality of scanners and digital cameras is measured?		
4.	Describe various types of output devices, including display devices and interactive whiteboards?		
5.	Discuss the advantages, disadvantages and limitations of various output devices?		
6.	Explain what criteria are used to measure the quality of display devices?		
7.	List and describe the software and equipment needed to operate input and output devices?		
8.	Discuss the purpose of OCR and hand-held OCR devices?		

TERM 2

CHAPTER 3

STORAGE, MEMORY AND PROCESSING DEVICES

CHAPTER OVERVIEW	
Unit 3.1	Storage devices
Unit 3.2	Processing devices
Unit 3.3	Basic troubleshooting

By the end of this chapter, you will be able to:

- Describe the difference between primary and secondary storage
- Discuss online storage
- List the best storage media for backups and archiving
- Describe the role and function of various internal computing components, such as the motherboard, CPU, RAM and ROM
- Interpret advertisements for storage media and computers
- Do basic troubleshooting on input, output, storage and processing devices

INTRODUCTION

In this section, you will get more detail about the purpose of storage, what the difference is between primary and secondary storage, why computers need storage and what online storage is. You will be introduced to the storage devices that do the processing in a computer, such as the motherboard, random-access memory (RAM), read-only memory (ROM) and central processing unit (CPU) and what their functions are.

3.1 Storage devices

Something to know

One gigabyte (GB) is equal to 1 024 megabytes (MB), and one terabyte (TB) is equal to 1 024 GB.

Storage media have come such a long way since the early days of computing, and the size of data has grown so much that it is impossible to imagine that all it took to get humans to the moon was about 600 MB of data.

PRIMARY STORAGE

Primary storage is also called the main or internal memory of the computer. This storage is accessed directly by the CPU and is where the main instructions for the computer's operations are stored. The CPU can access these instructions and execute them as they are needed.

Primary storage is most often the RAM and the ROM, which will be discussed later in this chapter. The main function of the primary storage devices is to hold data for a short period of time while the computer is running and power is going to the devices. This data is removed once the power is stopped (like when the computer is shut down).

SECONDARY STORAGE

Secondary storage is also called external, secondary or auxiliary memory. This type of storage holds data for the long term. Data stored on secondary storage devices can only be removed by deleting it. Secondary memory is where the operating system, hardware drivers and data created by the user is kept and stored permanently.

This means that, in the case of power failures, secondary storage will preserve the information that is saved to it, even if the power to the computer is lost, while the data on the primary storage devices will be lost.

The most common example of secondary storage is the hard drive inside a computer. Other examples include solid-state drives (SSDs), USB flash drives and secure digital (SD) cards.

Table 3.1: *Comparison: Memory versus storage*

MEMORY	STORAGE
Memory needs power to keep its contents (volatile). The RAM in a computer is an example of **volatile memory**. This means that data is not stored permanently but is kept for short-term use only. The data is cleared as soon as the power to the RAM is stopped.	Keeps its contents even when the computer is switched off (non-volatile). Storage holds programs and data more permanently.
Memory is fast to access. It is more expensive per GB than storage.	Because magnetic and optical storage works mechanically, it is slow. Even electronic storage operates at lower speeds than memory.

STORAGE MEDIA FOR BACKUP

One purpose of storage devices is to back up or **archive** your important data. In the business world, there is a need to store data permanently and in a way that does not get destroyed, corrupted or damaged easily. Different types of storage media can be used for backing up or archiving.

Backups are records of important information that is used often. Backups are kept for a relatively short period of time. Table 3.1 lists the advantages and disadvantages of different types of storage media used for backups.

BACKUP DEVICES

Backup refers to the process of making copies of data or data files to use in the event the original data or data files are lost or destroyed or storing the copies in a different place from where you keep your computer.

The most popular backup media to use are:

- **External hard drives (HDD):** These are quite fast and generally reliable. However, if an external hard drive is used often, the mechanical stress can shorten its lifespan. External hard drives are fragile.
- **External SSDs:** SSDs have no moving parts. SSDs are more expensive that hard drives and the storage space is limited due to the cost (the more space you get, the more expensive the SSD becomes).
- **USB flash drives:** USB flash drives are cheap and relatively easy to use. There are no moving parts, so they are an excellent way to move data around. However, they can be slow and unreliable.
- **Tapes:** Tape backup is copying data from a primary storage device to a tape cartridge so the data can be recovered if there is a hard disk crash or failure. Tape backups can be done manually or be programmed to happen automatically with appropriate software.
- **CDs and DVDs:** CDs and DVDs are still occasionally used but writing a CD or DVD is much slower and less convenient than using other media. They have a lower capacity than most flash drives and much lower capacity than portable hard drives.
- **Online storage/backup services:** Online data storage is virtually unlimited in size. This means that there is plenty of space for you to back up your entire hard drive, including all of your purchased programs, music, photos, and files. Saving to the cloud means that you are saving to hard drives in a remote location. You must keep your username and password safe in order to protect your data because if someone knows (or even guesses) your credentials, it may result in loss of data.

Archiving, on the other hand, is the long-term storage of information that will be used in future. Archived data is data that is not actively used and is original data that has been removed from its original location. There are several different storage media that can be used for archiving.

Magnetic tape has a very large storage capacity (up to 180 TB), but can be destroyed very easily and the data can be lost.

Online storage is an option and online storage providers (such as Amazon AWS) have relatively inexpensive packages available for storage and archiving.

The data stored in a backup is a copy of the current and active operational data in use by a business. This includes files which are currently being accessed and changed on a regular basis. The files stored on an archive are generally no longer in use, not changing frequently and not required on a regular basis.

Activity 3.1

1. Multiple choice:
   a. Which of the following cannot be used to back up files?
      A. External HDD
      B. USB drive
      C. Optical disc
      D. RAM
   b. Which of the following is the most expensive storage?
      A. RAM
      B. HDD
      C. SSD
      D. iCloud
   c. Which of the following is secondary storage?
      A. RAM
      B. CPU
      C. HDD
      D. ROM
2. Match Column B with Column A:

COLUMN A	COLUMN B
2.1. Most often the most expensive equipment in a PC, e.g. processor.	A. Archiving
2.2. A storage device that is relatively rugged and virtually shockproof as it does not have moving parts.	B. 1 024 GB
2.3. A cheap storage device and backup device option.	C. Primary storage
2.4. The long-term storage of information that will be used in future.	D. Online storage
2.5. The size of one TB in GB.	E. USB
2.6. Also called external, secondary or auxiliary memory.	F. SSD
2.7. Very common and relatively cheap storage device.	G. HDD
2.8. Amazon AWS and Google Drive, for example.	H. Secondary storage

3. Write True or False next to the question number. Correct the statement if it is FALSE. Change the underlined word(s) to make the statement TRUE. (You may not simply use the word NOT to change the statement.)
   a. Primary storage is accessed by the motherboard.
   b. Magnetic tape has a very large storage capacity but can be easily destroyed and the data can be lost.
   c. Online storage has limited space and you must pay to get more space.
   d. The main purpose of primary storage is to store data for a long period of time.
   e. Archiving is the short-term storage of information.
4. Answer the following:
   a. What is the main purpose of primary storage?
   b. Briefly describe the difference between primary and secondary storage.
   c. What is the difference between backing up and archiving data?
   d. What storage devices would you recommend to someone who needs to store data on a server and someone who wants to store copies of their digital photographs? Motivate your answer.

UNIT

3.2 Processing devices

Processing is the second stage of the information processing cycle you learned about in Chapter 1. Processing mainly uses the system components of the computer, such as the motherboard, CPU and RAM, for its tasks. In this unit, you will learn more about the role of each component of a computer system, how they work and what they do.

MOTHERBOARD

The motherboard is one of the most essential parts of a computer. It holds many of the components that allow a computer to function, such as the CPU, RAM and the connectors for input and output devices.

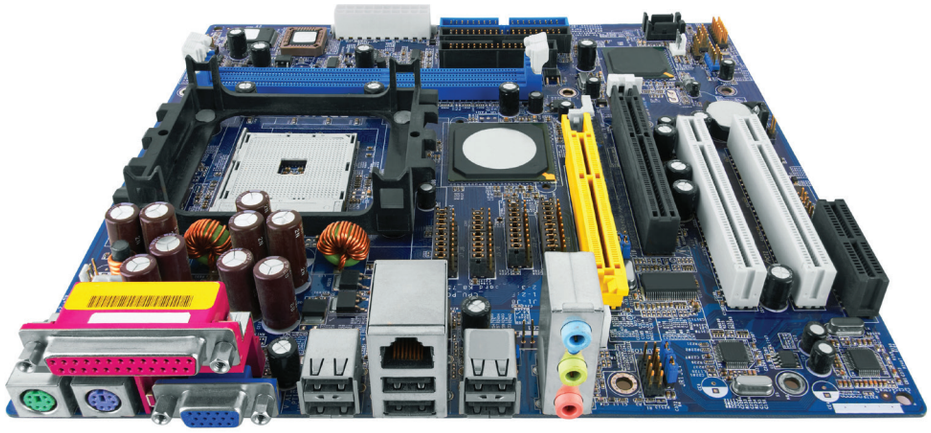


Figure 3.1: *Computer motherboard with components*

The motherboard is made of a thin piece of rigid, **non-conductive** material. A thin layer of copper or aluminium foil is printed onto the sheet. These circuits are called traces. They are very narrow and form the connections between the various components housed in the motherboard.

The role of the motherboard is to:

- Provide a place for other devices or interfaces to be installed (such as more memory or another **graphics card**).
- Distribute power to the various components.
- Act as a communication hub as the components send and receive information through the motherboard.

CENTRAL PROCESSING UNIT (CPU)

The CPU, which is also called the processor, carries out the instructions of a computer program. It is, basically, the "brain" of the computer and does the **arithmetical**, logical and input/output operations of a computer program. The speed of the CPU tells you how much data it can process in a specific time. The speed is measured in **gigahertz** (GHz).

Figure 3.2: *Intel Core i7 CPU*

HOW A CPU WORKS

https://www.youtube.com/watch?v=cNN_tTXABUA

All instructions, whether they have been generated by the system or the user, go through the CPU. This could be anything from the operating system executing a task to the user typing letters in a document.

WHAT ARE CORES IN A CPU?

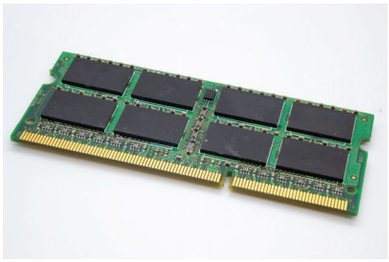
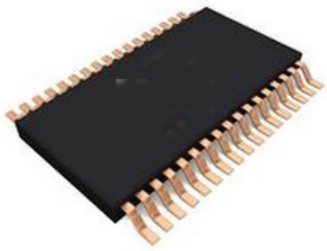
A core is usually the basic computing unit of the CPU. A single core can run a single program, problem or context. A CPU may have one or more cores to perform tasks at any single time. Original CPUs had single cores, but manufacturers began adding more cores to increase the performance of the CPU. A CPU with two cores can split the task into two tasks and thereby complete it faster. This speeds up the computer because it is, essentially, able to multitask.

A dual-core processor has two cores, so it looks like two CPUs to the operating system. A **quad-core** CPU has four cores, an **octa-core** CPU has eight cores, and so on. These cores also make sure that the CPU is still small enough to fit into a single socket, taking up less space on the motherboard.

RANDOM-ACCESS MEMORY (RAM) AND READ-ONLY MEMORY (ROM)

While **RAM** and **ROM** are both types of memory, they perform different functions. Table 3.2 compares and contrasts the roles and functions of RAM and ROM.

Table 3.2: *Roles and functions of RAM and ROM*

	RAM	ROM
Role	RAM is also called random-access memory and is a specific type of data storage. It allows data to be accessed in random order, which means specific information can be found quickly.	The ROM, or read-only memory, stores the basic instructions for what needs to happen when the computer is switched on.
Function	Ram is where the CPU goes to fetch the instructions and data that it needs to work on. (RAM gets its contents by loading them from storage.) RAM is also temporary storage for data for programs that are running, allowing the programs to work faster.	It contains the basic code to get the computer started. The ROM is normally stored on the BIOS chip in the motherboard. The information stored in the ROM is often difficult to change and the data is not lost when the computer is powered down.
Image		

INTERPRET COMPUTER ADVERTISEMENTS

When you want to buy a new computer or storage device, there are several key factors to consider. By using what you know about these components, you will be able to interpret the information in advertisements for computers.

Figure 3.3: *A computer advertisement*

Using what you have learned so far in this chapter, you will be able to interpret any advertisement by looking at the following key pieces of information:

- How fast is the CPU in the computer? Remember that the faster the CPU works, the faster your computer will be able to process data. So, a 3 GHz processor is twice as fast as a 1,5 GHz one. In this example, the CPU speed is up to 3.10 GHz.
- How big is the memory? The more RAM you have, the more programs and applications you can run at once. Most computers come with 4 GB of RAM, which is good for users who do not need to do much more than check emails or create some documents. Users who need their computer to do slightly more can look at getting 8 GB of RAM, while 16 GB is good for those who will often be using more memory-intensive programs on their computers (such as games and videos and photo-editing software). In this example, the memory is 8 GB RAM.
- How much storage capacity does it have? Most computers come with a fairly large hard drive (about 500 GB). You can also buy external hard drives that can store terabytes of data. Make sure you get one that will suit your needs. In this example, the storage capacity is 1 TB.
- Which operating system does the computer use? The latest operating system will be more compatible with new programs, and will be more secure and able to support the drivers for your hardware. In this example, Windows 10 Home is used.

Activity 3.2

1. Multiple choice:
   a. The start-up process is stored on which hardware component?
      A. BIOS
      B. RAM
      C. ROM
      D. CPU
   b. The speed of a CPU is measured in?
      A. GHz
      B. MHz
      C. Hz
      D. Calculations per second
   c. The various components of a motherboard are connected by which metal?
      A. Sulphur
      B. Copper
      C. Silica
      D. Silver
2. Match Column B with Column A:

COLUMN A	COLUMN B
2.1. This unit performs all the basic mathematical tasks and logical functions of the CPU.	A. Control unit
2.2. Memory that is lost when the device shuts down.	B. Volatile memory
2.3. The high-speed memory where instructions can be copied to and retrieved for the CPU.	C. ALU
2.4. This part of the CPU manages the components by reading and interpreting instructions from memory and turns them into signals.	D. CPU
2.5. The most essential part of the computer.	E. Cache
2.6. This unit carries out the instructions of a computer program.	F. Motherboard
2.7. This unit allows data to be accessed in random order.	G. ROM
2.8. Data on this unit is often difficult to change.	H. RAM

… continued

Activity 3.2

… continued

3. Write True or False next to the question number. Correct the statement if it is FALSE. Change the underlined word(s) to make the statement TRUE. (You may not simply use the word NOT to change the statement.)
   a. The motherboard distributes power to the computer.
   b. The RAM is stored on the BIOS chip.
   c. The motherboard is the brain of the computing operation.
   d. Temporary files are stored on the CPU.
   e. Data stored on the RAM is permanent.
4. Answer the following:
   a. Briefly describe the role and function of the motherboard and CPU.
   b. Explain RAM.
   c. Describe ROM.
   d. Which questions should you ask yourself when looking at an advertisement for a computer?

3.3 Basic troubleshooting

It is important for you to know how to do basic troubleshooting on your storage devices, especially if those devices contain very important information. This unit will look at some basic troubleshooting for storage media.

STORAGE AND PROCESSING DEVICES

Most of the basic troubleshooting guidelines for external storage devices can apply to internal storage and processing devices as well, although there are some specific scenarios where advice for storage media will not solve problems with RAM or ROM modules.

FORMATTING

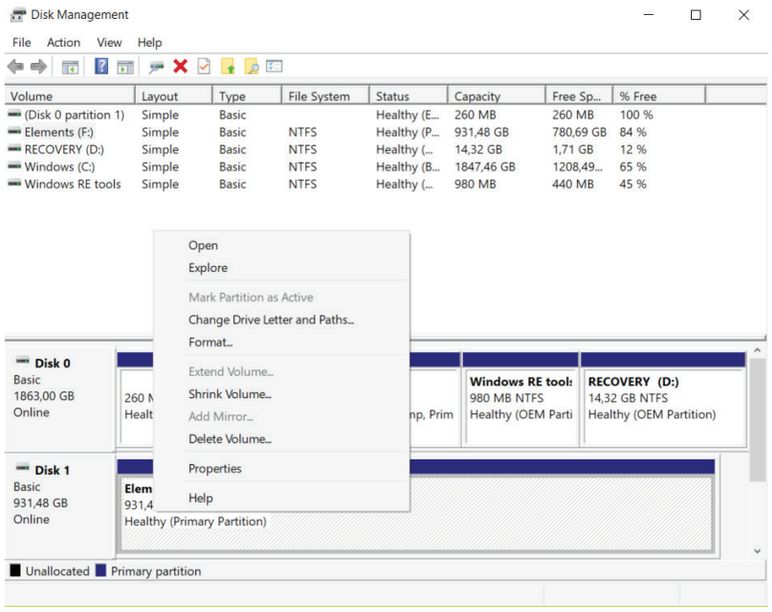
Formatting means preparing a disk to store data. Some disks, such as flash disks or hard drives, may need to be reformatted from time to time. Formatting will erase any data that is on the disk, so you will need to back up the data up before you **format**.

Windows 10 has a built-in disk management tool to make formatting a disk easier.

FORMATTING A DISK

To format a disk, you must do the following:

Step 1: Click on the *Search* icon on the bottom left corner of your screen.
Step 2: Type in *format*.
Step 3: Select *Create and format hard drive partitions*.
Step 4: This opens the *Disk Management* dialogue box.
Step 5: Right-click on the disk you want to format and click on *Format*.
Step 6: Choose *NTFS* (new technology file system) as the file system and select *Default* as the *Allocation Unit Size*.
Step 7: Click *OK* to format the drive. **BE VERY CAREFUL AS THIS ACTION WILL DELETE ALL DATA ON THE DRIVE.**



DISK SCANS

Disk scans can help detect and fix errors in USB flash drives, hard drives and SSDs. There is a disk scanner built into Windows 10.

USING A DISK SCANNER

To use the disk scanner, do the following:

Step 1: Click on the *Search* icon on the bottom left corner of your screen.

Step 2: Type in *Explorer* to open Windows Explorer (or press the Windows key + E).

Step 3: In the *File Explorer* window, click on *This PC* in the left navigation pane.

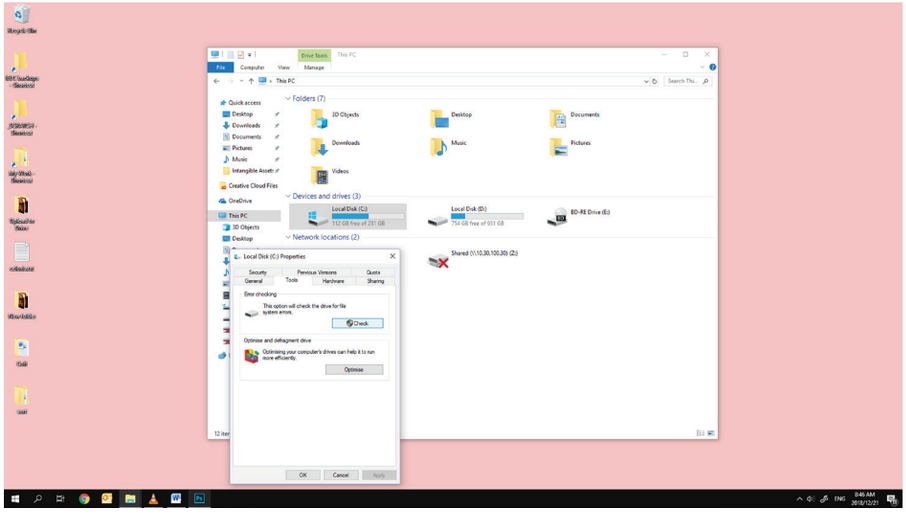
Step 4: A list of drives will be shown in the right window. Right-click on the drive you want to scan and select *Properties*.

Step 5: In the *Properties* window, click the *Tools* tab.

Step 6: Click the *Check* button in the *Error Checking* section.

Step 7: Run the scan without any interruptions.

Step 8: You may need to restart your computer if the scan detects any problems.



DISK DEFRAGMENTATION

Over time, the files on your computer's hard drive become scattered, making your computer slower. This is called **disk fragmentation**. **Defragmenting** your hard drive pulls these scattered bits of data back together. Windows 10 automatically defragments your hard drive once a week.

The process of defragmentation moves the data blocks on the hard drive around to bring all the parts of a file together. Defragmentation reduces file system fragmentation, increasing the efficiency of data retrieval and thereby improving the overall performance of the computer. At the same time, it cleans the storage and provides additional storage capacity.

DISK CLEANUP

While you are using your computer, you generate many types of files. These files take up space on your computer, making it slower. In Grade 10, you learned how to zip and unzip files, but this may not be enough to speed up your system.

Windows 10 also has a built-in disk cleanup tool that will delete the following:

- Temporary files from the internet.
- Deleted files and folders in the recycle bin.
- Temporary files created by the operating system.
- The component of the operating system you are not using.
- Applications or programs that you do not use.

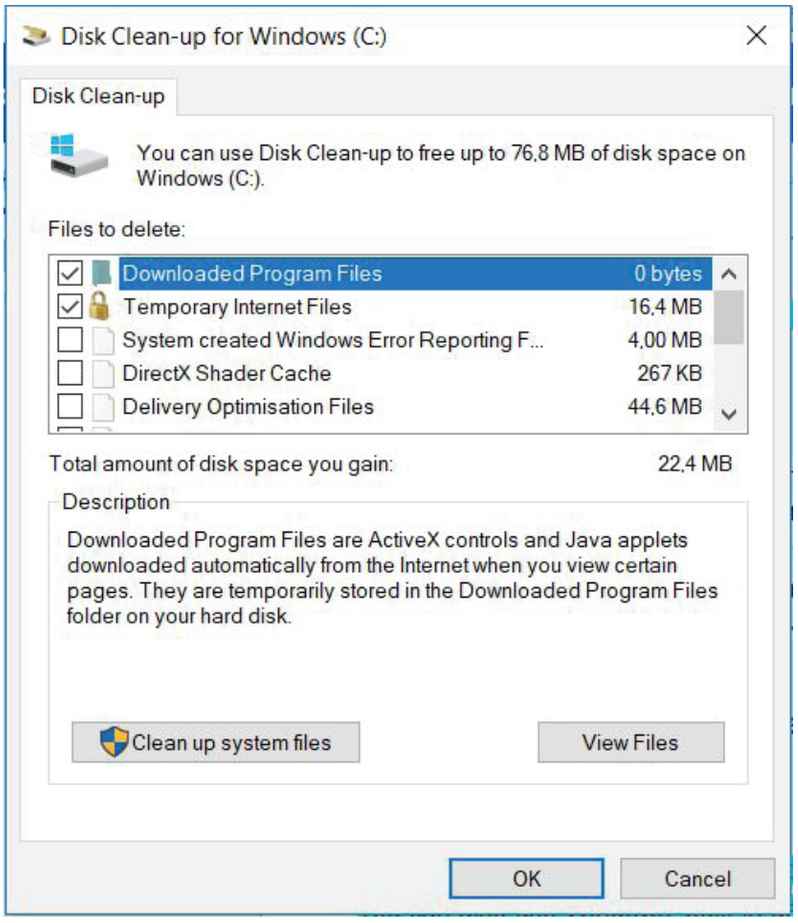


Figure 3.4: *Disk cleanup helps with freeing up space on your computer*

Activity 3.3

1. Match Column B with Column A:

COLUMN A	COLUMN B
1.1. Preparing a disk to store data.	A. NTFS
1.2. When the files on a disk are divided into pieces scattered around the disk.	B. Formatting
1.3. The process of locating segments of fragments of data stored on a hard drive and rearranging and restoring them into fewer fragments or into the whole file.	C. Disk fragmentation
1.4. A file system for a USB drive	D. Disk defragmentation
1.5. Window key + E is a shortcut to open.	E. Disk cleanup
1.6. A program that deletes temporary files	F. Windows Explorer
1.7. The window where you find the Tools tab when doing a disk scan.	G. The manufacturer's website
1.8. A resource you can use to find troubleshooting tips for output devices.	H. Properties

2. Write True or False next to the question number. Correct the statement if it is FALSE. Change the underlined word(s) to make the statement TRUE. (You may not simply use the word NOT to change the statement.)
   a. Microsoft Windows 10 needs disk scanning software.
   b. Formatting your device deletes program files.
   c. You must make sure Num Lock is on if your Page Up/Page Down keys are not working.
3. Answer the following questions in your own words:
   a. Describe how you would format a disk.
   b. What is the purpose of a disk scan?
   c. Explain how you would manually defragment your disks.
   d. What does the Windows 10 disk cleanup tool do?

REVISION ACTIVITY

QUESTION 1: MULTIPLE CHOICE

1.1 Which of the following is an example of primary storage? (1)
   A. Motherboard
   B. ROM
   C. CPU
   D. USB

1.2 Which of the following types of storage is volatile? (1)
   A. ROM
   B. Internal HDD
   C. RAM
   D. Internal SSD

1.3 Which of the following is involved in the start-up of a computer? (1)
   A. CPU, ROM
   B. RAM, ROM
   C. RAM, CPU
   D. HDD, ROM

… continued

REVISION ACTIVITY

… continued

1.4 When you look at a computer advertisement, what are the most important things to look at? (1)

- **A.** Storage, operating system, brand
- **B.** Memory, processing speed, external hardware
- **C.** Software, operating system, memory
- **D.** Processing speed, storage, memory

1.5 Formatting means _____ a disk to store data. (1)

- **A.** Priming
- **B.** Preparing
- **C.** Saving
- **D.** Processing

QUESTION 2: TRUE OR FALSE

Write True or False next to the question number. Correct the statement if it is FALSE. Change the underlined word(s) to make the statement TRUE. (You may not simply use the word NOT to change the statement.)

a. Data that is being processed is stored in memory. (1)
b. The more cores a CPU has, the slower it operates. (1)
c. RAM is related to storage, while the CPU is related to speed. (1)
d. Before you format an SD card you must erase the information on it. (1)

QUESTION 3: MATCHING ITEMS

Choose a term/concept from Column B that matches a description in Column A. Write only the letter next to the question number (e.g. 1-M). (6)

COLUMN A	COLUMN B
1. High-speed memory that can be used to copy or retrieve instructions.	A. Secondary storage
2. The start-up process of a computer.	B. Motherboard
3. A component that performs basic mathematical tasks and logical functions.	C. ALU
4. A device that physically connects all the internal components of a computer.	D. Control unit
5. A storage method that makes use of the internet.	E. Cache
6. The process of pulling scattered bits of data together.	F. Memory card
	G. Boot
	H. Disk defragmentation
	I. Online storage

QUESTION 4: FILL IN THE MISSING WORD(S)

Fill in the missing word(s) in the following statements. Provide only one word for each space.

a. If you want to delete all the temporary files created by the operating system use i) _____ _____. (1)
b. Components on a motherboard are connected with ii) _____. (1)
c. The speed of the iii) _____ _____ _____ _____, which is measured in GHz, determines how much data your computer can process in a specific time. (1)
d. The CPU fetches instructions from the hardware that need to be iv) _____. Then the CPU translates the instructions to v) _____ _____. (2)

… continued

REVISION ACTIVITY

... continued

QUESTION 5: MEDIUM QUESTIONS

Look closely at the advert below and answer the following questions.

Product Specifications

Windows 10 Home 64

Intel Core i3-5005U 2.8 GHz

1 TB 5400 rpm SSD

4 GB DDR4-2133 SDRAM

802.11b/g/n and Bluetooth 4.0 combo

15.6" diagonal HD SVA BrightView WLED backlit (1366 × 768)

5.1 What is the speed of the CPU in the computer? (1)

5.2 How big is the volatile memory? (1)

5.3 How much storage capacity does the computer have? (1)

5.4 Which operating system does the computer use? (1)

5.5 What does the 15.6" specification in the advert refer to? (1)

5.6 What does the 1366 × 768 specification refer to? (1)

5.7 What does the SSD acronym stand for? (1)

5.8 Give TWO reasons why users would prefer an SSD instead of an HDD? (2)

5.9 Suggest ONE way you can use to transfer data from this computer. (1)

QUESTION 6: SCENARIO-BASED QUESTIONS

Ronaldo has recently bought a new external hard drive for his laptop computer, since his laptop has started running out of space. Ronaldo's laptop has an SSD with a storage capacity of 500 MB, while his new external hard drive has a storage capacity of 1 GB.

6.1 Which of Ronaldo's storage devices has the longest lifespan? Give one reason for your answer. (2)

6.2 When Ronaldo connects his external hard drive to his laptop, his laptop detects it but cannot read it. What should Ronaldo do to work out what is wrong with the external hard drive? (1)

6.3 Ronaldo finds out that he should format his new external hard disk. Why should he do this? (1)

6.4 Over the past three years, Ronaldo's laptop has become slower. Mention three things that might be causing this. Also provide a possible solution to each problem. (6)

TOTAL: [40]

AT THE END OF THE CHAPTER

NO	CAN YOU ...	YES	NO
1.	Describe the difference between primary and secondary storage?		
2.	Discuss online storage?		
3.	List the best storage media for backups and archiving?		
4.	Describe the role and function of various internal computing components, such as the motherboard, CPU, RAM and ROM?		
5.	Interpret advertisements for storage media and computers?		
6.	Do basic troubleshooting on input, output, storage and processing devices?		

TERM 2

CHAPTER 4

SOFTWARE

CHAPTER OVERVIEW	
Unit 4.1	The role of application software
Unit 4.2	Collaboration and communication software
Unit 4.3	Compatibility issues
Unit 4.4	Software for physically challenged users
Unit 4.5	Cloud-based applications
Unit 4.6	Online storage

By the end of this chapter, you will be able to:

- Define the role of application software
- Discuss application software in terms of collaboration and communication software
- Define compatibility issues in software
- Describe why software must be updated
- Describe software for physically challenged users
- Explain the advantages and disadvantages of online or cloud storage
- Discuss cloud-based applications with a focus on Google Docs and Microsoft Office 365

INTRODUCTION

In Grade 10, you learned about what software is. Software is the programs that contain the instructions you use to tell the computer what you want it to do. There are two types of software:

1. **Application software** allows you to perform tasks on the computer, for example, playing music or games and creating presentations, spreadsheets and documents.
2. **System software** controls and manages the operations of the computer.

Application software is the most useful type of software and the one that you interact with the most. There are different types of application software, for example:

- Word processors, such as Microsoft Word or LibreOffice Writer.
- Office suites such as Microsoft's Office Suite, which contains programs such as Word, PowerPoint and Excel.
- Internet browsers such as Google Chrome and Mozilla Firefox.
- Movie and media players such as VLC media player and Windows Media Player.

System software manages the computer and the flow of data and information by:

- Translating instructions from the software to the hardware.
- Sending the right instructions to the right hardware to complete the task.
- Receiving information from the hardware and sending it to the software.
- Allowing different applications to communicate with each other.
- Checking the condition of the hardware and the software.

There are also different types of system software, such as operating systems, device drivers and firmware.

In this chapter, you will learn more about application software, specifically collaboration and communication software. You will explore what compatibility issues are and what you can do to work around them. You will also look at what versions, patches and service packs are and what role they play in updating software. We will also highlight application software for physically challenged users.

You will be introduced to online or web-based applications, such as Google Docs and Office 365, and their uses, advantages and disadvantages.

UNIT

4.1 The role of application software

As you learned, application software (also called an app or application for short) is a computer program or group of computer programs designed for users. It makes using a computer easier. In the past, users would need to enter commands into a text field but now doing anything on your computer is as easy as clicking a button or tapping on an icon.

There are different types of application software. Table 4.1 has a list of some of these types and descriptions of what they do. This list is by no means a full list of application software, since there is software for everything you do on your computer and there are many different variations of the same type of software.

Table 4.1: *Types of application software*

NAME	DESCRIPTION
Word-processor	A word-processing program used to create, edit and manipulate text documents. It can also support images and other graphical elements (such as videos). Example: Microsoft Word
Media player	A media player allows you to watch videos and listen to music that is stored on your computer or streamed from an online source. It can also be used to convert media files to a wide variety of different formats. Example: VLC media player or Windows Media Player
Web browser	An application that allows you to access and browse the World Wide Web. The browser communicates with a web page to display all the web page's features to allow you to navigate around it. Example: Google Chrome, Firefox or Safari
Desktop publishing	Multimedia software that allows you to create, edit and manipulate images and other visual media, such as brochures, logos etc. Example: CorelDRAW, MS Publisher or Adobe InDesign
Email	Communication software that allows you to send and receive electronic communications to and from other people. Example: Microsoft Outlook or Gmail

UNIT

4.2 Collaboration and communication software

Multimedia and communications applications are some of the most common applications in use today.

MULTIMEDIA SOFTWARE

Multimedia refers to integrating multiple forms of media into a single, often digital, product. This could be a PowerPoint presentation that includes videos and audio clips, a Word document with animations and images, or a web page with interactive elements.

Although images and text are different types of media, multimedia is usually used to refer to things that incorporate video, audio, animated images (such as GIFs) and text.

Multimedia software refers to the programs you use to create and interact with multimedia. There are two broad categories of multimedia software: media players and media creators. Media players are software applications that allow you to play back multimedia files, including audio and video files. Media players can also be used to view still images (such as photographs or illustrations). Some examples of media players are shown in Table 4.2.

Table 4.2: *Examples of media players*

NAME	DESCRIPTION	OPEN SOURCE, FREEWARE OR PROPRIETARY
VLC media player	Video and music player that integrates streaming and file conversion.	Open source
YouTube	Video player, only available on the World Wide Web.	Web-based application
iTunes	Video and music player that integrates internet radio broadcasting and mobile device management.	Pre-installed on Apple devices – freeware.
Adobe Flash Player	Used to display interactive web pages and online games as well as audio and video content. Mostly unused now.	Freeware

Multimedia software is also used to create multimedia content, which is any content that uses a combination of text, audio, images, animations, video and interactive elements. There are several different types of multimedia software available, depending on what you would like to create. Table 4.3 shows examples of multimedia software and what they are mainly used to create.

Table 4.3: *Examples of multimedia software*

NAME	DESCRIPTION	FREEWARE EXAMPLES
Adobe Photoshop, InDesign and Illustrator; CorelDRAW	Creating images and graphics, animations and GIFs.	Pixlr, Pablo
Adobe Dreamweaver	Creating websites	WebFlow, Squarespace, WordPress
Adobe Premiere Pro or Adobe Premier Elements	Video editing	OpenShot, Windows Movie Maker, Apple iMovie
Adobe Audition	Sound and music editing	Audacity, Apple GarageBand, Acoustica

Something to know

You may have noticed that in the examples given above, the name Adobe pops up quite often. Adobe Systems was founded by John Warnock and Charles Geschke in 1982, after they left the Xerox company to open a new company to sell their product PostScript.

PostScript was a powerful computer language that described the layout of a page to a printer, allowing the printer to reproduce in hard copy exactly what was on the digital page.

PostScript allowed laser printing to become a reality, since the program could guide the lasers to draw the digital page on the printer's drum correctly. Soon, PostScript became a staple in the advertising industry, since it allowed advertisement creators to quickly print out a copy of their advert to see what it would look like on a page.

Their next revolution was the Type 1 typefaces, which provided digital fonts that could be printed at any resolution. This was ground-breaking, because at the time more elaborate fonts would have to be lettered by hand and could only be printed at higher resolutions or they would lose their detail. The Type library soon became the largest collection of typefaces for personal computers in the world.

The introduction of Adobe Illustrator brought the ability to create detailed and high-quality digital drawings, which changed the face of advertising and marketing forever. Images could be created, manipulated, edited and updated quickly and more easily than traditional by-hand drawings.

Each new version of Adobe's products and each new product they bring out makes creating high-quality multimedia content easier and faster and their products remain some of the most popular multimedia software available.

COMMUNICATION SOFTWARE

Communication software is the group of applications that allow users to share files, text and video or audio messages over an internet connection. It is more than just email; communication software includes **Voice over Internet Protocol (VoIP)** systems and chat programs. Some examples of communication software are:

- Email clients such as Outlook.
- VoIP software such as Skype and RingCentral.
- Chat applications such as Slack and WhatsApp.

Communication software makes it easier for people to communicate and it is often more cost-effective to install and implement than traditional communications methods (such as telephone lines).

Most communication software doubles as collaboration software. This means that it can be used by multiple people to work on the same thing or to share work online. For example, Skype allows you to make video calls and to share your screen with the people on the call with you, allowing them to see what you are working on.

Activity 4.1

1. Multiple choice:
   a. Which of the following video players is only available on the World Wide Web?
      A. VLC media player
      B. YouTube
      C. Windows Media Player
      D. iTunes
   b. Which of the following is not antivirus software?
      A. NOD32
      B. Avast
      C. AVG
      D. AMG
   c. What is the file extension for animated images?
      A. *.jpeg
      B. *.mp3
      C. *.gif
      D. *.mp4
2. Match column B with column A:

COLUMN A	COLUMN B
2.1. An application that allows you to watch videos and listen to music that is stored on your computer or streamed from an online source.	A. Media player
2.2. A program used to create, edit and manipulate text documents.	B. Antivirus
2.3. Communications software that allows you to send and receive electronic communications from other people.	C. Word processer
2.4. A program that provides real-time protection against viruses, malware and other malicious software for your computer.	D. PowerPoint
2.5. Multimedia software that allows you to create, edit and manipulate images and other visual media such as brochures and logos.	E. Paint
2.6. A program that is used for creating and displaying presentations.	F. CorelDRAW
2.7. Basic image manipulation and drawing software that is built into Microsoft Windows.	G. Outlook
2.8. Chat application used for collaboration in business environments.	H. Slack

3. Answer the following questions in your own words:
   a. Explain what antivirus software is used for.
   b. List two examples of multimedia software and describe what they are specifically used for.
   c. Define communications software.
   d. Why does communications software make it easier for people to communicate?

4.3 Compatibility issues

The huge variety of application software available and all the versions of the same software mean there are bound to be compatibility issues, even when people are using the same kind of software. Compatibility issues come up when users are using the same type of software for a task, such as word processors, that cannot communicate with each other. This could be due to a difference in their versions or because they are made by different companies.

Compatibility issues can be small, for example certain features not working properly in older versions of the same software, but they can also be problematic, such as when a newer version of the software cannot open a document created in an older version.

In Microsoft Word for example, documents created in Word 2016 or 2013 can be opened in Word 2010 or 2007, but some of the newer features (such as collapsed headings or **embedded videos**) will not work in the older versions.

If someone using Word 2016 opens a document created in Word 2010, the document will open in Compatibility Mode. Microsoft Office does this to make sure that documents created in older versions still work properly.

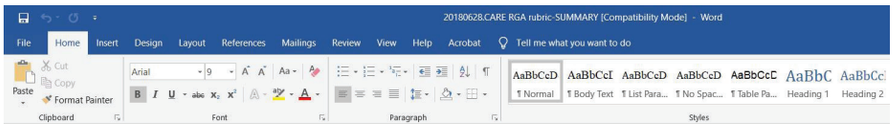


Figure 4.1: *Microsoft Word Compatibility Mode*

The feature in Figure 4.1 is an example of something called backwards compatibility, which is the ability of newer software to interact with files (or programs or systems) made with older versions of that software. It is usually built into the software and is a way to avoid compatibility issues. Another way to avoid this is to update your software.

UPDATING SOFTWARE

More and more software providers are offering subscription services for their software. An example of this is Microsoft's Office 365, which gives you the full range of Microsoft Office products and access to Microsoft's online productivity tools, such as OneDrive (their cloud storage service). Since Office 365 is a subscription service, you never truly own the software and will need to renew your subscription every year, but the software is updated once a month to make sure that you have access to the latest features.

Making sure that your software is up to date is important as you will be able to get the newest fixes for **bugs** in the software, the most recent virus and malware fixes and the latest features. This is especially important for software such as your antivirus programs and your operating system. Microsoft Windows 10 will let you know when a new version of any of your software becomes available so that you can update it. Some software also has the option to check for and install updates automatically, so you do not need to remember to do so.

TO UPDATE YOUR SOFTWARE

Whenever your computer asks to update a program, allow it to update as soon as possible. If it is not possible to install the update immediately, schedule a time that evening to install the update.

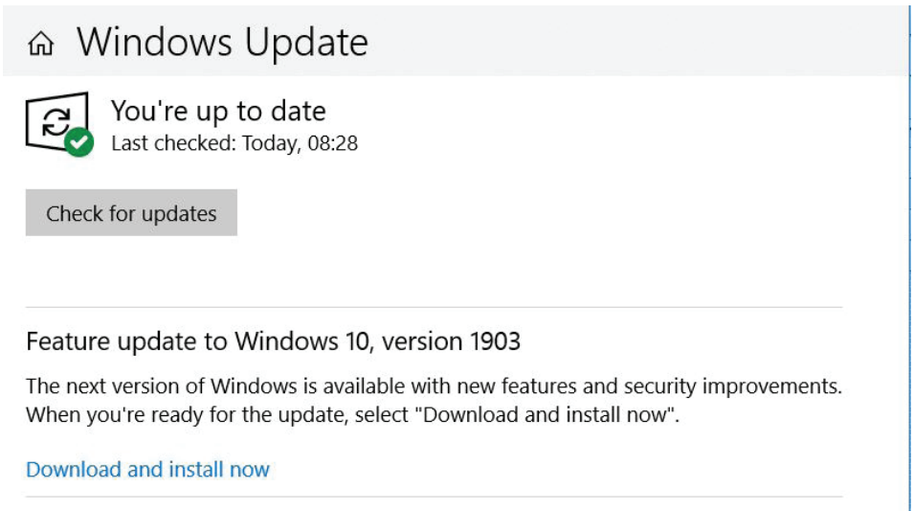


Figure 4.2: *Microsoft Windows automatically installs updates*

If the application informs you that an update is available with a link, download the newest version and install the downloaded program. This will update the program to the newest version without changing your settings.

If a program you use often does not inform you about an update, search the internet once or twice a year to see if a new version has been released. If it has, download this version and install it to update your software.

PATCHES AND SERVICE PACKS

A patch is a program that makes changes to software installed on a computer. Software companies issue patches to fix bugs or security problems in their programs or add new functions to the software. Microsoft refers to their patches as hotfixes.

A service pack (SP) is a collection of updates and fixes for an operating system or a software program. SPs are usually made up of patches. Many of these patches are often released before a larger SP, but the SP allows for an easy, single installation.

An installed SP also usually updates the version number for Windows. This is the actual version number, not the common name, such as Windows 10.

SPs often include new features as well as fixes. This is why one version of a program or operating system can be very different to another on a different computer.

Most, if not all, operating systems and software programs provide SPs free of charge as either a manual update from the developer's website, or through an auto-update feature within the program or operating system.

Something to know

Since releasing Windows 10, Microsoft has moved away from SPs and instead releases regular major features updates.

Activity 4.2

1. Write True or False next to the question number. Correct the statement if it is FALSE. Change the underlined word(s) to make the statement TRUE. (You may not simply use the word NOT to change the statement.)
   a. Microsoft Office 2016 is an example of a subscription service.
   b. Microsoft refers to their patches as hotfixes.
   c. An installed service pack (SP) also usually updates the version number for Microsoft Office.
   d. Most SPs are provided for a fee.
2. Answer the following questions in your own words:
   a. Explain what a compatibility issue is.
   b. Describe what backwards compatibility is.
   c. Why are more software companies offering subscription services for their products?
   d. Elaborate on the main difference between buying software and using a subscription service.

UNIT

4.4 Software for physically challenged users

In this unit, we will take a closer look at the software incorporated into most software for able-bodied users that makes it easier for physically challenged users to use.

Each assistive technology input and output device comes with specialised software to interpret the input correctly to give the correct output. For example, text-to-speech software converts text on a page to speech, allowing visually impaired users to "read" the page. Some of the more complex input and output devices, such as gesture-controllers and sip-and-puff devices, need specific software to work correctly. This software is usually included with the devices.

More recently, the developers of operating systems for smartphones and computers have begun to include accessibility software in their operating systems. Microsoft's Windows 8 and 10, Apple's OSX and Google's Android operating systems all have settings and built-in applications designed for physically challenged users.

While alternative input and output devices and accessibility software are important components in giving physically challenged users the opportunity and ability to use computers, these devices cannot work properly if the information they are interacting with has not been put together with accessibility in mind.

This is especially important when it comes to accessing the internet. Screen readers can struggle with interpreting websites that have not been designed for visually impaired readers. Since websites and web pages are mostly designed as a visual experience, users who cannot see these visual elements struggle to interact with the sites.

There are, however, ways that designers and developers can make their websites more accessible to visually impaired or blind users, for example:

- Giving links and buttons descriptive labels (saying "click here to sign up" instead of just "click here").
- Giving images and graphics good descriptions and *Alt Text*.
- Using headings to organise the content on a website's pages.
- Using descriptive titles for pages.
- Closed captions, which describe all the audio elements of a video and not just the dialogue, can also help deaf and hearing-impaired users watch videos and learn from them.

USING A SCREEN READER

https://youtu.be/7Rs3Ypsnfol

Almost all modern operating systems contain a series of special settings and functions to make using a computer easier for physically challenged users. These are usually referred to as accessibility settings and can include things such as:

- Colour settings for colour blind people to make browsing the web easier.
- Magnifying the screen to make it easier to read for partially blind users.
- Text-to-speech software to read the typed text out loud to blind users.
- Displaying visual notifications instead of having a notification sound to alert users who are hard of hearing to potential problems or updates for their computer.
- Speech recognition software to allow users to control their computers using their voices.

You can see what range of accessibility options your computer has by clicking on the Windows icon, searching for *Control Panel* and clicking on *Ease of Access*.

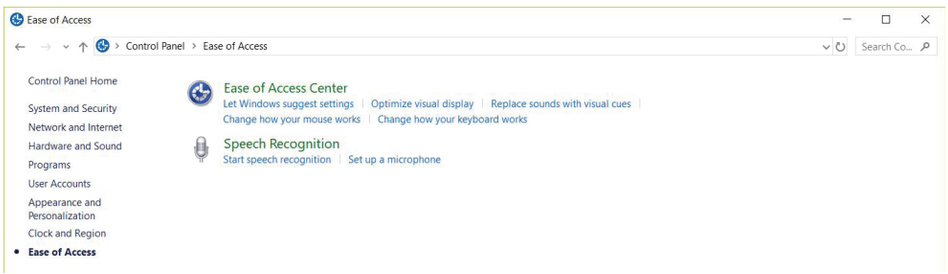


Figure 4.3: *Ease of Access menu in Windows 10*

Activity 4.3

1. Match Column B with Column A:

COLUMN A	COLUMN B
1.1. Special settings and functions to make using a computer easier for physically challenged users.	A. Screen reader
1.2. Device used to interpret websites for visually impaired readers.	B. Monitor
1.3. Click on *Ease of Access* on the *Control Panel* to view…	C. Accessibility software
	D. Accessibility options
	E. Accessibility settings

2. Write True or False next to the question number. Correct the statement if it is FALSE. Change the underlined word(s) to make the statement TRUE. (You may not simply use the word NOT to change the statement.)
   a. To find accessibility options, you need to click on *Ease of Use*.
   b. Speech recognition software reads text aloud for blind users.
   c. Closed captions can help deaf and hearing-impaired users watch videos.
3. Answer the following questions in your own words:
   a. What are accessibility settings? Give two examples.
   b. How do you access the accessibility features in Windows 10?
   c. Give one example of software for physically challenged users.
   d. Why is it important to design websites with accessibility in mind?
   e. List four ways in which website developers can make their websites more accessible.

UNIT

4.5 Cloud-based applications

With the rise in internet access and smartphone use, more people are turning to online or cloud-based applications to get their work done, since they can access these programs wherever they are as long as they have an internet connection. Cloud-based applications are any applications that are accessed using an internet connection instead of being stored in a device's memory.

Gmail, Google's online email client, was more popular in 2018 than Microsoft's Outlook. Online service providers are also offering cloud-based applications to businesses.

In this unit we will look at two web-based applications, namely Google's G Suite and Microsoft Office 365. We will discuss the advantages and disadvantages of each and how you can use them.

GOOGLE G SUITE

Google's G Suite is a free, online-only office suite. You can use it (with Google Docs and its companion applications Google Sheets and Google Slides) to create more or less the same documents you can create using more traditional desktop office suites (such as Microsoft Office). Google G Suite is offered with Google Drive, Google's cloud storage platform, and Gmail.

Google Docs has several advantages, for example:

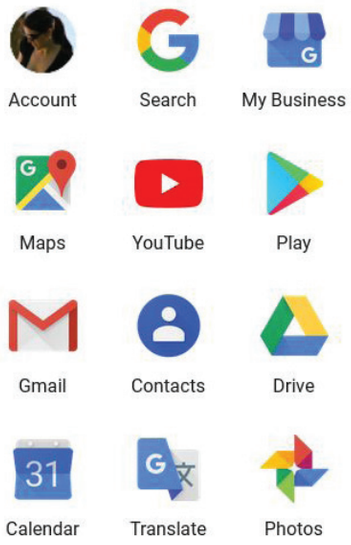
- It is easier to share and work with others in real time and multiple people can work on the same document at the same time.
- While Google Docs does have an offline editing option, it will only save your changes once you are connected to the internet again.
- The software is always up to date and does not require you to download or install anything.
- You can access your documents anywhere you have internet access and access to your Google account.
- Your documents do not take up space on your computer's storage. Instead, they are saved on the cloud.
- Because the documents are saved online, your documents are backed up automatically.

However, Google Docs also has its disadvantages, such as:

- It does not have the full range of word-processing features, e.g. you are limited to a set number of styles and formatting. This means that you cannot customise your documents as much as you can with other cloud-based applications.
- As with anything stored on the internet, your documents are vulnerable to attack and you do not have full control over the security of your documents.

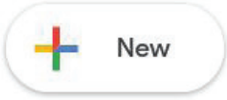
ACCESSING GOOGLE DOCS

To access Google Docs, you will need to go to Google Drive. You can do this by clicking on this icon in your Gmail account, followed by clicking on *Google Drive*. You need to set up a Gmail account to get access to Google Docs.

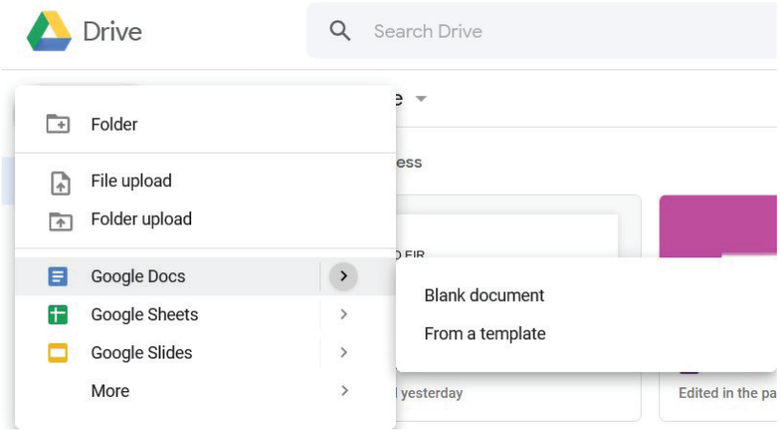


Alternatively, you can visit https://drive.google.com.

Once you are in your Google Drive account, click on *New*.



Click on *Google Docs* and choose *Blank document* or *From a template* to get started.



MICROSOFT OFFICE 365

Microsoft Office 365 is a subscription-based software service that combines traditional, locally stored software (the Office Suite) with cloud-based applications and storage. As part of your Office 365 subscription, you get access to Microsoft's OneDrive and online versions of Microsoft's word-processing, presentation, spreadsheet and database-management software.

You are also able to share this software across multiple devices you own, for example a laptop, smartphone and tablet.

The advantages and disadvantages of Microsoft Office 365 are very similar to the advantages and disadvantages of Google Docs. While Office 365 does come with more features, you still have to pay to use them and you will need to renew your subscription every year.

Table 4.4 shows how Google G Suite compares to Microsoft Office 365.

Table 4.4: *Comparison between G Suite and Microsoft 365*

GOOGLE G SUITE	MICROSOFT OFFICE 365
Free, online-only office suite	Subscription-based software service
You can use it (with Google Docs and its applications Google sheets and Google slides) to create more or less the same documents you can create using more traditional desktop office suites (such a Microsoft Office).	Combines traditional, locally stored software (the Office Suite) with cloud-based applications and storage.
Software is always up to date and does not require you to download or install anything.	While Office 365 does come with more features, you still have to pay to use them and you will need to renew your subscription every year.
Google's G Suite includes Gmail, Google Drive, Google Docs, Sheets, Slides, Calendar, Keep, Hangouts, and other Google apps.	Microsoft's Office 365 includes Outlook, OneDrive, Word, Excel, PowerPoint, One Note, Skype, and other Microsoft apps.

Activity 4.4

1. Multiple choice:
   - a. Which of the following is Google's online storage service?
     - A. Google Drive
     - B. Google Docs
     - C. Chrome
     - D. OneDrive
   - b. Which of the following is NOT part of the Microsoft Office 365 package?
     - A. Outlook
     - B. OneNote
     - C. PowerPoint
     - D. Notepad
   - c. Which application does not need an internet connection to work?
     - A. Notepad
     - B. Google Docs
     - C. Office 365
     - D. Google Maps
2. Match Column B with Column A:

COLUMN A	COLUMN B
2.1. Which online office suite has the advantage of being used with any operating system and web browser?	A. OneDrive
2.2. Which company's online services have different payment packages?	B. Google Drive
2.3. Microsoft's version of a file hosting service that synchronises with Microsoft's Office Online services.	C. OneNote
	D. Microsoft Office 365
	E. Google Docs

... continued

Activity 4.4

… continued

3. Write True or False next to the question number. Correct the statement if it is FALSE. Change the underlined word(s) to make the statement TRUE. (You may not simply use the word NOT to change the statement.)
   a. You have access to a full range of formatting options in Google Docs.
   b. Microsoft Office 365 is a free service.
   c. You can use Office 365 on multiple devices.
   d. Google Docs is a free, online-only office suite but you pay for extra storage.
   e. Google Drive is separate from your Gmail account.
4. Answer the following questions in your own words:
   a. Explain what a cloud-based application is.
   b. List the steps taken to access Google Drive and open a spreadsheet.
   c. List two advantages Google Docs has over Microsoft Word.

UNIT

4.6 Online storage

Online storage is becoming more popular as access to the internet grows. Online storage is also called **tertiary storage** or cloud storage and uses websites and online portals to store information on the World Wide Web. Examples of online storage include services such as Google Drive, Dropbox and Apple iCloud.

While storing information online seems like you are sending your information into the cloud, you must remember that this information does get stored on a physical computer somewhere, usually on a server in a server farm.

Figure 4.4: *Online storage services include Apple iCloud, Google Drive and Dropbox*

Online storage has several advantages and disadvantages.

Some of the advantages of online storage are:

- Allows you to access your information anywhere.
- Frees up physical storage space on storage devices.
- A reliable way to back up important or critical information.
- Data stored online can be shared more easily

A number of disadvantages of online storage:

- It is vulnerable to attacks (hacking) and distribution.
- May have **bandwidth** or storage limits.

Activity 4.5

1. Multiple choice:
   a. Which of the following is not an example of online storage?
      A. iCloud
      B. Google Drive
      C. Google Docs
      D. Dropbox
   b. Which of the following has potentially the largest storage space?
      A. Primary storage
      B. Cloud-based storage
      C. External HDD
      D. SSD

... continued

Activity 4.5

… continued

2. Match Column B with Column A:

COLUMN A	COLUMN B
2.1. Information gets stored on a physical computer, usually in a server farm.	A. Internet access
2.2. Cloud-based storage is also considered as …	B. PC
2.3. The most important thing needed to access online storage; this is also a disadvantage.	C. Tertiary storage
	D. HTTP
	E. Online storage

3. Write True or False next to the question number. Correct the statement if it is FALSE. Change the underlined word(s) to make the statement TRUE. (You may not simply use the word NOT to change the statement.)
   a. Online storage has limited free space and you pay to get more space.
   b. Dropbox is only compatible with the Microsoft Windows operating system.
   c. Spotify songs are stored on a cloud-based storage system.
4. Answer the following:
   a. Explain how your data can potentially be lost when using cloud storage.
   b. List THREE advantages of cloud-based storage.

REVISION ACTIVITY

QUESTION 1: MULTIPLE CHOICE

1.1 What is the definition of software? (1)

A. Programs that allow you to perform specific tasks on the computer.
B. Programs that control and manage the operations of the computer.
C. Programs that contain the instructions you use to tell the computer what you want it to do.
D. Programs that allow different applications to communicate with each other.

1.2 Which of the following is NOT an example of application software? (1)

A. Microsoft Excel
B. Norton Antivirus
C. Windows XP
D. Mozilla Firefox

1.3 Which of the following is multimedia software? (1)

A. Microsoft Paint
B. Microsoft Access
C. Microsoft Edge
D. Notepad

1.4 Which of the following is an example of system software? (1)

A. WordPad
B. Windows Defender
C. Google Chrome
D. Windows Media Player

1.5 Hotfixes are also known as _____. (1)

A. Traces
B. Hotspots
C. Patches
D. Service packs

QUESTION 2: TRUE OR FALSE

Write True or False next to the question number. Correct the statement if it is FALSE. Change the underlined word(s) to make the statement TRUE. (You may not simply use the word NOT to change the statement.)

a. You can own subscription software as long as you pay for it. (1)
b. Subscription software can update itself automatically. (1)

… continued

REVISION ACTIVITY

... continued

c. Service packs are updates for system software. (1)
d. Google Docs has all the features that Microsoft Word has. (1)
e. Multimedia software refers to the plans you use to create and make multimedia. (1)

QUESTION 3: MATCHING ITEMS

Choose a term/concept from Column B that matches a description in Column A. Write only the letter next to the question number (e.g. 1J). (5)

COLUMN A	COLUMN B
1. Software used to create 3D models.	**A.** Adobe Photoshop **B.** Microsoft Excel **C.** Google Drive **D.** Google Chrome **E.** VLC media player **F.** NVIDIA GeForce Experience **G.** Windows Defender **H.** Dropbox **I.** Microsoft Outlook
2. Software used to play movies and music.	
3. Software to email people online.	
4. Software used to edit photos and GIFs.	
5. Software for data storage.	

QUESTION 4: MEDIUM AND LONG QUESTIONS

4.1 Describe what backwards compatibility is. (2)
4.2 Explain briefly what accessibility settings are. (2)
4.3 Give two examples of accessibility settings. Mention which physical challenge could benefit from this setting. (4)
4.4 Identify the compatibility issue for the following scenarios. (4)

SCENARIO	COMPATIBILITY ISSUE
1. While playing a newly installed game, you realise that at certain points on the game map the controllers are not responding the way they should.	
2. The new functions advertised by an application are not working or showing on my device.	
3. As soon as I open a Word document on the school computer, a window pops up saying that certain characters will not be displayed.	
4. Every time I use a calculator app on my laptop and press the multiply button, it adds the values instead.	

4.5 Your teacher has asked you to create a presentation that includes at least one video, some audio clips and an animation. Which three software programs will you use to make these multimedia items and why? (6)
4.6 Describe the difference between a service pack and a patch. (4)
4.7 Provide two reasons why it is important to update your software regularly. (2)
4.8 Give one advantage Microsoft Word has over Google Docs. (1)

TOTAL: [40]

AT THE END OF THE CHAPTER

NO	CAN YOU ...	YES	NO
1.	Define the role of application software?		
2.	Discuss application software in terms of collaboration and communication software?		
3.	Define compatibility issues in software?		
4.	Describe why software must be updated?		
5.	Describe software for physically challenged users?		
6.	Explain the advantages and disadvantages of online or cloud storage?		
7.	Discuss cloud-based applications with a focus on Google Docs and Microsoft Office 365?		

TERM 2

HARDWARE, SOFTWARE AND COMPUTER MANAGEMENT

CHAPTER 5

CHAPTER OVERVIEW	
Unit 5.1	Basic system requirements
Unit 5.2	Software installation
Unit 5.3	File management

By the end of this chapter, you will be able to:

- List and describe basic system requirements and how they relate to software
- Discuss the difference between installing software from an online download and a portable storage medium
- Describe the installation process
- Explain how to manage files and folders on a computer

INTRODUCTION

In this chapter, you will learn what basic system requirements are and how they link to software. You will learn how to install software from a portable storage medium (such as a CD) and from an internet download, as well as dig deeper into file management and what file attributes are. You will also learn how to **import** and **export** files and how to search for files.

UNIT

5.1 Basic system requirements

System requirements are the minimum necessary specifications that you will need to make sure that the software runs smoothly and does not overwork the hardware on your computer. It is basically a list of what you need to make sure that a game or program runs properly.

If your computer does not meet these requirements, you may not be able to install the software or, if you can install the software, it may run slowly. The system requirements for software are usually printed on the package that the software comes in or are listed on the software's website.

Figure 5.1 below shows the list of system requirements for installing Photoshop.

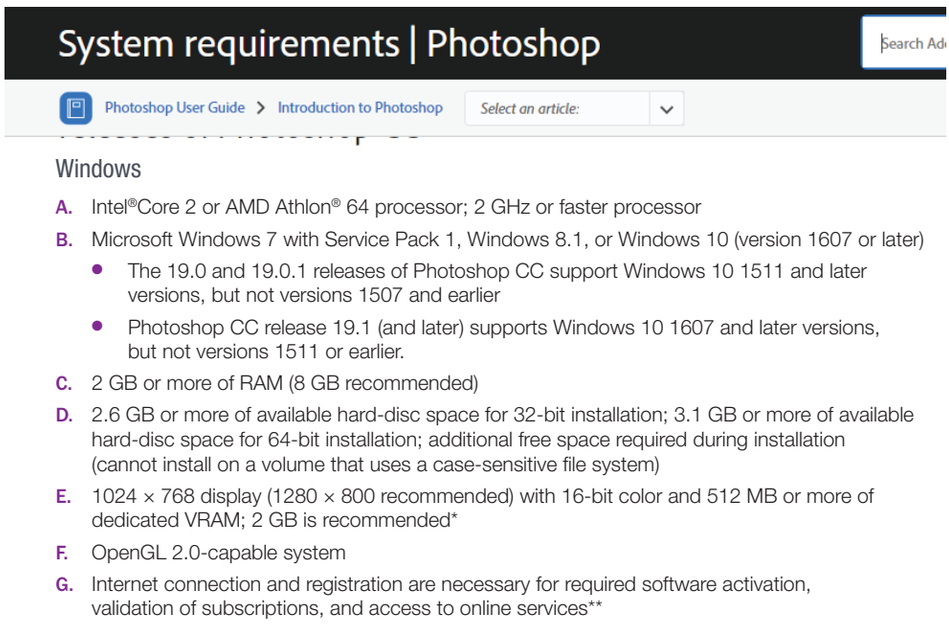


Figure 5.1: *Adobe Photoshop system requirements*

As you can see, the software makes several recommendations, including:

A. The type of CPU you will need (Intel® Core 2 or AMD Athlon® 64 processor operating at 2 GHz or faster).
B. The operating system you should be using (Microsoft Windows 7, 8.1 or 10).
C. How much RAM your system should have (a minimum of 2 GB but 8 GB is recommended).
D. How much space should be on your hard drive.
E. The size of your display (or screen).
F. Whether or not you will need an internet connection.

Knowing what the system requirements are for the software you will be using most often will help you decide what computer to buy when you are shopping for one. Most of the information you will need will be on a label on the computer or will be listed in an advertisement for the computer.

System requirements will also let you know if you need to purchase any additional hardware (such as microphones when using audio recording software). Hardware items, such as

printers, also come with system requirements. For example, a printer may only be compatible with Windows 8.1 and 10 or Apple's macOS and cannot be connected to a computer running Windows 7.

For your computer to be able to run all the newest gaming software, you would need to look at the graphics card. A GPU is a programmable logic chip to render images, animations and video for the computer's screen. GPUs can be located in plug-in cards, in a chipset on the motherboard or in the same chip as the CPU. The gaming software's system requirements will recommend the size of the additional GPU.

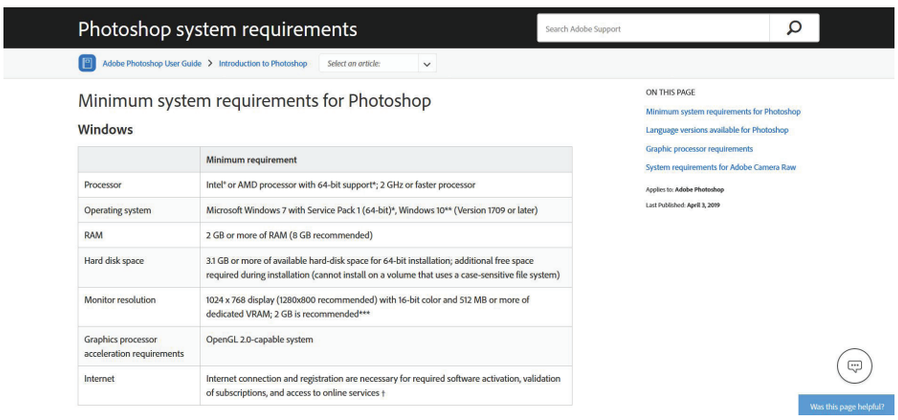
If your computer does not meet all the requirements to run specific software or communicate with a specific device, you will not necessarily have to buy a whole new computer. It is possible to upgrade your RAM, GPU or CPU. You can, for example, upgrade your operating system or you can install the latest device drivers to make sure that your computer and hardware can communicate with each other.

Activity 5.1

1. Answer the following questions pertaining to the advertisements below:

Features for **DELL 39 cm (15.6") Inspiron 3552 Intel Celeron Laptop**

Operating System:	Windows 10 Home
Processor:	Intel Celeron - N3060 (Up to 2.48 GHz)
Memory:	4 GB RAM
Storage:	500 GB hard disk drive
Graphics:	Intel HD
Optical Drive:	Yes
Display Size:	39 cm (15.6")
Display Resolution:	1366 x 768
Touch Display:	No
HDMI Input:	Yes
USB Ports:	Yes
SD Card Reader:	Yes
Connectivity:	Wi-Fi / Ethernet / Bluetooth


Photoshop system requirements

Search Adobe Support

Adobe Photoshop User Guide > Introduction to Photoshop Select an article:

Minimum system requirements for Photoshop

Windows

	Minimum requirement
Processor	Intel® or AMD processor with 64-bit support*†; 2 GHz or faster processor
Operating system	Microsoft Windows 7 with Service Pack 1 (64-bit)*, Windows 10** (Version 1709 or later)
RAM	2 GB or more of RAM (8 GB recommended)
Hard disk space	3.1 GB or more of available hard-disk space for 64-bit installation; additional free space required during installation (cannot install on a volume that uses a case-sensitive file system)
Monitor resolution	1024 x 768 display (1280x800 recommended) with 16-bit color and 512 MB or more of dedicated VRAM; 2 GB is recommended***
Graphics processor acceleration requirements	OpenGL 2.0-capable system
Internet	Internet connection and registration are necessary for required software activation, validation of subscriptions, and access to online services †

ON THIS PAGE

Minimum system requirements for Photoshop

Language versions available for Photoshop

Graphic processor requirements

System requirements for Adobe Camera Raw

Applies to: **Adobe Photoshop**

Last Published: **April 3, 2019**

Was this page helpful?

a. Does the DELL laptop have the minimum requirements for Windows 10? How can you be sure without looking at the minimum hardware needed for Windows 10?
b. What does OS mean in the *Call of Duty: Modern Warfare 2* game requirements?
c. What does *display resolution 1366 × 768* mean?

… continued

Activity 5.1

… continued

d. Describe what is meant by *Touch Display*.
e. Explain what 32-bit means.
f. Decide if the *Call of Duty: Modern Warfare 2* and Photoshop in Figure 5.1 can be installed on the laptop and add relevant comments.
g. What does VRAM stand for?
h. State which component of the computer will be the easiest and cheapest to upgrade.
i. List the different processors' names in the adverts and sort them from fastest to slowest.

2. Write True or False next to the question number. Correct the statement if it is FALSE. (You may not simply use the word NOT to change the statement.)
   a. If your hardware does not meet the system requirements, it means that the software will not work.
   b. Certain programs can run even if you have no RAM.
   c. Certain programs cannot work if you do not have the right operating system.
   d. The motherboard is the core component in a computer that brings all the different aspects of the computer together.

UNIT

5.2 Software installation

Once you have worked out what requirements you need to install software, you will need to begin the installation process. Before installing the software, you need to:

1. Download the software files from a website; or
2. Purchase a CD or DVD from a store.

After downloading the installation software, you can install it. Usually this installation software is an **installation wizard** to assist you with the installation process.

ONLINE DOWNLOAD

The most common way to get new software is to download it from the internet. To do this, you must go to the website where the software is available and download the files. Make sure that you download software from trusted publishers or verified retailers only. This ensures that you are getting the software you want and that you do not accidentally download malware or a virus.

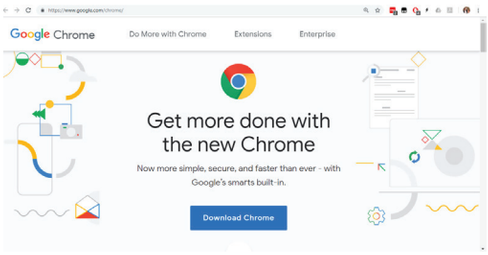
You will usually use a credit card to buy the software to download. Once you have purchased the software, you will click on the download link to begin the process.

You can also buy software from app stores, such as Google's Play Store, Apple's App Store or the Windows Store. The software you are looking for is usually sorted according to its category, for example, gaming, word processing or design.

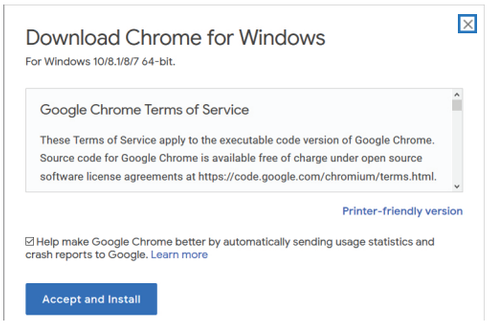
DOWNLOADING CHROME

To download software from the internet, do the following:

1. Go to https://www.google.com/chrome/ (or the site where the software is available to download).



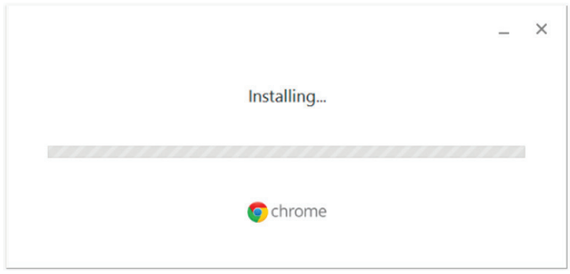
2. Click on the *Download* button. A dialog box will appear. Accept the *Terms of Service* and make sure that you are downloading the correct version for your computer.



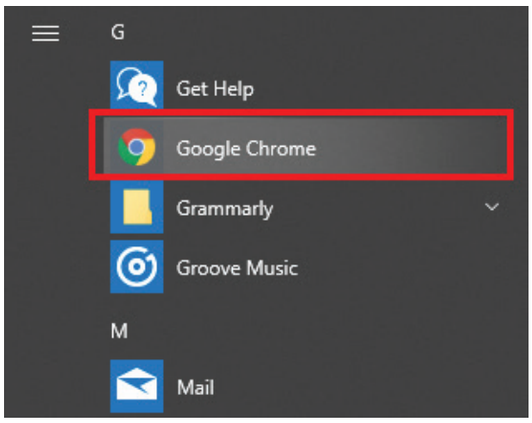
... continued

DOWNLOADING CHROME

3. Follow the instructions to install the software.



4. Open the application from the *Start* menu.



PORTABLE STORAGE MEDIUM INSTALLATION

Some software can be installed using the files found on a CD or DVD. This includes software such as the operating system, Microsoft Office (not Microsoft Office 365) and some games.

Figure 5.2: *An example of software on a portable storage medium*

To get this software, you will need to go to a store and buy the product and bring it home with you to install. You do this by inserting the disk into your computer's optical disk drive (its CD or DVD player). The installation program will usually start automatically but you can also look for the setup program to start the installation.

HOW TO INSTALL SOFTWARE

Once you have downloaded the software or inserted the disk, the installation wizard will guide you through what to do. While the installation wizard does not handle all the aspects of the installation, since these may be different from one program to the next, the process is very similar for all software.

SOFTWARE STEPS FOR INSTALLATION

You will usually start by either clicking on the downloaded file or inserting the disk and then letting the program setup file run (usually called *Setup.exe* or *Install.exe*).

STEP	DESCRIPTION
Accept the license agreement	Most software cannot complete the installation if you do not agree to the manufacturer's terms of use. This license agreement is a legally binding contract between you and the manufacturer and outlines what you can and cannot do with the software.
Enter the product key/activation code/registration number	The product key is the way that the manufacturer links the software to you, stops the software from being installed on more devices than the licensing terms agree to and prevents piracy. It also links you to any online support available.
Choose the installation location	The installer will suggest a default folder. It is usually best to stick to this suggestion. For example, if your installer suggests installing all your software on the C:/ drive, you will know where to look for a program.
Choose the type of installation you want	You can usually choose between the following types of installation: • Typical installation, which installs the components that are used most often. • Custom installation, where you can choose which components to install. • Full installation, which installs all the components of the software. This is not always an option in an installation.
Install extras	Some software comes with extra software bundled in (such as McAfee antivirus with some Microsoft products). In this step you can choose which extra software to install. Often these extras are ticked by default and you will have to untick them to not install them. You should always check which extras are installing to your computer and untick the ones you do not want.
Check for updates	Once a program has installed, the installer may ask if you want to check for the latest version. This is usually done with software that is installed from a disk. Downloaded software is often more up to date.
Register your product	Some programs require that you register on their online portal so that the company can contact you with news and notifications of updates. You should be allowed to skip this step if you do not want to be contacted by the manufacturer.
Add shortcuts	The last step in the installation process is to add a shortcut. Most software will ask you if you want a shortcut to the program on your desktop. If you do not, deselect this option.
Take a tour	Some software offers a tutorial the first time you open the program. These tutorials will usually highlight important features and how to use them. If it is the first time you are using a specific program, you should work through the tutorial before getting started.

HOW TO UNINSTALL SOFTWARE

Uninstalling software is when you remove the program and all its files from your computer.

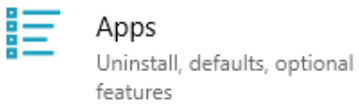
UNINSTALL A PROGRAM

To uninstall a program in Windows 10:

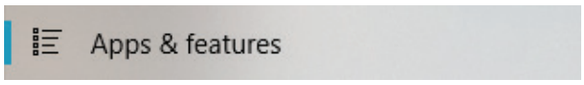
Step 1: Click on the *Windows* icon.

Step 2: Click on *Settings*.

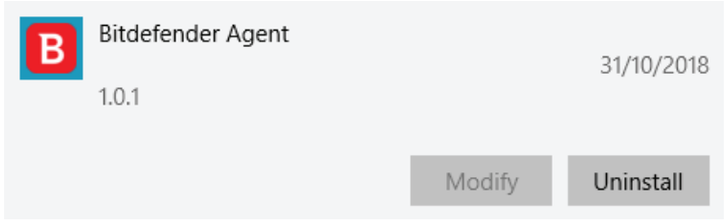
Step 3: Click on *Apps*.



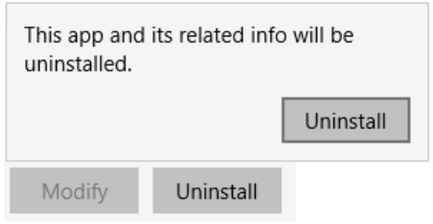
Step 4: Click on *Apps & Features* in the left pane. A list of all installed apps will appear.



Step 5: Click on the one you want to uninstall and then click on the *Uninstall* button (if this button is greyed out, it is a system app and cannot be uninstalled).



Step 6: Click on *Uninstall* in the pop-up window that appears and wait for the system to uninstall the app.



Activity 5.2

1. Write True or False next to the question number. Correct the statement if it is FALSE. (You may not simply use the word NOT to change the statement.)
   - **a.** You completely eradicate the associated files and folders when you uninstall a program.
   - **b.** Some installation software files are sold on a flash disk.
   - **c.** The installation wizard will guide you through what to do when installing software.
   - **d.** Most hardware is already installed on the Microsoft operating system, thus most hardware are plug-and-play devices.
   - **e.** Most primary hard drives are saved with the drive location of E:\.

UNIT

5.3 File management

When you are setting up a file management system, there are several key things you need to look out for. You will need to know what types of files you are creating and how big those files are (so that you know how much of your computer's resources they are using).

It also helps you to understand certain attributes that files have, such as hidden and read-only, and how to import/export files and how to search folders and drives for a specific file. This section will look at these aspects of files.

FILE TYPES

In Grade 10, you learned about file extensions and how they give you an idea of what content is likely to be in the file. File extensions usually link to a specific file type. For example, seeing a file that ends in .docx will let you know that it is a Microsoft Word document. File types indicate the specific characteristics of a document and will let the operating system know which program to use to open that file.

If you were to try and open an Adobe Photoshop document using Microsoft Excel, it would not work. Some file types are associated with specific programs, while others are standard file types that can be opened by a range of programs that support that file type. File types are not file formats, however. The file format usually describes the structure of the file and what it contains. Table 5.1 shows a list of file types and if they are program specific or standard.

Table 5.1: *File types*

FILE EXTENSION	NAME	TYPE
*.pdf	Portable Document Format	Adobe Acrobat Reader specific
*.docx	Microsoft Word document	Microsoft Word specific
*.rtf	Rich text format	Standard or open format
*.txt	Text file	Standard or open format
*.xml	Extensible Markup Language file	Extensible Markup Language
*.mp3	MP3 audio file	Standard or open format
*.flv	Animate video file	Standard or open format
*.gif	Graphic interchange format	Standard or open format
*.jpg	Image file	Standard or open format
*.accdb	Access database file	Microsoft Access specific
*.xlsx	Excel spreadsheet file	Microsoft Excel specific

When you are organising files, you can either organise them by file type or by subject.

Something to know

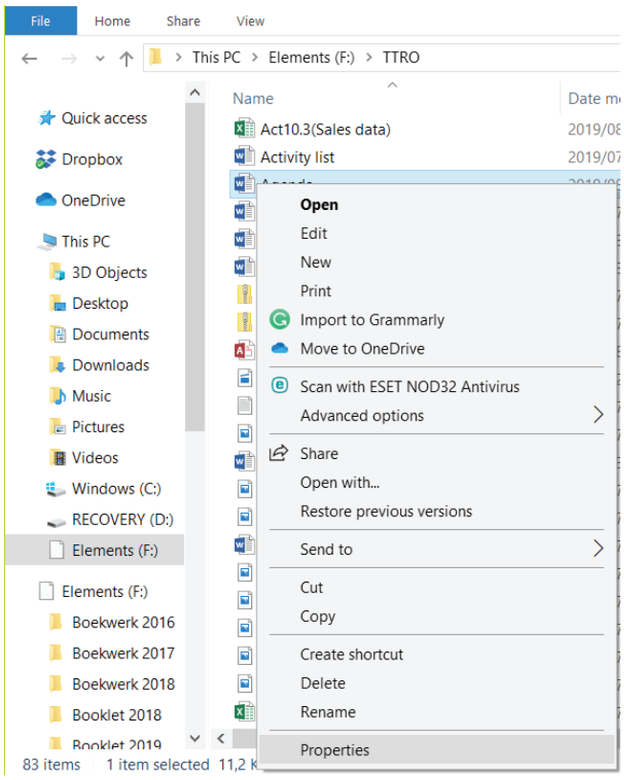
You can find a complete list of all file types at FileInfo.com (https://fileinfo.com/).

PROPERTIES

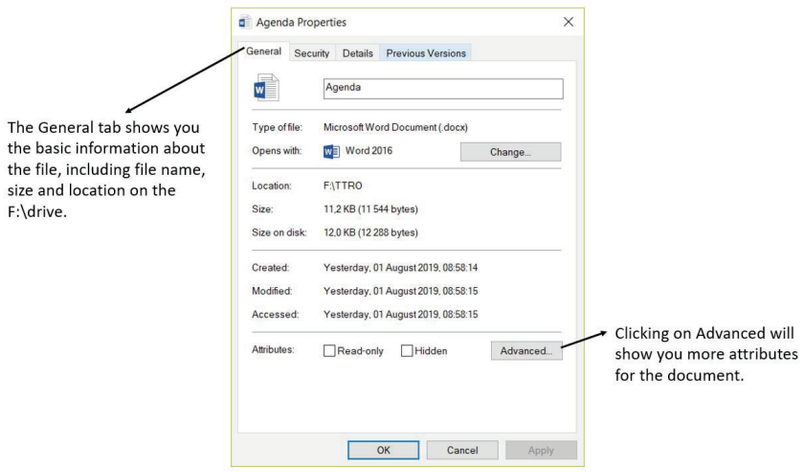
The file *Properties* window shows you a range of information about a file, such as its file type, size and when it was last modified. It can also show you information on where a photograph was taken (its **geo-location**) and even what type of camera was used to take it. The *Properties* window will also give you information on how you can manipulate the file.

FILE PROPERTIES

1. To see the properties of a file, right click on the file name and select *Properties*.



2. Click on *Properties*.



The *Properties* dialog box will give you information about the file, as you can see in the example above.

The *General* tab shows you the basic information about the file, including its name, size and location on the C:\ drive. It also shows attributes such as "read-only" and "hidden". Clicking on *Advanced* will show you more attributes for the document. We will discuss these in more detail later on in this unit.

The *Security* tab allows you to change what access the system and other users have to the file. The *Details* tab gives you more in-depth details about the file, including its word count and what template was used to create it. The *Previous Versions* tab allows you to see if there are other versions of the file.

FILE ATTRIBUTES

File attributes are settings linked to computer files that give or deny certain rights to how a user or the operating system can access that file. There are several types of file attributes, but the most important are "read-only" and "hidden".

Read-only files cannot be changed, edited or saved. They can only be opened and read. This is done to protect the data in the file from being edited accidentally. Hidden files are any files with the "hidden" attribute turned on. This means that these files are invisible while browsing through folders – you cannot see them without specifically allowing all of them to be seen.

IMPORT AND EXPORT

Most computer programs have their own way to organise and encode data into the files they save. Therefore, they can recognise their own files, but not necessarily those from another program. To be able to send or receive such files, it has to export or import the files. To export a file means to convert it into a format other than the one it is currently in. To import a file is to bring it from another program into the one you are using. This function allows different computer programs to read each other's files.

Applications such as Access or Excel allow you to import or export your data from one file type to another. A good example of this is importing your Outlook data (.ost files) into Excel (.xlsx) or Word (.docx) files. This allows you to make a backup of your data.

You can also use this function to convert files from one file type to another. Importing files also allows you to quickly and easily move your files from one computer to another, especially if you are moving from an Apple product to a computer that uses the Microsoft Windows operating system.

SEARCH

You can use *File Explorer* to search for a file you saved. This is especially helpful if you have many files or you have forgotten where a particular file is stored. If you remember the file name, you can simply enter that in the search box in *File Explorer*.

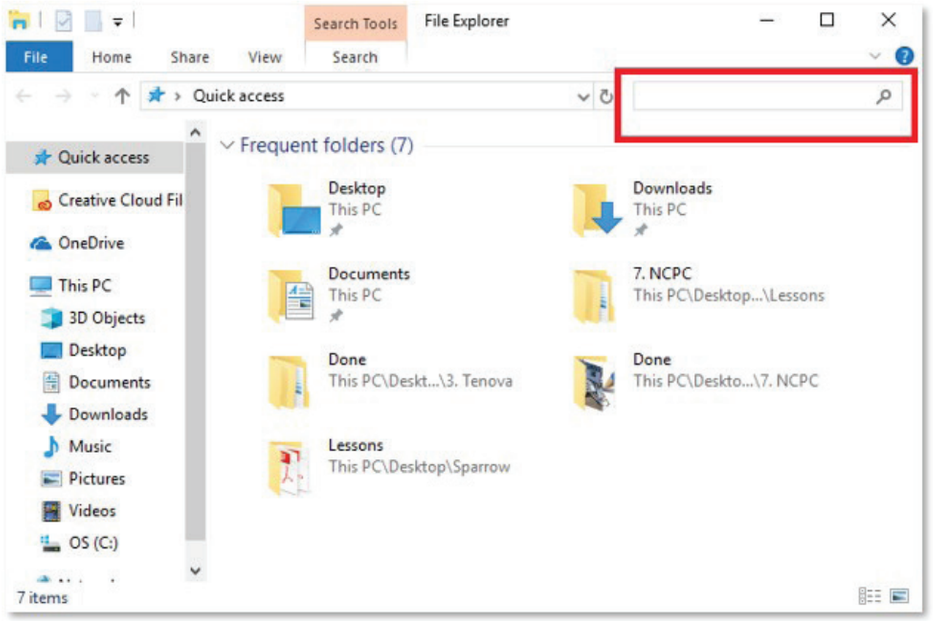


Figure 5.3: *The search box in File Explorer*

You can also search by file type or size. Using an asterisk wildcard (*) will let you search for groups of files, for example:

- *.txt searches for all text files.
- Home* will search for all files that start with "home", such as homework.docx or homedesign.psd.

Activity 5.3

1. Multiple choice:
   a. Which attribute allows the user to view but not edit the file?
      A. Hidden
      B. Security
      C. Read-only
      D. Sharing
   b. Which one of the following file extensions is not used in typing a report?
      A. .txt
      B. .docx
      C. .pdf
      D. .png
   c. Which of the following file extensions is not part of the Microsoft Office 365 package?
      A. .txt
      B. .docx
      C. .xlsx
      D. .pttx

... continued

Activity 5.3

… continued

2. Match Column B with Column A:

COLUMN A	COLUMN B	ANSWER
2.1. File extension for an animation.	**A.** .gif	
2.2. File extension for a picture.	**B.** Import	
2.3. Term used to describe information on where and when a photograph was taken.	**C.** .mp3	
2.4. To convert a file into the format required by the application being used. For example, most word-processing programs can … documents created in other word processors.	**D.** .jpg	
2.5. To save a copy of the current open document, database, image or video into a file format required by a different application.	**E.** Geo-satellite	
	F. Geo-location	
	G. Export	

3. Write True or False next to the question number. Correct the statement if it is FALSE. (You may not simply use the word NOT to change the statement.)
   - **a.** You can find a complete list of all file types at FileInfo.com.
   - **b.** The file extension can indicate what type of data is on the file as well as what program is needed to open the file.
   - **c.** The most important file attributes are security and sharing.
4. Answer the following in your own words.
   - **a.** How do file extensions help you identify the type of document?
   - **b.** Give two examples of standard file types.
   - **c.** What does the *Properties* window tell you about a file?
   - **d.** Explain how you can see the file properties of a document.
   - **e.** What are read-only and hidden files?
   - **f.** Explain how you search for a file in Windows 10.

REVISION ACTIVITY

QUESTION 1: MULTIPLE CHOICE

1.1 Which of the following is not a system requirement? (1)

- **A.** Type of CPU
- **B.** Type of RAM
- **C.** Type of operating system
- **D.** Storage capacity

1.2 A hidden file is _____. (1)

- **A.** A file that cannot be changed
- **B.** A file that cannot be edited
- **C.** A file that will not display
- **D.** A file that cannot be saved

… continued

REVISION ACTIVITY

… continued

1.3 A software installer will use _____. (1)

- **A.** A password
- **B.** An online verification system
- **C.** A CD
- **D.** An installer wizard

1.4 Which of the following is an example of a program setup file? (1)

- **A.** Word.docx
- **B.** Photoshop.psd
- **C.** Chrome.exe
- **D.** Notepad.rtf

1.5 A license agreement indicates the manufacturer's _____. (1)

- **A.** Terms of use
- **B.** Contact details
- **C.** Rules and regulations
- **D.** Terms of agreement

QUESTION 2: TRUE OR FALSE

2 Write True or False next to the question number. Correct the statement if it is FALSE. Change the underlined word(s) to make the statement TRUE. (You may not simply use the word NOT to change the statement.)

- **a.** Before a person can use installed software, he or she must accept the license agreement. (1)
- **b.** Uninstalling software involves removing the program and all its files from your computer. (1)
- **c.** File properties are settings linked to computer files that give or deny users access to certain rights. (1)
- **d.** Importing a file converts it from one format to another. (1)
- **e.** Windows Explorer is used to search for files on a computer. (1)

QUESTION 3: MATCHING ITEMS

Choose a term/concept from Column B that matches a description in Column A. Write only the letter next to the question number (e.g. 1J). (5)

COLUMN A	COLUMN B
1. Where you should go to find information about a file.	**A.** System requirements **B.** Details tab **C.** Read-only file **D.** Adobe Illustrator **E.** .pdf **F.** Export **G.** Security tab **H.** Check for updates
2. A file that can be opened and edited by Adobe Acrobat.	
3. The properties a gamer must look at to see if a game will run on their computer.	
4. Where you should go to find out what access the system and other users have to the file.	
5. A file that can only be read and not edited or saved.	

QUESTION 4: MEDIUM QUESTIONS

4.1 Name two methods that can be used to install software. (2)

4.2 What is the advantage of using a custom install method? (1)

4.3 What is the difference between exporting a file and importing a file? (2)

… continued

REVISION ACTIVITY

... continued

4.4 Give two examples of file extensions for the following file types:

- **a.** Audio files (2)
- **b.** Text files (2)
- **c.** Video files (2)
- **d.** Picture files (2)
- **e.** Document files (2)

QUESTION 5: SCENARIO-BASED QUESTIONS

The Civvie Computer Club meets once a week to discuss new and trendy computer-related topics. The club members frequently need to install new versions of software by using a CD. Installing software from a CD is easy since you just need to follow the installation wizard.

- **a.** Briefly explain what an installation wizard is. (2)
- **b.** Activation codes are usually sent via email. Explain what an activation code is. (2)
- **c.** Explain the difference between a full and custom installation. (4)
- **d.** The club members sometimes need to remove programs. Outline the correct way of uninstalling software. (2)

TOTAL: [40]

AT THE END OF THE CHAPTER

NO	CAN YOU ...	YES	NO
1.	List and describe basic system requirements and how they relate to software?		
2.	Discuss the difference between installing software from an online download and a portable storage medium?		
3.	Describe the installation process?		
4.	Explain how to manage files and folders on a computer?		

TERMS 1, 2, 3

CHAPTER 6

SOCIAL IMPLICATIONS OF HARDWARE

CHAPTER OVERVIEW	
Unit 6.1	Input and output devices for physically challenged users
Unit 6.2	Health issues due to input and output devices
Unit 6.3	Protecting your hardware
Unit 6.4	Power supply and settings

By the end of this chapter, you will be able to:

- Identify input and output devices for physically challenged users
- Discuss the health issues caused by input and output devices
- Describe how to protect your hardware from theft and damage

INTRODUCTION

This chapter will focus on input and output devices for physically challenged users, the health issues associated with hardware devices, how to protect your devices from theft or damage and how to protect your devices from **power surges** and power failures.

UNIT

6.1 Input and output devices for physically challenged users

Input and output devices for the physically challenged are used to help people with physical disabilities to interact with the modern world.

INPUT DEVICES

The author of *A Brief History of Time*, famous scientist Stephen Hawking, was diagnosed with a disease called amyotrophic lateral sclerosis (ALS) in 1963 and given only two years to live. He would go on to live for 55 more years (until his death in 2018), but the ALS would cause him to lose the ability to control his muscle movements. An operation done in 1985 to save his life left him unable to speak.

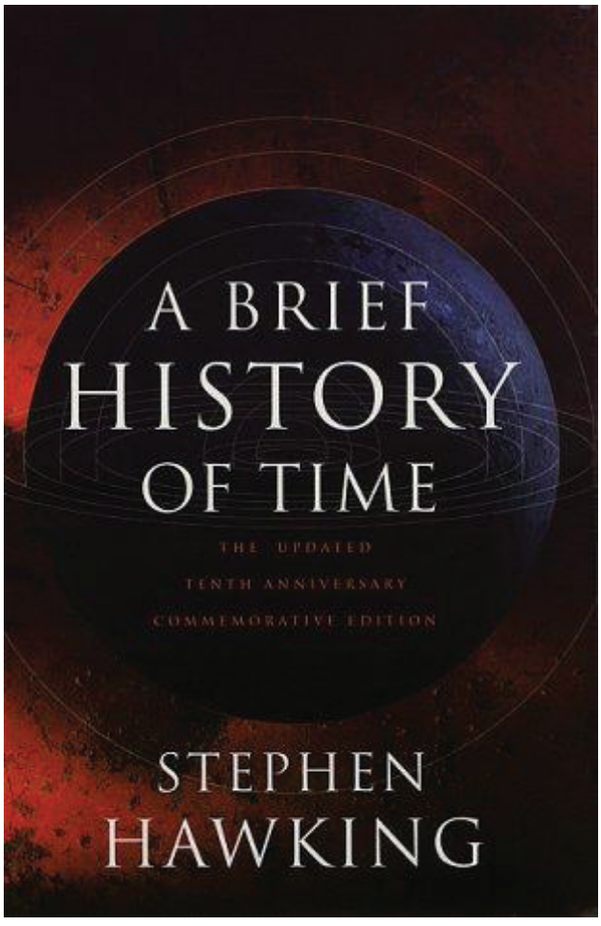


Figure 6.1: *A Brief History of Time by Stephen Hawking*

A Brief History of Time was written using two things, a piece of software called Equalizer that took Professor Hawking's eye movements and translated them into words, and a sensor in his glasses that could track those eye movements. With the help of this technology, a person who would not have been able to use normal computer equipment was able to create ground-breaking work.

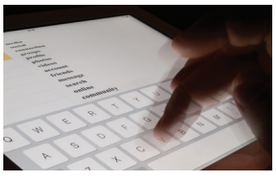
There are a variety of alternative input devices available to physically challenged users. These range from fairly common and easy-to-implement adaptations to traditional input devices, to more specialised devices. Next, some of these devices and their advantages and disadvantages are discussed.

INPUT DEVICES FOR PHYSICALLY CHALLENGED USERS

Many options are available to help people who are physically challenged when using ICT. These are just a few devices that could be used.

- **Braille keyboard and Braille display device:** These are keyboards with Braille lettering, that can be used by blind or visually impaired users.
- **On-screen or virtual keyboards:** The keyboard is displayed on a user's screen and used with gesture-controlled pointers or joysticks.
- **Microphones:** Are used with speech recognition software, allowing the user to dictate their input to the computer.
- **Keyguards:** Metal or plastic plates that allow a user to rest his/her hands on a keyboard without accidentally pressing the keys.
- **Head-mounted pointers:** These are controlled by switches to simulate the function of a mouse. The switches can be in hand or foot pads, or pedals or sensors that detect eye movement or facial expressions.
- **Gesture-recognition devices:** The device recognises hand gestures, head or eye movements, or read lips or sign language to input information into a computer.
- **Sip-and-puff devices:** A switch that operates the computer when users breathe into (puffing) or through (sipping) special tubes. Special software is used to interpret the sips and puffs and turn them into data that the computer can use.
- **Magnification devices:** Enlarges the information displayed on the computer screen in a range of magnifications and a variety of fonts. The magnifier may have the ability to create a large, scrolling virtual screen, or may only magnify the portion of the display near the mouse pointer.
- **Large-key keyboards:** The print on the number and letter keys of the keyboard are three times larger than those on standard keyboards. The bright white printing on the large black keys increases visibility and the contrast makes it easier to read. These features are helpful to those with vision impairment and for those who wear reading glasses or bifocals, or work in low-lit areas.
- **Braille printers:** These printers operate by embossing raised braille dots onto Braille paper. Pins are pressed into one side of the paper in order to create raised dots on the other side. This is only output.

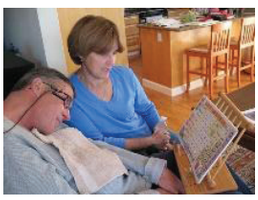
Braille keyboard



On-screen or virtual keyboards

Microphones

Keyguards



Head-mounted pointers

Gesture-recognition devices

Sip-and-puff devices

Keyboard and mouse settings can also be customised to make input easier for physically challenged users. Sticky keys allow users to use common keyboard shortcuts without needing to hold down all the keys at the same time, for example, when using the *Paste* command, users do not need to hold down the *Ctrl* and *V* keys at the same time. They can instead press the keys one at a time.

You can turn sticky keys on in one of two ways.

1. You can press the *Shift* key five times to turn sticky keys on and off.
2. If this does not work, you can click on the *Windows* key or press the *Windows* key on your keyboard, click on the *Settings* icon and then click on *Ease of Access*. You can then scroll down to the keyboard settings and tick or untick the *Sticky Keys* box.

OUTPUT DEVICES

Physically challenged users can also use a variety of output devices to access information on their computers. Headphones and speakers can, for example, be used with various types of screen-reading software, such as screen-magnifying programs or physical magnifiers mounted onto their screens, to make sections of the screens easier to read.

Braille interfaces work by raising metal or plastic pins on a surface, allowing blind users to read what is on their screens. These devices can only read basic text documents.

Figure 6.2: *Computer with Braille display*

Braille printers can be used to aid visually impaired users by printing the raised **patterns** of dots on special paper, thereby allowing them to read the text with their fingers.

Activity 6.1

1. Multiple choice:
   a. Stephen Hawking was diagnosed with?
      A. ALS
      B. ADHD
      C. CTS
      D. Parkinson's disease
   b. Which of the following is NOT a device for the physically challenged?
      A. Microphones
      B. On-screen or virtual keyboards
      C. Monitor
      D. Keyguards

... continued

Activity 6.1

… continued

2. Match Column B with Column A:

COLUMN A	COLUMN B
2.1. A device that recognises hand gestures.	**A.** Sip-and-puff device
2.2. A device that is used by everybody, not just physically challenged users.	**B.** Keyguards
2.3. A switch that operates the computer when users breathe into or through special tubes.	**C.** Gesture-recognition device
2.4. An output device used by physically challenged users.	**D.** Screen reader
2.5. Metal or plastic plates that allow users to rest their hands on a keyboard without accidentally pressing the keys.	**E.** Microphone

3. Write True or False next to the question number. Correct the statement if it is FALSE. Change the underlined word(s) to make the statement TRUE. (You may not simply use the word NOT to change the statement.)
   - **a.** Braille interfaces are for deaf people.
   - **b.** The *Paste* keyboard shortcut uses the *Ctrl + P* keys.
   - **c.** Sighted users may not be able to use screen readers.
4. List the advantages and disadvantage of the following devices:
   - **a.** On-screen or virtual keyboards
   - **b.** Braille keyboards
   - **c.** Head-mounted pointers
   - **d.** Gesture-recognition devices
   - **e.** Sip-and-puff devices

UNIT

6.2 Health issues due to input and output devices

With more and more people using computers in their daily lives, certain health issues surrounding computer use have come up in recent years. Some of these have to do with the impact that using a computer has on your body, for example, **repetitive strain injuries (RSIs)** to wrists and back and eye strain from bad posture and lighting.

This section looks at how to prevent these health issues to make sure that you stay healthy.

ERGONOMICS

Ergonomics is concerned with how to design/arrange furniture and equipment in a way that will make people more comfortable and efficient in their work. It also looks at how people interact with their input and output devices to minimise the amount of physical strain placed on their bodies. Therefore, ergonomically designed computer mice, keyboards, desks and chairs have been developed to reduce RSIs, **carpal tunnel syndrome** and back strain.

Ergonomics also determine how people should sit (their posture), how they should look at a screen and how often they should get up.

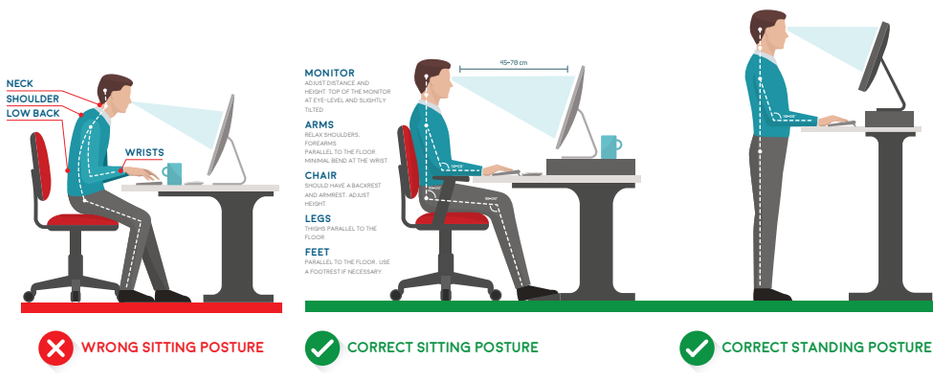


Figure 6.3: *Good ergonomics*

When you want to reduce the amount of strain on your body, remember to do the following:

- Make sure that your desk, chair and screen are all at a comfortable height.
- Sit properly and do not slouch or hunch your shoulders. This could cause backache and neck pain.
- Stand up and move around at least once an hour. Try using a standing desk (if possible) for some of the time you are working.
- Never bend your neck to look at your screen. Always make sure that your chin is parallel to your desktop.
- Make sure your shoulders are relaxed when you are typing (not raised or hunched), your knees are at a 90° angle and your feet are flat. If you are too short for your feet to touch the floor and have your arms at a comfortable angle, find a footrest to put your feet on.
- Make sure your back and hips are in contact with the back of the chair you are sitting on and that the chair has good back support.

COMPUTER ERGONOMICS

https://www.youtube.com/watch?v=bLBKUbnLYTs

Computer and smartphone screens can be set to have less blue light, lessening the glare and reducing eye strain. They can also be tilted until you find a comfortable viewing angle.

Activity 6.2

1. Multiple choice:
   a. Which of the following equipment does not carry a lot of germs?
      A. Smartphones
      B. Computer mice
      C. Keyboards
      D. Monitors
   b. Which one of the following is not an effect of sitting for too long in front of a computer?
      A. Obesity
      B. Increased blood pressure
      C. Hair loss
      D. High blood sugar
   c. Which of the following is not an injury due to improper ergonomics?
      A. Repetitive strain injury
      B. Computer vision syndrome
      C. Repetitive strain injury
      D. Back strain
2. Write True or False next to the question number. Correct the statement if it is FALSE. Change the underlined word(s) to make the statement TRUE. (You may not simply use the word NOT to change the statement.)
   a. Repetitive strain injuries and eye strain are examples of health issues due to input and output devices.
   b. Hardware needs to be protected from theft and damage.
   c. Computer and smartphone screens can be set to have less red light, lessening the glare and reducing eye strain.
   d. You will have good back support when you place your hips and back on the back of the chair.
3. Answer the following questions in your own words:
   a. Define ergonomics.
   b. List two ways that you can keep your hardware clean and hygienic.
   c. List three ways that you can reduce the amount of strain on your body.

UNIT

6.3 Protecting your hardware

Knowing how to protect your hardware so that it carries on working correctly is as important as knowing what hardware is used for and the health risks associated with using input and output devices. This unit looks at protecting your hardware from theft, damage and power surges. You will also learn about the optimal power settings for your devices and how your devices can contribute to energy savings.

HARDWARE PROTECTION

Hardware needs to be protected from two major things, namely theft and damage. Because your hardware is expensive and sensitive equipment, you must make sure that you do your best to keep it safe and in good working condition for as long as possible.

To protect your hardware from theft, you can do the following:

- Use locking cables attached to walls or hard-to-move desks to lock items such as monitors into place. Use lockable cages or boxes for things such as computer cases and servers.
- Invest in lockable docking stations for laptops. These docks lock as soon as you click a laptop into place, keeping your laptop safe from theft.
- Always be alert and aware of your surroundings when using mobile computing devices such as smartphones and tablets.

To protect your hardware from everyday wear and tear, you should keep the following in mind:

- Always use a screen protector and case for smartphones and tablets.
- Avoid spilling liquids on keyboards and mice.
- Make sure that any device drivers you need are up to date and correctly installed.

Figure 6.4: *Do not spill liquid on computing devices*

Activity 6.3

1. Answer the following questions in your own words:
   a. List four ways that you can protect your hardware from theft.
   b. Give three examples of ways to protect your hardware devices from damage.

6.4 Power supply and settings

Each piece of hardware you use will need to draw on some kind of power to operate, whether it is plugged directly into a power supply (such as monitors and desktop computers), operates with batteries (such as most wireless devices and smartphones, tablets and laptops), or draws power from the computer it is plugged into (such as wired keyboards and mice).

Computers and their associated hardware are some of the largest consumers of power in the home and workplace. By learning how to set these devices so that they use the minimum amount of power needed to operate effectively, and by purchasing devices that have a low energy consumption, you can reduce the amount of power your computer consumes.

Most displays and touchscreens can be adjusted to consume less power. You can do this by adjusting the brightness of your display until it is at a comfortable level. Most screens have a button on the bottom right-hand corner to turn the brightness up or down. Laptops usually have brightness keys on the keyboard and smartphones and tablets can be adjusted by going into the display settings.

You should adjust your screen brightness to suit the area, time of day and lighting. Even lowering the brightness by a small amount can save power and limit the strain you put on your eyes.

When you buy new hardware, you should look for devices that have an **Energy Star rating**. Devices with an Energy Star rating are usually more energy efficient, meaning they use less energy to perform the same tasks as devices that are not rated.

HOW TO PROTECT YOUR DEVICES FROM POWER FAILURES

Uninterruptible power supplies (UPSs) can protect your devices from unexpected power failures and even power surges. UPSs are plugged directly into the main power supply to charge their batteries and will immediately start providing power to the computers connected to them in the case of a power failure.

Activity 6.4

1. Write True or False next to the question number. Correct the statement if it is FALSE. Change the underlined word(s) to make the statement TRUE. (You may not simply use the word NOT to change the statement.)
   a. Devices with an Energy Star rating are usually more energy efficient.
   b. All the data on your hard drive will be lost in case of a power failure.
   c. Your display should never be brighter or darker than the area you are using it in.
2. Answer the following questions in your own words:
   a. Describe a UPS.
   b. Explain how you would protect your device from power failure.

REVISION ACTIVITY

QUESTION 1: MULTIPLE CHOICE

1.1 Which of the following is an output device for physically challenged computer users? (1)

- **A.** Gesture-recognition software
- **B.** Braille interfaces
- **C.** Sip-and-puff devices
- **D.** Braille keyboards

1.2 What is an advantage of a keyguard? (1)

- **A.** It reduces the number of typing errors.
- **B.** It does have a universal standard for its keyboard.
- **C.** It can be operated with multiple input devices.
- **D.** It can be used with speech-recognition software.

1.3 Text-to-speech software can be used by which of the following output devices? (1)

- **A.** Monitor
- **B.** Keyboard
- **C.** Printer
- **D.** Speaker

1.4 Ergonomics does not involve _____. (1)

- **A.** Making sure people are in a comfortable position
- **B.** Arranging furniture and equipment
- **C.** Reducing strain on the human body
- **D.** Adjusting the lighting of an area

1.5 Which of the following will not reduce your computer's power usage? (1)

- **A.** Unplugging your computer when you are not using it
- **B.** Reducing the brightness of your display
- **C.** Buying hardware with an Energy Star rating
- **D.** Reducing your CPU's speed

QUESTION 2: TRUE OR FALSE

Write True or False next to the question number. Correct the statement if it is FALSE. Change the underlined word(s) to make the statement TRUE. (You may not simply use the word NOT to change the statement.)

a. An eye-motion sensor is activated when a user breathes into its special tubes. (1)

b. A foot-operated mouse can be used by people who are blind. (1)

c. Text-to-speech software uses microphones. (1)

d. The interaction between the human body and computing hardware refers to economics. (1)

e. Looking at a computer monitor for a long time can damage your sight. (1)

QUESTION 3: MATCHING ITEMS

3.1 Choose a term/concept from Column B that matches a description in Column A. Write only the letter next to the question number (e.g. 1J). (5)

COLUMN A	COLUMN B
1. Something that protects your computer from the damage caused by power cuts.	**A.** Microphone **B.** Screen protector **C.** Energy Star rating **D.** Wireless keyboard **E.** UPS **F.** Padlock **G.** Ergonomics **H.** Braille printer **I.** Virtual keyboard
2. A standard that determines if a device is energy efficient.	
3. An object that protects a device from scratches and damage.	
4. An object that locks computing devices in place.	
5. A device that can use biometrics to identify a user.	

… continued

REVISION ACTIVITY

... continued

QUESTION 4: SCENARIO-BASED QUESTIONS

Mr Riaad is a primary school teacher who teaches eight and nine-year-olds. He wants to teach them how to use computers safely. Since they will be using the computers a lot, he is also concerned about their eyesight.

4.1 Mention two devices that Mr Riaad's learners can use to improve their interaction with computers. Give a reason for each of your answers. (4)

4.2 Mention one way his learners may not benefit from using each of these devices. (2)

4.3 Mention three things Mr Riaad's learners can do to reduce the strain on their eyes. (3)

4.4 One of his learners has been struggling to see the letters on her keyboard. Suggest two alternative input methods that she could use. (2)

4.5 A head-mounted pointer is an input device for phisically challenged users.

a. Explain how a head-mounted pointer is operated. (2)

b. Give two disadvantages of using a head-mounted pointer. (2)

4.6 Mr Riaad must travel a lot. Name three things he can do to protect his smartphone and laptop while travelling. (3)

4.7 Mr Riaad often uses trains to travel from one place to another. During this time, he uses his laptop to complete some of his work. Provide four tips he can use to reduce the strain on his body. (4)

4.8 List three ways that Mr Riaad can teach his learners to save energy. (3)

TOTAL: [40]

AT THE END OF THE CHAPTER

NO	CAN YOU ...	YES	NO
1.	Identify input and output devices for physically challenged users?		
2.	Discuss the health issues caused by input and output devices?		
3.	Describe how to protect your hardware from theft and damage?		

TERM 3

NETWORKS AND INTERNET TECHNOLOGIES

CHAPTER 7

CHAPTER OVERVIEW	
Unit 7.1	Networks
Unit 7.2	Intranet vs internet
Unit 7.3	Basic network security
Unit 7.4	Internet services

By the end of this chapter, you will be able to:

- Describe local area networks (LANs)
- Discuss the advantages and disadvantages of LANs
- Describe wireless local area networks (WLANs)
- Describe the basic components of a network
- Explain various types of connections
- Discuss the basic components of a network, including workstations, servers and network devices
- Describe how network connection speed is measured on wired and wireless networks
- Explain how wired and wireless network communication works
- Discuss the differences between the internet and an intranet
- Define passwords in terms of basic network security
- Discuss what usernames are
- Describe what access rights are in terms of networks on web services
- Discuss the advantages and disadvantages of various forms of online communication

INTRODUCTION

In Grade 10, you learned about home area networks (HANs) and personal area networks (PANs). HANs are very small networks that usually cover a single home. PANs, on the other hand, are much smaller and are usually designed to serve a single user.

In this section, you will learn about local area networks and wide area networks and how they are generally used.

Something to know

In 1973, the Defence Advanced Research Projects Agency (DARPA) in the United States began researching the techniques and technologies needed to develop communication protocols that would allow computers in the same network to communicate with each other across multiple linked networks. This was called the "Internetting" project and it resulted in what we know as the internet today. This was also the first functioning example of LANs communicating with each other. Before this, computers could only communicate with each other if they were connected in the same network.

NETWORKS AND INTERNET TECHNOLOGIES

What is the difference between the internet, a network, and an intranet?

https://www.youtube.com/watch?v=nojwX3_XZBs

7.1 Networks

In this unit, you will be focusing on:

- LANs and WLANs
- Basic network components
- Network software
- Network connections
- Network communication

TYPES OF NETWORKS

LOCAL AREA NETWORKS

A **local area network (LAN)** is a small network of computers covering a small area, such as an office building or school. A **wireless local area network (WLAN)** is the same as a LAN but it has the ability to connect wireless devices such as smartphones, laptops and tablets to the LAN.

LANs may serve only one or two users (for example in a home) or they can serve hundreds of users (in an office building or on a school campus). No matter how many users LANs serve, they are all designed to share resources such as internet connections, printers or server connections. Most LANs use either wireless or wired connections or a combination of the two to connect devices. For example, desktop computers and laptops can be connected to the network with cables while the printer and mobile devices are connected using wireless connections.

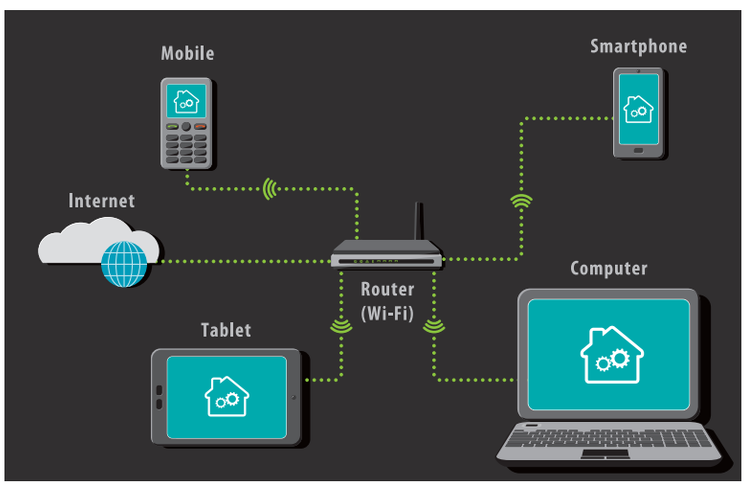


Figure 7.1: *A LAN in which computers are connected in the same room*

LANs have several advantages and disadvantages.

Some of the advantages of LAN are:

- Software (and licenses), files and hardware can be shared easily with the devices connected to the network.
- Files and other data can be shared faster if they remain on the network and do not need to be uploaded to the internet or emailed.
- Networks can be centrally controlled, making it easier to make changes, monitor users, update software, troubleshoot hardware and software issues and maintain resources.

Some of the disadvantages of LAN are:

- The initial setup costs for creating a network can be high, especially in a school or office environment, as you need to make sure that you have enough resources for the number of computers.
- There is a risk of privacy and data violations. **Network administrators** may have access to all the files created by each user.
- If a network is not secured properly, one infected computer can infect the entire network.

WIRELESS LAN (WLAN)

A wireless LAN (WLAN) is a wireless computer network that links two or more devices using wireless communication to form a local area network (LAN) within a limited area such as a home, school, computer laboratory, campus, office building etc. This gives users the ability to move around within the area and yet still be connected to the network. A WLAN allows users to move around the coverage area, often a home or small office, while maintaining a network connection.

BASIC COMPONENTS OF A NETWORK

A network consists of the following basic components:

- Workstation and servers
- NIC
- Network devices
- Communication media
- Network software

WORKSTATIONS, CLIENTS AND SERVERS

Workstations and servers are usually part of a network. Workstations are the computers connected to the network. They are used by people to carry out tasks, for example the accountant who creates spreadsheets or the designer who designs websites.

Workstations will have input and output devices because they are designed to be used by humans. Some workstations, such as those designed to run **computer-aided design (CAD)** applications, will be more powerful than the computers you can buy to use at home.

Figure 7.2: *Workstations in a computer laboratory*

Servers are designed to manage network resources and hardly ever carry out tasks beyond their server tasks (for example, you would not use a server to design an advertisement).

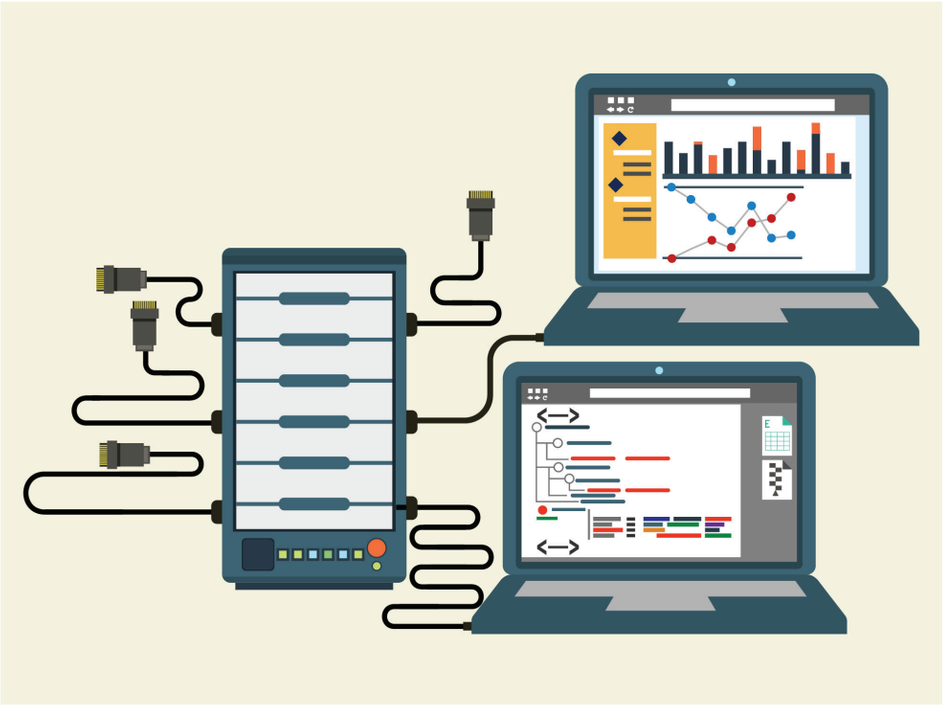


Figure 7.3: *A computer server connected to laptops*

The main function of a server is to serve the information stored on it to other computers that are connected to it by a network. A server will usually have more RAM than a normal computer so that it can process data faster and it will use special operating systems, such as Linux and Windows Server, to carry out its tasks. Servers also usually have faster CPUs and larger hard drives, and they are often connected to UPSs.

Servers are usually only used for one type of task, for example:

- Email servers send and receive emails and store each user's email information (their email address, username and password). Email servers can be local, such as those used by businesses, or global, such as Gmail. You interact with email servers through an email client, such as Microsoft Outlook or Gmail.
- Web servers are where the World Wide Web is. You will use a web browser, such as Google Chrome or Internet Explorer, to interact with a web server. Web servers deliver web pages to you when you request them, but they are also where you can upload data to cloud storage systems or your own website.
- Database servers are usually local servers that cannot be accessed by users outside the network they are connected to. Users can access database servers using specialised software (such as Microsoft **SQL**) to interact with them.
- A file server is a computer responsible for the central storage and management of data files so that other computers on the same network can access the files.

Some networks have a dedicated server which serves workstation (called clients). This is known as a client-server network. Other networks have workstations (called nodes) which act as both server and client. This is known as a peer-to-peer network.

NETWORK INTERFACE CARDS

Network interface cards (NICs) are pieces of hardware that allow a computer to connect to a network. Most modern computers have this device integrated into their motherboards, but NICs can also be purchased separately.

Figure 7.4: *A network interface card*

Network interface cards are also called network interface controllers or network cards. An NIC connects using **ethernet** cables, while a wireless NIC (WNIC) uses an antenna to connect to a wireless network. Smartphones use WNICs to connect to data signals and Wi-Fi hotspots. Laptops and desktops can use both NICs and WNICs to connect to a network.

Something to know

Network cards that plug into a computer or laptop using a USB cable are not NICs. They are called network adapters.

CONNECTION DEVICES

For a network to function, it needs some of the following:

SWITCHES	Switches, which are small devices that act as a controller for the networked devices to communicate (they create the network).	
ROUTERS	Routers, which allow multiple computers to connect to the network, but not necessarily the internet (they guide the traffic on the network).	
MODEMS	Modems, which connect to an internet service provider (ISP) to give internet access. Connecting the router to the modem gives the network internet access	
ACCESS POINTS	Access points are devices that are used to set up a WLAN in a large building such as an office or school. They allow wireless devices such as smartphones to connect to the network.	

Most modern routers combine the modem and the switches. A modem is a communication device. Modems are hardware devices that connect a computer or router to a broadband internet network. They work by converting the digital data sent by the computer into the **analogue signal** used by telephone lines. Modems are classified by how much data they can send (in bits per second) and how they connect.

Early modems used a dial-up connection to communicate but now they use digital connections (digital subscriber line, or DSL), fibre or wireless.

NETWORK SOFTWARE

Network software refers to a range of software aimed at the design, implementation and operation of computer networks. It exposes the inner workings of the network to the network administrators, assisting them in managing and monitoring the network. It also allows multiple devices such as desktops, laptops, tablets, mobile phones and other systems to connect to each other as well as to other networks.

> It is important that you understand the difference between network software and software applications. Network software is mostly used by network administrators, while software applications allow users who are working within a network to do their work.
>
> If your network has a server, that server will need a server operating system. You can choose between different types of server operating systems to suit your needs. Device management software will allow you to manage all the devices connected to a network.

The functions of network software can be summarised as follows.

- Its main function is to set up and install computer networks.
- It allows network administrators to add or remove users from a network.
- It helps administrators to protect the network from data breaches, unauthorised access and attacks on a network through the use of a security tool.
- It helps administrators to define locations of data storage and allows users to access that data.

COMMUNICATION MEDIA

Network connections can be wired or wireless. Wired network connections use ethernet cables to connect all the devices in a network, such as the computers, routers and switches. Ethernet cables are made up of several twisted pairs of wires inside a plastic casing and have a connector on either end called an RJ45 connector, which plugs into network ports on the various devices.

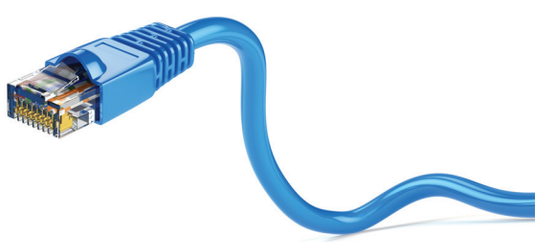


Figure 7.5: *An ethernet cable with RJ45 connector*

ETHERNET VS WI-FI

https://www.youtube.com/watch?v=l6wfN4Y7d0U

Wireless networks use radio signals to connect all the devices in a network (such as the computers, routers and printers). When you connect to a Wi-Fi hotspot in a restaurant or hotel, you are connecting to a wireless network.

HOW FAST IS MY NETWORK?

Wired and wireless networks can only transfer data as fast as their connections allow. The speed at which a network can transfer data is based on its components.

WIRED SPEEDS

For wired networks, the speed of the network is determined by the rated speed of the cables you use. The most common cable speed is **1 Gb (gigabit)**, these cables can transfer 1 000 Mb data per second.

WIRELESS SPEEDS

The speed of wireless networks depends on the standards they use. Wi-Fi standards are certified by the Institute of Electrical and Electronics Engineers (IEEE). The main IEEE standard for wireless networks is 802.11 and there are a number of specifications under this banner.

The 802.11 standards are different in terms of speed, transmission ranges and the frequency they use, but there are only a few of these standards that you will need to know. These standards make it easy for you to know what speeds you can expect from a given **wireless access point** (WAP).

LOOKING AT ADVERTISEMENTS FOR NETWORK DEVICES

Now that you have a better understanding of what a LAN is and how they are created, you will be able to take what you have learned and use it to interpret advertisements for network devices. There are several key pieces of information you will need to look out for when it comes to deciding which networking devices you want to buy.

Look at the rated speed for NICs and cables and match them to make sure that your data is transferred as quickly as possible. Make sure that WNICs are using the newest wireless standard (802.11ac).

Product Features

802.11ac wireless specification
10 - 100 - 1000 Gigabit Ethernet WAN
4 x Gigabit Ethernet LAN ports
USB 2.0 for local network sharing
Dual-band wireless for connections
1 year warranty

On routers, check the number of ports, whether it is able to handle wireless connections, how many networks it can connect and whether or not it has a built-in modem.

Lastly, look at how well these devices meet your requirements and how suitable a connection type is to the space available (work out if a wired or wireless connection would be better).

Something to know

Remember: The frequency of the bandwidth determines how much data can be carried through a specific network at any given time. A one GHz connection is equal to a 1 000 MHz connection.

NETWORK COMMUNICATION

Now that you understand how networks are connected, you need to understand how the different components of a network communicate with each other. Wired and wireless networks use very different communication media to connect the various components.

WIRED COMMUNICATION

There are two types of cables that connect modern wired networks to each other, namely unshielded twisted pair (UTP) cables and fibre optic cables. UTP cables are commonly used to connect LANs and telephone networks as they are easy to make and set up and are relatively cost-effective.

COPPER VS FIBRE

https://www.youtube.com/watch?v=_Bw2NFBDxR8

They are made up of two cables that are twisted together (the twisted pair) to cancel out electromagnetic interference from outside sources. They are called unshielded because no extra interference shields, such as metal meshes or aluminium foil, are added to the cables.

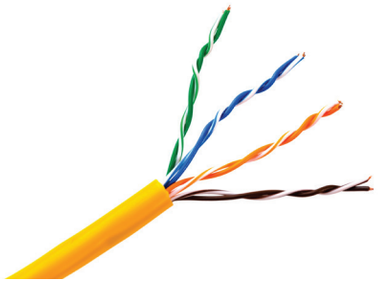


Figure 7.6: *UTP cable with different twist rates*

The wires are then connected to a connector (such as the RJ45 connector of an ethernet cable).

Fibre optic cables, on the other hand, are made of thousands of very thin strands of pure glass, called optical fibres, inside an insulating jacket. Instead of using electrical signals, fibre optic cables use light to transmit data very quickly.

Figure 7.7: *A multi-fibre cable*

Fibre optic cables are largely replacing metal cables since they are more flexible and lighter and can transmit data over longer distances with lower rates of data loss. The most common application for fibre optic cables is in internet connections.

WIRELESS COMMUNICATION

As you know, wireless connections allow you to transfer data over a distance without using cables, wires or physical connectors. Most common wireless communication uses radio waves to send data from one point to another.

A transmitter on the sending end turns the signal into an electromagnetic radio wave. The antenna picks up the radio wave and the receiver turns the electrical signal back into data.

Activity 7.1

Answer the following questions:

1. Briefly describe the difference between a workstation and a server.
2. List two functions of network software.
3. How do wireless networks connect devices in a network?
4. Provide two advantages of using fibre optic cable to connect to a network.

UNIT

7.2 Intranet vs internet

While they may sound like the same thing, there are actually a fairly large number of differences between the internet and an intranet. In this unit, you will learn about these differences as well as what an extranet and a virtual private network (VPN) are.

INTRANET VS INTERNET

An intranet is a private, web-based network that is only available to an organisation's staff. Intranets work using **internet protocols** to share data and information across the network. To put it simply, an intranet is like a private internet. Very often, a company's intranet will have information on it that the company does not want the public to have access to, such as employee contact details and calendars.

Intranets are also a valuable communication tool in a company as they allow all members of staff to work together, find information, create content and share tasks quickly and easily. Intranets act as a website and a communication channel together. Access to an intranet is limited to users who have been given usernames and **passwords** to connect with it.

The internet, on the other hand, is a massive network of networks with millions of computers connected to each other across the globe. All of these computers can communicate with each other as long as they are connected. By design, the internet is decentralised, meaning that it is not controlled by a single, central authority. Each computer, or host, is independent and the owner or operator of that host can choose which internet services to use and which local services they will make publicly available.

The internet itself is publicly accessible and is not the World Wide Web (WWW), which is simply a way to access information over the internet. Access to the internet is usually provided by ISPs.

VPNs are groups of computers (a network) connected over a public network (like the internet). Businesses use VPNs to allow their staff to connect to their internal networks without them being connected to the LAN (for example, if a staff member has to work in an office in Cape Town, they can connect to the main office in Johannesburg using a VPN).

VPNs can also be used to secure your computer's internet connection to keep the data you are sending and receiving safe from unwanted access when you are using an internet connection you do not trust (like a Wi-Fi connection in a coffee shop). A VPN encrypts all the data your computer sends over an internet connection.

INTRANET VS EXTRANET

https://www.youtube.com/watch?v=zlEstGNVdwo

HOW A VPN WORKS

https://www.youtube.com/watch?v=rFg7TSwVcL4

Activity 7.2

1. Answer the following questions in your own words.
   - a. Define an intranet.
   - b. What are the main differences between an intranet and the internet?
   - c. What is the main purpose of an extranet?
   - d. What would you use a VPN for?

UNIT

7.3 Basic network security

In our modern age, more and more of our important and personal data is being stored digitally and hackers and other criminals want to get hold of that information. That is why it is extremely important that the networks we use daily are secured and protected.

In this unit, you will learn about the basics of passwords, usernames and access rights, and how those three factors combine to secure a network.

PASSWORDS

Passwords are the most basic form of network security. Passwords, at their core, are a secret string of letters, numbers and symbols created by users or generated by a computer to limit or restrict access to a system.

More often than not, you will need to pick your own password to make sure that it is something you can remember.

USERNAMES

Usernames are a unique identifier given to any person who uses a secure computer network. Usernames are also called an account name, login ID or user ID. Usernames are most commonly used with passwords and can be used on computers or websites.

ACCESS RIGHTS

On a computer, for example, a user may only have access to a personal folder where they can open, read, write, create and delete files and folders. A user with administrative rights can access all the files and folders on a computer and can make changes that will affect all users.

Activity 7.3

Answer the following in your own words.

1. Read the following case study and answer the questions which follow:

> **Cyber-attacks: Protecting universities and solving cyber security issues**
>
> Oxford, Warwick, and Greenwich Universities are among many of the higher education institutes to have fallen victim to attacks in recent years, with hackers attempting to steal research data and documents. The problem has become acute enough to warrant the publication of cybersecurity guidance for universities and colleges by the UK Government's National Cyber Security Centre (NCSC) recently.
>
> No organisation today is immune from the threat of cyber-attacks. While we most often hear about breaches suffered by retailers, financial institutions and, since the infamous WannaCry ransomware attack in 2017, healthcare providers, many other types of organisations are becoming appealing targets for cybercriminals.

... continued

Activity 7.3

… continued

a. Define what a "hacker" is and distinguish between a "hacker" and a "cracker".
b. Give THREE ways to secure information on a network.
c. Why would it be valuable for hackers to steal research data and documents?
d. What are the consequences of being a victim of a ransomware attack?

REVISION ACTIVITY

QUESTION 1: MULTIPLE CHOICE

1.1 A private network that is only available to the organisation`s employees. (1)
A. Internet **B.** WLAN
C. Intranet **D.** LAN

1.2 A network of computers covering a small area such as a school or office building. (1)
A. WAN **B.** LAN
C. GAN **D.** PAN

1.3 All the computers that are connected to the network. (1)
A. Work stations **B.** Servers
C. Input devices **D.** Network software

1.4 A network that uses radio waves to communicate rather than cable. (1)
A. WAN **B.** LAN
C. GAN **D.** WLAN

1.5 A computer that provides shared resources, such as files and printers. (1)
A. NIC **B.** Server
C. Workstation **D.** Network security

QUESTION 2: TRUE OR FALSE

Choose the answer and write True or False next to the question number. Correct the statement if it is FALSE. Change the underlined word(s) to make the statement TRUE. (You may not simply use the word NOT to change the statement.)

a. If a network is not secured properly, the entire network will be infected should there be one infected computer. (1)
b. A PAN (personal area network) is designed to connect networks across large distances, for instance a province. (1)
c. In a LAN, networks are globally controlled, for easy changes and updates. (1)
d. An NIC (network interface card) allows a computer to communicate with a network. (1)
e. The main function of a workstation is to serve the information stored on it to the other connected computers. (1)

QUESTION 3: MATCHING ITEMS

Choose a term/concept from COLUMN B that matches a description in COLUMN A. Write only the letter next to the question number (e.g. 1-J). (5)

COLUMN A	COLUMN B
1. To make communication possible between the computer and the network.	**A.** Switch **B.** File server **C.** Network security **D.** Email server **E.** LAN **F.** WLAN **G.** Network software **H.** NIC **I.** Hub
2. Data transmission is slower when using this network.	
3. A server that controls all the incoming and outgoing emails.	
4. A hardware device used to connect computers in a network.	
5. Policies that are in place to ensure the security of a network.	

… continued

REVISION ACTIVITY

... continued

QUESTION 4: MEDIUM QUESTIONS

4.1 Besides computers, name one other hardware device you might find connected to a network. (1)

4.2 Give two reasons why a wireless network (WLAN) is better than a cabled network. (2)

4.3 List two possible disadvantages of using a WLAN. (2)

4.4 Provide two examples of servers that can be used in a network. (2)

4.5 Briefly explain the following communication devices:

- **a.** Modem (2)
- **b.** Router (2)

QUESTION 5: SCENARIO-BASED QUESTIONS

Choco`s Chocolate Company sells chocolates to distributors as well as directly to the public. The company`s head office is in Cape Town with branches in Port Elizabeth, Durban and Johannesburg. Each branch has its own LAN, which communicates with head office.

5.1 The company uses a LAN in all its branches.

- **a.** Briefly explain what a LAN is. (2)
- **b.** Give two advantages of using a LAN. (2)
- **c.** Give two disadvantages of using a LAN. (2)

5.2 Some of the employees have decided to communicate with their clients using IM.

- **a.** Explain how IM works. (2)
- **b.** Provide two reasons why the employees should be careful when using IM. (2)

5.3 The company uses **FTP** for the electronic sharing of documents larger than 6 GB.

- **a.** Why is it a good idea that the company uses FTP? (2)
- **b.** Give two disadvantages of using FTP. (2)

TOTAL: [40]

AT THE END OF THE CHAPTER

NO	CAN YOU ...	YES	NO
1	Describe local area networks (LANS)?		
2	Discuss the advantages and disadvantages of LANs?		
3	Describe wireless local area networks (WLANs)?		
4	Describe the basic components of a network?		
5	Explain various types of connections?		
6	Discuss the basic components of a network, including workstations, servers and network devices?		
7	Describe how network connection speed is measured on wired and wireless networks?		
8	Explain how wired and wireless network communication works?		
9	Discuss the differences between the internet and an intranet?		
10	Define passwords in terms of basic network security?		
11	Discuss what usernames are?		
12	Describe what access rights are in terms of networks on web services?		
13	Discuss the advantages and disadvantages of various forms of online communication?		

TERM 3

CHAPTER 8

SOCIAL IMPLICATIONS OF COMPUTER NETWORKS

CHAPTER OVERVIEW	
Unit 8.1	Social issues for networks
Unit 8.2	Network security
Unit 8.3	Databases and big data
Unit 8.4	Normal currency vs cryptocurrency

By the end of this chapter, you will be able to:

- Define unauthorised access to networks
- Describe the ethical use of networks
- Explain what acceptable use policies (AUPs) in schools are
- Define the social implications for network usage
- Discuss network security and BYOD environments
- Explain the privacy issues you can encounter on a network
- Discuss personal responsibility in relation to network security
- Define databases and big data
- Explain the differences between normal currency and cryptocurrency

INTRODUCTION

We live in a digital world where everything about us, from our holiday pictures to our names and ID numbers, is somewhere on a computer. Companies are storing more of their private information on networks and people are using cloud storage to save more of their personal information online. With the click of a button, you can find out more about strangers on the other side of the world than you ever could before.

This is why network security is more important than ever. In this world, where all the information you need about someone is so easily available, attackers want to get their hands on this information and use it.

UNIT

8.1 Social issues for networks

UNAUTHORISED ACCESS

Unauthorised access on a network is when someone gains access to a network using someone else's credentials or through other illegal methods. Accessing a network, website, account or service that you do not have permission to access is illegal.

This is why having usernames and passwords and setting up access rights for routers and other connection devices are important. Access to secure data on the network should also be controlled.

Authentication works to protect your personal information from unwanted access. You can protect your computer by setting up a username and password that you will need to enter each time you start it up.

You can also set up authentication for your smartphone and tablet. New types of authentication, beyond usernames and passwords, have made it possible for you to easily secure your devices and access them yourself. New types of authentication include biometrics (fingerprint-unlock or face-unlock) screen-lock patterns and PINs.

In this unit, you will build on your knowledge of authentication by looking at what unauthorised network access is and its negative consequences, how networks must be used **ethically** and why AUPs (in schools and other environments) are drawn up. We will also discuss network safety and security issues, especially when it comes to BYOD environments and the privacy issues surrounding networks.

ETHICAL USE OF NETWORKS

Since networks are used by a wide range of people, they must be used responsibly and ethically. Anything negative that any user does on a network can reflect negatively on the company, school or organisation whose network they are using. This is why most organisations set up **acceptable use policies (AUPs)** for those people who will be using their networks, especially when it comes to what users can and cannot do on the internet.

The chances are very high that your school has an AUP that you had to read and then sign or acknowledge in some way. This section will look at the basics of AUPs for schools and what guidelines they should contain. The AUP is there to protect the users (and the organisation) when they use ICT facilities and when they are online.

ACCEPTABLE USE POLICIES OF SCHOOLS

In a school, an AUP can cover a wide range of computing devices and networks and is a contract between the user (learner) and the organisation (school) that outlines what the user can and cannot do on a particular network.

Below are some guidelines that should be in AUPs:

- A list of basic **netiquette** rules, including not sending **spam** or **hoax emails** and how users should communicate using email or social media websites
- What may or may not be accessed online using the school's ICT facilities. This could include restricting access to social media websites
- How much information users may download from the internet (for example, no **live streaming** or downloads larger than a certain file size)
- Guidelines on respecting **copyright**, intellectual property laws and privacy, as well as how to avoid **plagiarism**
- When and how portable storage devices can be used
- Restrictions on what software can be installed on the school's computing devices
- What to do if users find that they have become the victims of identity theft, cyber-stalking and cyber-bullying, and what to do if their devices become infected with viruses or malware
- Clear descriptions of what will happen to a user who breaks the rules outlined in the AUP

Each school will have its own AUP depending on the computing devices, services and access they provide.

Activity 8.1

Answer the following questions:

1. How does authentication work?
2. What is an acceptable use policy?
3. Compare your school's acceptable use policy with the list of guidelines given above. Make a suggestion on how to improve your school's AUP.

UNIT

8.2 Network security

All networks can be the target of an attack, especially those that connect to the internet. This is why it is extremely important to understand and implement basic network security. In this section you will look at basic things that you can use or do to keep the network secure, for example:

- **firewall**
- antivirus software
- use passwords and usernames where necessary
- understanding BYOD environments and applying all relevant safety requirements

The first and most important is security software for your devices. Firewalls are built into most routers and computers to stop unwanted traffic getting onto your network. Firewalls are basically the security guards of a network. Everything that comes into your network from the internet should be going through a firewall.

All the computers in a network should also have anti-virus software installed to protect them from being infected with malware, viruses and other harmful programs. Anti-virus software constantly scans the programs on a computer and destroys any threats.

Most organisations have network security policies that outline the rules that are in place to protect the network. One of the most common policies is to give staff a username that they can use to log into the network and have them choose a password. When you need to choose a password, there are a few things you must keep in mind:

- The longer your password, the more difficult it is to crack. Make sure your password is at least 10 characters long or use a **passphrase** that is at least 15 characters long.
- Make sure that your password is something you can remember without needing to write it down. If you need to write your password down, make sure that you keep it hidden and mixed in with other notes, so it is not clear which one is your password. Keep these notes away from your computer.
- Do not use your name, a family member's name or the name of a pet. A password that cannot be linked to your personal information is the best kind.
- Your password should not be something easy to guess, such as "password" or "12345".
- Make sure that your passwords are a mix of uppercase and lowercase letters, numbers and special characters.
- Make sure that your passwords do not follow a pattern on the keyboard (such as "asdfgj").
- Never give out your password to anyone and try not to share your account details with anyone.
- You are responsible for keeping your password safe. Anything that is done on a network using your password and username will be your responsibility. To make sure your passwords are safe, you should change them every two months or so and you should never use the same password for different websites and networks.

FIREWALLS

https://www.youtube.com/watch?v=OQyXMYh6qLo

2018 FACEBOOK DATA BREACH

Cambridge Analytica Scandal: https://www.wired.com/story/wired-facebook-cambridge-analytica-coverage/

BASIC COMPUTER SECURITY PRINCIPLES

https://www.youtube.com/watch?v=6p_q_Xp--Rs

Something to know

Microsoft Intune is a cloud service from Microsoft that helps organisations to manage the mobile devices that employees use to access the organisation's data and applications, thereby protecting their mail and data.

Case study The 2018 Facebook data breach

Read the case study below and answer the questions that follow.

On the 25th of September 2018, Facebook announced that a security flaw in its website allowed hackers to access the personal data of roughly 90 million users of the social network. The attackers used a vulnerability in Facebook's "View As" tool, which allows users to see what their profile looks like to other people. By using this vulnerability, the attackers stole Facebook access tokens that they could use to take over almost 50 million user profiles.

An access token is a short line of code stored in your browser or device that keeps you logged into your account without you needing to log in each time you want to access the website that issued it.

Facebook quickly patched the bugs in the code that gave the attackers access and logged 90 million users out of their accounts (the 50 million that were compromised and 40 million that were potentially compromised) on the web and on their mobile devices. Users who were logged out were greeted with a message explaining what had happened when they logged back in and a link to more details about the breach. Facebook also temporarily disabled the "View As" feature while they worked to patch up the code.

According to later reports, Facebook security personnel first noticed that something was wrong when they spotted a spike in unusual activity on the 16th of September 2018 and began investigating. The vulnerability had been in place since July 2017, which means that attackers could potentially have had access to the accounts for a long time.

The attack also left vulnerable users' other accounts where they had used Facebook to login to those sites. Facebook advised users to change their passwords and use their accounts' security and login page to see where they had been logged in with their Facebook credentials.

This data breach came hot on the heels of another scandal involving Facebook and a company called Cambridge Analytica, where it was found that Cambridge Analytica used the data from 50 million Facebook accounts, kept the data and used it to influence the 2016 American Presidential Campaign.

1. Do you think that Facebook did the right thing by logging users out before informing them of the data breach?
2. How do you think Facebook's security team could have handled the vulnerabilities better?
3. Do you think that Facebook is doing everything it possibly can to protect its users' privacy following the two major scandals?
4. What advice would you give to users whose accounts were affected by the data breach?

NETWORK SECURITY

Any time a network becomes accessible, it becomes vulnerable to attack. This is especially true of networks that connect to the internet. Another security concern for networks is making sure that the devices that connect to them are not making them open to attacks.

When it comes to BYOD environments, this could be difficult, since the network administrator does not have full control over what is done with those devices when they are taken home at the end of the day,

This section therefore looks at network and safety issues related to BYOD and privacy, and how they can be prevented.

NETWORK SECURITY AND BYOD

The main concern with personal devices that are used for work is how to keep the company's private data separate from a user's personal data and how to make sure that an employee does not accidentally share that private data. One way to avoid this is to set up a data

loss prevention policy and using **data loss prevention** tools. Organisations can also use mobile device management software, such as Microsoft Intune, to manage the devices on their networks.

Another concern is that most mobile devices, such as smartphones and tablets, might not have anti-virus software installed, or, if there is anti-virus software, it is not up to date. This becomes a problem when users accidentally download applications that contain malware, **adware** or **spyware**. Mobile devices can also become infected with viruses. When these devices connect to the network, they can spread the infection, making the network unsecured.

The last issue with BYOD environments is that employers cannot control what employees install on their devices. Employees may be able to install games or other media that can become a distraction at work.

Because of these issues, companies that use a BYOD policy must set up a clear AUP for their staff regarding what they can and cannot do with their devices.

PRIVACY ISSUES

With so much of what you do every day taking place on computers and online, privacy and who has access to your information has become a major issue. Networks have become powerful tools to access, collect, store and share personal data. Very often this data is used to provide a company's customers with a better service, or to make it easier and quicker for your doctor to access your medical history, for example. But this data can also be used by cyber-criminals to commit fraud or to steal.

It is the network owner's responsibility to make sure that the data their network stores and shares is accessed legally and that this data is only used for what they say its use will be. It is also their responsibility to make sure that this data is secure and safe.

PERSONAL RESPONSIBILITY

While it is true that network administrators must make sure that their networks are secure, you also have a responsibility to make sure that you do not expose a network you are using to attacks.

You do this by keeping the following tips in mind when using a network:

- Make sure that your devices have up-to-date antivirus software installed and that you never click on suspicious links or reply with personal information to suspicious emails.
- Respect others' privacy and products. Do not download or share content that has been obtained illegally (such as pirated movies or music) or content that violates someone else's copyright.
- Be careful what your share about yourself on the internet.
- Follow the AUPs of any network you are using.

If you keep these tips in mind, you can help make the networks you use more secure for everyone else.

Activity 8.2

1. What are the main concerns with BYOD policies in the workplace?
2. How can companies avoid security and usage issues in a BYOD environment?
3. List two tips you should keep in mind when using a network.

8.3 Databases and Big data

DATABASES

Networks must be protected to safeguard the personal information stored on them. This is especially true of networks that have databases, since these are where personal information is stored. Databases are often the targets of cybercrimes, so database security is extremely important.

The foundation of database security is the confidentiality, integrity and availability (CIA) triad:

- Confidentiality is the most important aspect of database security. People should be able to trust that any information about them that is stored is safe and secure. Databases should be encrypted to make sure that this is the case.
- Integrity is another important aspect of database security. Integrity means that the data can only be accessed by people who have the correct permissions to view it. This can be done by making sure that access to the data is controlled.
- Availability means that the databases should be up and running when users need to access them. This means that any **downtime** should be scheduled and if there is unexpected downtime, database administrators should check that this is not due to a security breach.

BIG DATA EXPLAINED

What is big data and how is it used? https://www.bernardmarr.com/default.asp?contentID=766

BIG DATA

Big data, a term that describes the massive amounts of data that are generated every day by every single person, plays a major role in privacy concerns. More and more companies are collecting this data and storing it on databases to use in marketing or product development. Big data is used in online services like:

- **Online banking:** Proper analysis of big data can help detect any and all the illegal activities that are being carried out, like the misuse of credit cards, misuse of debit cards, customer statistics alteration and money laundering.
- **Booking reservations:** Big data from several sources has helped travel agencies, hotels and the tourism industry better understand what customers are looking for and this has led to more direct reservations.
- **E-learning:** Big data that is being collected is related to the students, faculties, courses and results. This can provide insights to improve the effectiveness of educational institutes.
- **Social websites:** Users of social websites share photographs, personal data and make comments on posts by other users. This information is used by social websites to provides users with personalised content and also to assist advertisers to hyper-target users.

Companies also capture big data on consumer habits for targeted marketing. This has raised concerns about privacy because every time you click on a website, post on social media, use a mobile app and comment via email or to call centres, your data is collected for future use. People have a right to their privacy but, without their knowledge or consent, this right is being eroded.

As big data increases, it exposes more of our data to potential security breaches. For example, if you have approved a company to analyse your data, how certain are you that they will not fall prey to a cyber-attack or that they will not sell your data. This could result in your private data being in unsafe hands.

Activity 8.3

In small groups discuss if and how big data has social implications for:

- Online banking
- Booking reservations
- E-learning
- Video conferencing
- Social websites

UNIT

8.4 Normal currency vs cryptocurrency

In the past few years, cryptocurrencies such as Bitcoin and Etherium have captured the general public's attention, but what is a cryptocurrency and how is it different from the normal currency you can get from a bank?

Simply put, cryptocurrency is a digital currency that can be bought, sold and traded online using cryptography. Cryptography takes the identifying data of the people buying and selling cryptocurrency and transforms it into something that is not readable unless it is deciphered. Cryptocurrencies are completely digital and have no physical form, unlike the money you get from the bank.

Normal currency is also usually backed by something physical that gives it value, like gold, and is usually issued and supported by a country's central authority or bank (in South Africa, that would be the Reserve Bank and the government). Normal, or fiat, currency is usually referred to as legal tender and has a value on the world's stock markets as well.

Cryptocurrencies are not backed by a single country's central authority and their value is not tied to anything physical. This means that they are decentralised and global.

Cryptocurrencies, however, are finite. There is only so much of it to go around.

Something to know

Bitcoin, the most popular cryptocurrency, was created in 2008 and remained mostly unknown. A few years later, Bitcoin mining became a popular pastime for computer enthusiasts and the popularity of Bitcoin grew. The value of Bitcoin in real world currency began to grow exponentially. In January 2017, a single Bitcoin would cost you $800 (about R11 104 in 2018). By the end of 2017, however, the price had skyrocketed until one Bitcoin cost $13 000 (about R180 000 in 2018)!

Activity 8.4

1. What does the term "Big data" mean?
2. Distinguish between normal currency and cryptocurrency.

REVISION ACTIVITY

QUESTION 1: MULTIPLE CHOICE

1.1 Which of the following is NOT used to authenticate a user? (1)

- **A.** Username
- **B.** Password
- **C.** PIN
- **D.** BYOD

1.2 Which of the following techniques cannot be used to authenticate user access to your smartphone? (1)

- **A.** Fingerprint scanner
- **B.** Identity card
- **C.** Screen-lock pattern
- **D.** PIN

1.3 Which of the following scenarios will need an AUP? (1)

- **A.** A person wants to sell goods online.
- **B.** A person wants to open an internet café.
- **C.** A person buys car insurance.
- **D.** A person browses an online website.

… continued

REVISION ACTIVITY

... continued

1.4 What does BYOD mean? (1)

- **A.** Bring your own device
- **B.** Buy your online device
- **C.** Bring your device
- **D.** Bypass online detection

1.5 What is the purpose of a firewall? (1)

- **A.** It removes malware from your computer.
- **B.** It uninstalls programs from your computer.
- **C.** It updates your computer's software.
- **D.** It prevents outside devices or programs from accessing your network.

QUESTION 2: TRUE OR FALSE

2. Write True or False next to the question number. Correct the statement if it is FALSE. Change the underlined word(s) to make the statement TRUE. (You may not simply use the word NOT to change the statement.)

- **a.** Authentication is the process of working out whether something or someone is, in fact, what or who they claim to be. (1)
- **b.** Using a network in an unethical manner can improve the reputation of an institution. (1)
- **c.** On a network you must protect the privacy of others and yourself. (1)
- **d.** Unauthorised access on a network is when someone legally gains access with another user's password. (1)
- **e.** There are two main types of unauthorised access, internal and external threats. (1)

QUESTION 3: MATCHING ITEMS

Choose a term/concept from Column B that matches a description in Column A. Write only the letter next to the question number (e.g. 1J). (5)

COLUMN A	COLUMN B
1. Encrypting people's personal information to ensure that it stays safe and secure.	**A.** Integrity **B.** Privacy issue **C.** Password protection **D.** Availability **E.** Big data **F.** Confidentiality **G.** Authentication **H.** Cryptocurrency
2. Controlling user access by making sure that data stored online can only be viewed by those who have the correct permissions to view it.	
3. Ensuring that users are able to have constant access to their online data.	
4. A digital currency that can be bought, sold and traded online using cryptography.	
5. Matching the password that a person provides with the credentials stored on a database to prevent the unauthorised access of data and information.	

QUESTION 4: MEDIUM QUESTIONS

4.1 Name three types of institutions that would benefit from AUPs. (3)

4.2 List three AUP guidelines that should be used by schools. (3)

4.3 Name three advantages of cryptocurrencies over normal currencies. (3)

... continued

REVISION ACTIVITY

… continued

QUESTION 5: SCENARIO-BASED QUESTIONS

Stacy has recently had a friend of hers install a network in her house. Since she has a four-year-old daughter and a 14-year-old son who will eventually have access to this network, she needs to work out what safety precautions she must implement.

5.1 What type of network should Stacy install? Give a reason for your answer. (2)

5.2 What three things can Stacy do to keep her network secure? (3)

5.3 What two things can Stacy do to control what her children can access on their home's network? (2)

5.4 Stacy's son has created a Facebook account. What three safety tips can Stacy give him about his use of this online platform. (3)

5.5 Stacy's son comes to her and tells her that he thinks that someone has hacked into his Facebook account. What three things should they do? (3)

5.6 Give three guidelines that Stacy can use when choosing a password that will be difficult to crack. (3)

TOTAL: [40]

AT THE END OF THE CHAPTER

NO	CAN YOU …	YES	NO
1.	Define unauthorised access to networks?		
2.	Describe the ethical use of networks?		
3.	Explain what acceptable use policies (AUPs) in schools are?		
4.	Define the social implications for network usage?		
5.	Discuss network security and BYOD environments?		
6.	Explain the privacy issues you can encounter on a network?		
7.	Discuss personal responsibility in relation to network security?		
8.	Define databases and big data?		
9.	Explain the differences between normal currency and cryptocurrency?		

TERM 3

CHAPTER 9

ERRORS AND BUGS

CHAPTER OVERVIEW	
Unit 9.1	Human error
Unit 9.2	Verification and validation of data
Unit 9.3	Software bugs
Unit 9.4	Hardware failure

By the end of this chapter, you will be able to:

- Discuss the effects of computer and human error on data accuracy
- Describe the garbage in, garbage out (GIGO) principle
- Explain the different data types
- Describe databases
- Describe how data is verified and validated
- Explain what software bugs are
- Define hardware bugs

INTRODUCTION

There are two major factors that can lead to a computer giving you the incorrect results when you enter data, namely human error and bugs. In this chapter, you will learn about the effect that human error has on data input and the accuracy of data, how data is **verified** and **validated**, and what software bugs and hardware failure are and how they can affect your computer.

9.1 Human error

When data is added manually to a spreadsheet or database, there is room for error.

If the user makes a mistake when entering data, the computer will not be able to pick up on that. This is why we verify and validate data before analysing it.

Human errors can have a significant impact on the validity and accuracy of data. If, for example, a scientist makes a calculation mistake with one entry in a spreadsheet, their results could be off by a large degree. These types of errors can also impact businesses. If an employee enters the price of a product into the database incorrectly, the business may lose money.

THE GIGO PRINCIPLE

GIGO is a concept in data capture and evaluation. It stands for “garbage in, garbage out” and the idea is that if you enter bad data into a system (such as a database or Excel spreadsheet), you will get bad results, or bad input will give you bad output.

UNIT

9.2 Verification and validation of data

DATABASES

As you learned in Term 1, a database is a collection of a large amount of data, which is organised into files called tables.

When discussing data, you need to remember that there are many different types of data. The most common data types, and the ones you are most likely to deal with, are:

- strings
- numeric data
- boolean data
- date and time data.

VERIFICATION AND VALIDATION

In order to get the best results with your data, you will need to make sure that it is accurate. To do this, you will need to first verify the data and then validate it.

Data verification is the process of checking that the data a user has inputted is correct. This can be largely automated, providing someone has set up the rules on the spreadsheet or database. For example, the age range of high-school students is usually 14 to 18 and the spreadsheet can be set up to only accept an age in that range. This is called a range check. This does not always mean that the data will be 100% correct though. If a student is 15 and the user types in 17, the data is still valid in the range, it is just not correct.

Data verification is mainly used when data is entered into a system manually (that is, a human has entered the data into the database or spreadsheet) and there is a possibility that there will be errors in the data.

Data validation, on the other hand, is the process of making sure that the data that has been transferred from one source to the other matches the original data. For example, if you entered the results of a survey into a spreadsheet, you will check that the results you have match the results you entered.

Data validation also checks to see that the data is complete and matches the requirements of the system in which you entered it. In Access, this is done using data validation rules and input masks.

There are several ways to validate data. These are shown in Table 9.1.

Table 9.1: *Data validation techniques*

TYPE	HOW IT WORKS	EXAMPLE
Check digit	The check digit is used to check that the data entered is correct.	Barcodes have check digits at the end. They are calculated using the digits before them.
Format check	Checks that the data is entered in the correct format.	The correct way to enter a date in the spreadsheet is YYYY-MM-DD, so if a user enters the date as 21-10-2017, the spreadsheet will highlight it.
Length check	This makes sure the data is not too long or too short.	South African telephone numbers have 10 digits in them. If a user enters a telephone number with 11 digits, the spreadsheet will highlight that cell.
Lookup table	Looks up acceptable data in a table.	There are only 12 months in a year.
Presence check	Checks that there are no blank fields.	If you need the names of all employees, then a name field cannot be left blank.
Range check	Checks that a value falls within a specific range.	The number of subjects a learner has must be more than six and fewer than 10.
Spell check	Checks spelling and grammar.	This is most often found in word-processing software.

UNIT

9.3 Software bugs

A software bug is any error, flaw, failure or fault in a computer program or system that causes it to produce an incorrect or unexpected result or to behave in a way that it was not intended to. This can often cause the program to crash (or stop working) or produce an invalid response.

Did you know

Software bugs are called bugs because the first known programming flaw was caused by a moth that flew into a Harvard Mark II computer in 1946.

Most bugs are caused by human errors made when the source code for the program was written. Some bugs might not have a serious effect on how the program functions and may not be found for a long time, but a program may also be called "buggy" when it has several bugs that make it almost unusable. In some serious cases, programs may have bugs creating security flaws that can lead to a computer being accessed by cyber-criminals.

In the late 1990s, there was widespread fear that when the clock struck midnight on 1 January 2000, the Millennium Bug would cause software systems around the world to collapse, leading to an economic and social shutdown of the world.

This fear was caused because of a problem in the way that some early computers were programmed. They were only designed to handle years that contained two digits, so instead of using 1992, they would use '92. People started fearing that date-related processes would happen incorrectly for dates and times after 31 December 1999, since there was no way for the computer to tell the difference between the years 1900 and 2000, and that the computers would stop working when the date rolled over.

The idea that a simple change in the date could cause major computer systems to crash caused widespread panic due to the story being covered often in the media and being mentioned in reports on the topic from major corporations.

Needless to say, when the time came, no major computer failures happened. No one is sure if this was because many governments and companies upgraded their software or because there was nothing to fear in the first place.

UNIT

9.4 Hardware failures

Hardware failures are design errors in computer hardware that can cause the hardware to malfunction, fail or be damaged. Some hardware failures can also lead to security flaws in a computer's system.

FOR ENRICHMENT

Spectre and Meltdown are two hardware failures that affect CPUs built by Intel, AMD and ARM and can allow attackers to potentially steal sensitive data such as banking details and passwords. They were discovered in 2017 by a team from Google's Project Zero and several academic researchers from around the world.

Their results revealed that these failures had been in the hardware since about 1995 but that they had been previously undetected. They work by exploiting something called speculative execution (or the way a processor knows which task to fetch based on guessing what should happen next in the process and begins fetching instructions from where it thinks the program will go, without knowing for sure). This helps to speed up the computer's processors.

Combined, these two failures affect nearly every modern computer, including smartphones, tablets and PCs from different vendors running different operating systems. This is because the two failures are a fault in the processors themselves and are not linked to a flaw in any software.

While at the end of 2018 hackers had not released any software that could exploit these failures, computer and smartphone manufacturers advised that users should download and install the latest security fixes as they become available.

REVISION ACTIVITY

QUESTION 1: MULTIPLE CHOICE

1.1 Before you analyse data, you must do the following: _____. (1)

- **A.** Spell check it
- **B.** Review it
- **C.** Verify and validate it
- **D.** Organise and simplify it

1.2 Information that is incorrectly inputted is referred to as which of the following? (1)

- **A.** Human error
- **B.** Transcription error
- **C.** Transposition error
- **D.** Troubleshooting error

1.3 Which of the following is an example of a transposition error? (1)

- **A.** Accidentally deleting an entry
- **B.** Repeating an entry
- **C.** Making a typo
- **D.** Swapping two entries around

1.4 Which of the following is NOT a data type? (1)

- **A.** Numbers
- **B.** Strings
- **C.** Dates and times
- **D.** Characters

1.5 What does GIGO stand for? (1)

- **A.** Generated Input Generated Output
- **B.** Good Input Garbage Output
- **C.** Good Input Generates Output
- **D.** Garbage In, Garbage Out

… continued

REVISION ACTIVITY

... continued

QUESTION 2: TRUE OR FALSE

Write True or False next to the question number. Correct the statement if it is FALSE. Change the underlined word(s) to make the statement TRUE. (You may not simply use the word NOT to change the statement.)

a. When we enter data into a computer, the errors that occur are usually computer-based. (1)
b. Transcription errors are most common with text-based data. (1)
c. Human errors negatively impact the validity and accuracy of data. (1)
d. Entering data correctly leads to incorrect results. (1)
e. Binary code is similar to date and time data. (1)

QUESTION 3: MATCHING ITEMS

Choose a term/concept from Column B that matches a description in Column A. Write only the letter next to the question number (e.g. 1J). (5)

COLUMN A	COLUMN B
1. A process that is mainly used to check data that is entered into a system manually.	**A.** Data validation **B.** Boolean data **C.** String data **D.** Numeric data **E.** Transcription error **F.** Spreadsheet **G.** Hardware bug **H.** Data verification **I.** GIGO principle
2. A file that can be used to make calculations on numerical data.	
3. Basic text that is made up of a combination of characters, letters and numbers.	
4. Data that represents a count or measurements that can be used in mathematical calculations.	
5. Data can only have one of two possible values.	

QUESTION 4: CATEGORISATION QUESTIONS

4.1 Which data validation technique can be used to validate the data in the following scenarios? (7)

SCENARIO	DATA VALIDATION TECHNIQUE
1. An antivirus wants to confirm if its product key follows a specific pattern, before checking if it is correct.	
2. Checking the correctness of the numbers in a Fibonacci sequence.	
3. When you want to check if a person has provided both a username and a password on a login screen.	
4. When you want to check that the required fields on a form are completed.	
5. On a questionnaire you want people to only provide "Yes" or "No" answers.	
6. When you want to make sure that only users between 18 and 25 can open a bank account.	
7. When a bank wants to make sure that the user interface of an ATM makes it obvious where a PIN number and deposit amount must be entered.	

... continued

REVISION ACTIVITY

... continued

4.2 Define a software bug. (2)

4.3 Define a hardware bug. (2)

4.4 Determine if the following errors are caused by software bugs or hardware bugs. (4)

ERROR DESCRIPTION	TYPE OF BUG
1. When Roberta plays her favourite role-playing game on her computer, her computer starts to freeze during the game's cut scenes.	
2. Nomonde's Windows computer is stuck at the Blue Screen of Death and is preventing her from logging in.	
3. Nothing happens when Prakash presses the "P" key on his keyboard, but every other key on his keyboard still works properly.	
4. Shou's laptop heats up very quickly and only stays on for an hour, even when it's plugged into a power source.	

QUESTION 5: SHORT AND MEDIUM QUESTIONS

5.1 What is the main difference between data verification and data validation? (2)

5.2 How can you automate the data verification process on a spreadsheet? (2)

5.3 Describe the two types of data entry errors and give an example of each. (4)

5.4 Maryn's mouse cannot be detected by her computer when she plugs it in. Mention two things she can do to try and solve this hardware bug. (2)

TOTAL: [40]

AT THE END OF THE CHAPTER

NO	CAN YOU ...	YES	NO
1.	Discuss the effects of computer and human error on data accuracy?		
2.	Describe the garbage in, garbage out (GIGO) principle?		
3.	Explain the different data types?		
4.	Describe databases?		
5.	Describe how data is verified and validated?		
6.	Explain what software bugs are?		
7.	Define hardware bugs?		

TERM 3

CHAPTER 10

SOCIAL ISSUES AND ONLINE PROTECTION

CHAPTER OVERVIEW	
Unit 10.1	Social-engineering tricks
Unit 10.2	Data protection
Unit 10.3	Protecting yourself online
Unit 10.4	E-commerce and e-banking
Unit 10.5	How antivirus programs work

By the end of this chapter, you will be able to:

- Identify different social-engineering tricks
- Describe why data backup is important
- Back up data correctly
- Discuss how to avoid online harassment and what to do if you become a target of online harassment
- Describe what malware is and how to avoid it
- Explain multi-step verification
- Describe how antivirus and antimalware programs work

INTRODUCTION

The internet is one of the most amazing inventions of our modern age. At the click of a button, you have access to millions of people across the world. Using a simple search, you can access information. You can learn almost anything on the internet and can teach yourself everything from simple activities such as cooking to more complex things such as making your own furniture.

But there is also a dark side to the internet. Digital crimes are carried out by criminals like hackers who want to steal your information and data, and cyberbullies and stalkers who harass people online. Knowing how to protect yourself from these criminals and crimes is an important part of your online life.

In this chapter, you are going to look at what **social engineering** is and learn about social-engineering tricks. You will learn about online harassment and how to avoid **cyberbullying** and **cyberstalking**. There is also advice on how to shop and bank online safely.

There is a section that discusses what antivirus software is and how it works, and you will also learn how to back up your data for your safety.

UNIT

10.1 Social-engineering tricks

Social engineering is a technique used to gain access to a facility's systems, data and anything else by exploiting basic human psychology.

Some of these tricks include:

- **Phishing** is usually done via email where an attacker tricks people into giving out personal information or handing over money. Phishing is used with **email spoofing** and **website spoofing**. The most common phishing scam is an email from your bank to say your account has been suspended and that you need to reset the password by clicking on a link that takes you to a website that looks like your bank's website. When you enter your account details, the attacker will have your information.
- **Phishing and email spoofing:** Phishing and email spoofing attacks try to obtain sensitive information (such as usernames, passwords and banking details) by sending emails to users that look like official emails. These emails will either directly request the sensitive information, or redirect users to an official-looking website from where their information will be stolen.
- **Pharming:** Much like phishing, pharming attacks create an official-looking website that requests sensitive information. A very common pharming attack allows users to "change" their passwords. Instead of changing their passwords, the user's username and password are recorded and their account is taken over.

According to security studies, social engineering is the single most effective way to gain illegal access to a desired computer.

HOW HACKING WORKS

This is how a hacker hacks you using simple social engineering:

https://www.youtube.com/watch?v=lc7scxvKQOo

SMS PHISHING SCAMS

Social-engineering techniques:

Phishing for email: https://www.youtube.com/watch?v=PnHT7ANA5vM

WHAT TO DO WHEN YOU SUSPECT YOU ARE A VICTIM?

If you think you accidentally revealed any financial information, immediately contact your bank and have them put a hold on any accounts that may be compromised.

Immediately change your password if you think you might have revealed it.

Activity 10.1

Do the following activity on your own.

1. Read through the following case study:

> Kevin Mitnick is known as the world's most famous hacker. He was one of the first computer hackers to be prosecuted and labelled as a computer terrorist, after leading the FBI on a three-year manhunt for breaking into computer networks and stealing software from Sun, Novell and Motorola.
>
> Mitnick started hacking when he was only 16 or 17 years old and later became known more for his use of social engineering to get access into networks than actually hacking them. For example, he called an employee of Motorola and convinced her to send him the code for one of the Motorola cell phones. With this, he was able to use an elaborate social-engineering scheme by manipulating the telephone network and setting up call-back numbers within Motorola's campus. He even convinced a manager in operations to tell one of the employees to read off his SecurID code any time he needed it, so that he could access the network remotely.

... continued

Activity 10.1

He also managed to hack into their development servers for cell phones and find the source code to all the different cell phones.

When Mitnick was eventually arrested in 1995, he was held for four-and-a-half years without a trial. In the end, he signed a deal and admitted to causing between $5 million and $10 million in losses to Motorola and other companies, although he kept saying that the purpose of his hacking was never for personal gain – he did it for the fun of being able to do it.

After he was released in 2002, he became a security consultant who is now doing exactly what he did as a hacker, i.e. breaking into computer and network systems, but with the company's knowledge and authorisation.

2. Scan the QR code on the left to watch an interview with Kevin Mitnick.
3. Discuss the following questions in groups:
   a. What is social engineering?
   b. Discuss four of the types of social-engineering techniques.
      i. What is it?
      ii. How is it used?
      iii. Have you or anyone you know been targeted by social-engineering tricks? What happened?
      iv. What can you do to prevent yourself from becoming a victim?

MITNICK INTERVIEW

https://www.youtube.com/watch?v=c76ezYglN28

10.2 Data protection

It is important to back up your data regularly, since hardware can fail or accounts can be compromised. Backing up data lets you protect and store information.

CREATING A BACKUP

Because a back up is simply a copy of your computer's data, it can be created using the *Copy* and *Paste* functions.

Guided Activity 10.1

To do this, you should:

1. Start by setting up a backup schedule to work out how often you will create a backup.
2. Buy an external hard drive to use for the backup.
3. On the scheduled backup day, connect the external hard drive to your computer.
4. Select the files or folders you would like to back up and copy them using the *Copy* command.
5. Create a folder on the external hard drive with the correct date in the name.
6. *Paste* all the copied files and folders into this folder.
7. Disconnect the external hard drive and store it in a safe location.
8. Repeat these steps on each scheduled backup day.

To recover the files from this backup, simply connect the backup hard drive to your computer and copy the damaged or missing data back onto your storage device.

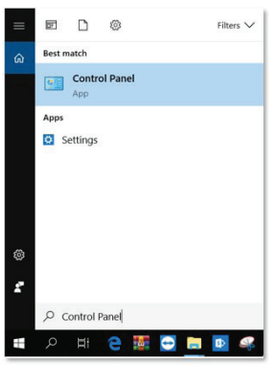
The problem with using *Copy* and *Paste* to back up your data is that the backups must be done manually. As a result, it is possible to forget to create backups. These backups will also be much larger, since each backup will contain all the files and folders you copied, even if some of these folders have not changed since the previous backup.

These problems can be solved by using a backup utility such as Windows 10's *Backup* and *Restore*.

Guided Activity 10.2

To use *Backup* and *Restore*:

1. Buy an external hard drive to use for the backup and connect it to your computer.
2. Open the *Start* menu and enter the words *Control Panel*. This will open the window.

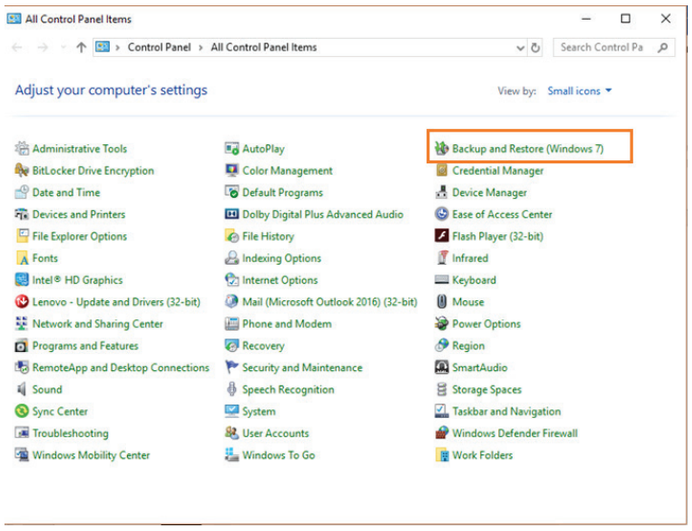


… continued

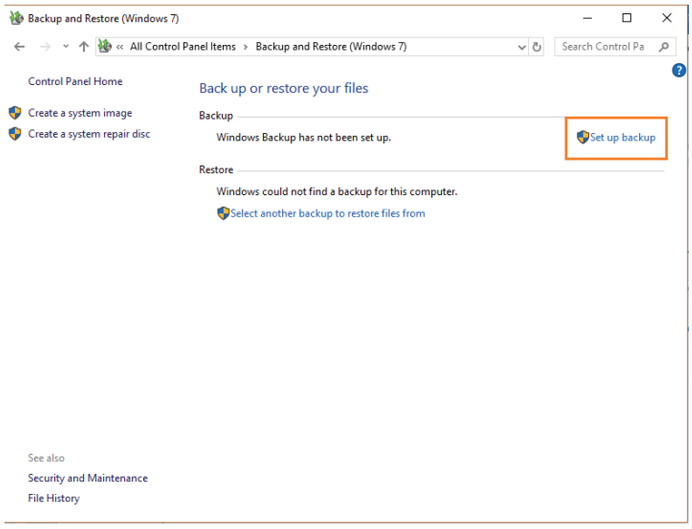
Guided Activity 10.2

... continued

3. Click on the *Backup and Restore* (Windows 7) option to open the *Backup and Restore* window.



4. Click on the *Set Up Backup* option.



5. Select the external hard drive as the location where you would like to save the backup.
6. If all your files are stored in your private folders (such as the *Documents*, *Music* and *Videos* folders), use the *Let Windows Choose* option. Otherwise, select the *Let Me Choose* option and manually choose the folders that should be backed up.
7. Click on the *Save Settings and Run Backup* option to create a backup of all your files.

Guided Activity 10.3

To restore files from a Windows backup:

1. Connect your external hard drive to your computer.
2. Open the *Backup and Restore* (*Windows 7*) application from the *Control Panel*.
3. Click on the *Restore All Users' Files* option.
4. Click on the *Browse for Files or Browse for Folders* option.
5. Tick the *In the Original Location* box and press *Restore*.

This will restore your files to where they used to be, thus replacing all lost files.

USING CLOUD STORAGE FOR BACKUP

One of the problems with backing up your computer's contents to an external hard drive is that your computer and the drive can be lost due to theft, flood or fire. Cloud storage puts your information on an off-site server that never goes offline and that can be accessed from anywhere through the internet.

Cloud storage, however, is not the same as cloud backup. Although they both work on a similar basis and the result is the same – storing files online – there are completely different reasons for using them.

With cloud storage, you choose which files you want to store online and you send them to your online account. When you delete a file that you stored online, it is still in your cloud storage because it is not really tied to your computer anymore. Cloud backup is when you install a program on your computer and you tell it to keep certain files backed up online. A backup service will also upload any changes that are made to those files so that the current version is always online.

A backup server works for people or businesses that have a lot of files they want to keep backed up online, so that, should one of the computers suddenly stop working, the files can still be obtained from the cloud backup server.

These are a few cloud storage providers:

- Google Drive: This works very well with Google products and you get 15 GB for free, after which you have to pay a monthly fee for more storage space.
- Apple iCloud: This service works with all Apple devices, whether a Mac, iPhone, iPad or iPod. You get 5 GB for free but have to pay for more than that.
- Dropbox: It gives users 2 GB for free and lets you access your files from the Web, your desktop or mobile devices.
- Microsoft OneDrive: Integrates well with Microsoft's products such as SharePoint and Word. Everyone with a Microsoft account gets 5 GB free storage space, after which you need to subscribe and pay for more space.

Activity 10.2

Answer the following in your own words.

1. Is it really necessary to back up the content of your computer? Why or why not?
2. Talk to at least two people you know who have their own computers.
   a. Find out if they back up their information? Why or why not?
   b. What do they back up?
   c. How many times do they back up their information?
   d. How do they back up their information?
3. What would be a practical and workable solution for you to back up your information?

10.3 Protecting yourself online

ONLINE HARASSMENT, STALKING AND BULLYING

Online harassment is a wide range of damaging behaviours such as hateful messages, **distributed denial-of-service (DDoS) attacks**, **defamation** and others. The goal of the harasser is to drive the target off the internet or punish them by publishing personal information, sending threats, or promoting harm.

Online harassment is especially prevalent in young adults; with people of colour and women more likely to be victims of serious harassment.

HOW DO YOU AVOID ONLINE HARASSMENT?

Limit the personal data you share on social media accounts and review your security or privacy settings regularly. Do not post your physical address, mobile number or email address (or make them publicly available as part of your profile).

Choose your passwords wisely, make them unique and strong. Change passwords regularly and do not use the same password for different sites. Make sure that the answers to your secret questions are hard to guess.

WHAT TO DO IF YOU ARE HARASSED?

Make a copy of everything. Take screenshots of the harassment and print them out. Keep a record of the websites where the harassment happened. Have your parents take a look at the posts. Report the bullying to the website and ask that they take the harassing content down. If necessary, take the evidence you have collected to the police to open a case.

If you are bullied or harassed, you can call Childline South Africa on 0800 055 555.

MALWARE (MALICIOUS WARE)

Malware is any software that is specifically designed to disrupt, damage or gain unauthorised access to a computer. Examples of malware are:

1. Viruses
2. Worms
3. Trojans
4. Scareware
5. Spyware
6. Adware
7. Ransomware

To prevent your computer from becoming infected with malware, computer experts suggest that you do the following:

- Do not open suspicious emails.
- Do not download suspicious programs or attachments.
- Keep your antivirus application up to date.
- Keep your other software up to date: Hackers can use software weaknesses or vulnerabilities to gain access to your computer.

ONLINE HARASSMENT

Here's what online harassment looks like:

https://www.youtube.com/watch?v=usclHi8jk2w

Something to know

A study that was done in 28 countries, including South Africa, in 2018, found that South Africa showed the highest **prevalence** of cyberbullying, with an increase of 24% from 2011. This could be attributed to the increased use of social media in South Africa.

CYBERBULLYING

Teens Talk: What works to stop cyberbullying?

https://cyberbullying.org/teens-talk-works-stop-cyberbullying

What is cyberbullying?

https://www.pacerteensagainstbullying.org/experiencing-bullying/cyber-bullying/

MULTI-STEP VERIFICATION

Two-factor authentication, or multi-step verification, prevents anyone from logging into your accounts using just your username and password. Instead, they need a second factor (which is usually a physical device such as your phone) to access your account.

Activity 10.3

1. Read the following case study and answer the questions that follow.

> Thando is a young woman who has always had weight and confidence issues. After she decided to improve herself and started following an exercise and diet regime, her friends encouraged her to take photos of herself to show the world her new-found body and self-confidence. Thando decided to share her progress and photos with her friends and family. When she uploaded her new photos on Facebook, a lot of people liked them. Unfortunately one person started to post horrible comments about her appearance and character.
>
> When Thando's sister saw these comments, she became worried that they would affect her sister's new-found confidence and her mental and physical health. She decided to talk to Thando about possible solutions to the problem. Both Thando and her sister eventually reported the person to Facebook and asked that Facebook remove that user's offensive comments and block their account.

   a. Have you experienced some kind of cyberbullying or harassment, or do you know of someone who has experienced it? Tell the story.
   b. Is it a problem in South Africa, or is it becoming a problem? Why do you say so?
   c. What can you as a young person do to prevent this from becoming a problem?
   d. What can you do if you learn that someone is being bullied?
   e. What must you do if you become the target of cyberbullying and harassment?
2. Is there something that you can do to stop cyberbullying at school? Come up with a school project.

UNIT

10.4 E-commerce and e-banking

When using online services such as online banking or shopping, you must be careful that your information is not stolen. Your banking or credit card information can be used to make multiple purchases.

Tips for safely using online banking and shopping include:

- Use proper antivirus software and make sure it is up to date.
- Do not log into online banking or shopping sites using public Wi-Fi or on public computers (like those in an internet café).
- Make sure that the operating systems on all your devices are up to date. This is important for both your phone and computer. Make sure that the banking app on your phone is also up to date.
- Change your passwords regularly and make sure they are strong.
- Do not sign into your banking account through a link in an email as this is most likely a phishing attack.
- Sign up for notifications on your bank account for when money comes in or goes out and when your account is accessed online.

You should always check that the website URL has an "https" extension whenever you are making a transaction online. The "s" stands for secure and it means that the website has something called a **Secure Sockets Layer (SSL)** certificate. This creates an encrypted link between you and the server, making the data that you and the server send and receive secure and private. This protects your data from being intercepted and stolen.

ADVANTAGES OF E-COMMERCE

Below are some of the advantages that e-commerce holds for the consumer, which is you.

- There is a very wide range of products and services available.
- There are no geographical limitations. It is just as easy to buy something from the USA or Europe as it is to buy it in South Africa.
- It definitely saves you time, for example travel time, waiting time and searching time.
- It is available 24/7.

RISKS OF E-COMMERCE

Unfortunately, there are also certain risks related to e-commerce, such as:

- Fraud: Because transactional data is transmitted over the internet, it has become one of the target areas of cybercriminals. Financial information can be hacked or stolen, leading to purchases made by people who are not the rightful owners of that information. Customers sometimes complain that they have not received their packages and it is difficult to determine whether that is true or not.
- Online security: There are many security threats such as malware, spam mail and phishing that can cause you harm.
- Exchanging a product that does not fit the online description can be difficult.

INTERNET BANKING

Internet banking explained:

https://www.youtube.com/watch?v=oADxUX4STjE

ADVANTAGES OF E-BANKING

Below are some of the advantages of internet banking:

- It is convenient, as customers have 24-hour access to the bank, seven days a week.
- It can be done from any location where you have Internet.

RISKS OF E-BANKING

Although online banking is secure enough to use on a daily basis, you should know about these risks:

- Fraudulent transactions
- Online theft of your access ID/user ID or PIN/password could happen.
- Banking apps can be compromised.

Activity 10.4

Answer the following in your own words.

1. What exactly does e-commerce mean?
2. What are the advantages of e-commerce?
3. What are the risks of e-commerce?
4. What can you do to make sure that you are safe when shopping online?

UNIT

10.5 How antivirus programs work

Antivirus software is any computer program that is designed to scan for, isolate and delete any harmful program from your computer before it causes any damage, but you can do an active scan any time you think that your computing device has been infected with a virus.

Antivirus and antimalware programs check all the files on a computer, checking all changes and the memory for specific types of file change patterns.

APPLICATION PERMISSIONS

When you install an app on your smartphone or tablet, you will need to give it permission to access certain functions on your device. For example, when you install a navigation app (such as Google Maps), you will first be asked for permission to access the device's GPS location.

Using app permissions means that you can control what capabilities or information the app can access.

Activity 10.5

1. Give two examples of ways to avoid online harassment.
2. What is malware?
3. How do you avoid getting a malware infection?
4. What is multi-step verification?
5. Give five tips for safe online banking.
6. What does the "s" in "https" mean?
7. Briefly describe three common types of virus detection in antivirus programs.

REVISION ACTIVITY

QUESTION 1: MULTIPLE CHOICE

1.1 Which of the following is NOT an example of social engineering? (1)

A. Phishing **B.** Malware
C. Tailgating **D.** Pretexting

1.2 If you come across fake news, what should you do? (1)

A. Post it and share it **B.** Do more research on it
C. Delete it from the internet **D.** Edit and try to fix it

1.3 Which of the following institutions is used in phishing scams the most? (1)

A. Banks **B.** Universities
C. Kindergartens **D.** Online shops

1.4 Which of the following scenarios do NOT use online banking? (1)

A. Ahmed owns an electronics store and does have a card swipe machine.
B. Chloe does not have a physical clothing store but she sells clothing through an online website.
C. Blessing only likes shopping for games online.
D. Hanno wants to send money to his mother overseas.

1.5 Which of the following is NOT an antivirus program/application? (1)

A. Avast **B.** Norton
C. Bitdefender **D.** OneDrive

... continued

REVISION ACTIVITY

... continued

QUESTION 2: TRUE OR FALSE

Write True or False next to the question number. Correct the statement if it is FALSE. Change the underlined word(s) to make the statement TRUE. (You may not simply use the word NOT to change the statement.)

a. Multi-step verification can be used to keep your email password secure. (1)
b. A disadvantage of e-commerce is that it is hard to send physical money online. (1)
c. Emails from an unknown source are known as suspicious emails. (1)
d. If you want to prevent people from accessing your online accounts, you must use a strong password. (1)
e. Hackers use Quid Pro Quo to steal passwords. (1)

QUESTION 3: MATCHING ITEMS

Choose a term/concept from Column B that matches a description in Column A. Write only the letter next to the question number (e.g. 1J). (5)

COLUMN A	COLUMN B
1. Done via email where an attacker tricks people into giving out personal information or handing over money.	**A.** Adware **B.** Quid Pro Quo **C.** Phishing **D.** Firewall **E.** Pretexting **F.** Baiting **G.** Spam **H.** Tailgating
2. The art of lying to get sensitive data. This can be done in person or over the phone.	
3. When the attacker offers something someone wants and tricks the user into giving away login data to particular websites.	
4. The promise of something, usually a thing or a benefit, in exchange for information.	
5. When an attacker walks into an access-controlled environment by following a person with legitimate access.	

QUESTION 4: MEDIUM QUESTIONS

4.1 Briefly explain how to recover data from a backup? (2)
4.2 What are three disadvantages of using an external hard drive to back up your computer's data? (3)
4.3 What is a preferable alternative to physical computer backups? (1)
  a. Explain what this alternative backup does. (3)
  b. Who would benefit most from this type of alternative backup? Mention three of them. (3)
  c. What three things can you do to prevent your computer from getting infected by malware? (3)
4.4 What is the difference between e-commerce and e-banking? (4)
4.5 List two risks of online banking. (2)
4.6 Explain the concept of cloud storage. (2)
4.7 Provide two examples of cloud storage providers. (2)

TOTAL: [40]

AT THE END OF THE CHAPTER

NO	CAN YOU ...	YES	NO
1.	Identify different social-engineering tricks?		
2.	Describe why data backup is important?		
3.	Back up data correctly?		
4.	Discuss how to avoid online harassment and what to do if you become a target of online harassment?		
5.	Describe what malware is and how to avoid it?		
6.	Explain multi-step verification?		
7.	Describe how antivirus and antimalware programs work?		

TERM 3

CHAPTER 11

INTERNET AND THE WORLD WIDE WEB

CHAPTER OVERVIEW

By the end of this chapter, you will be able to:

- Describe and discuss what Voice over Internet Protocol (VoIP) and video conferencing are
- Discuss the advantages and disadvantages of VoIP and video conferencing
- Describe the different types of transactions you can perform online
- Define the Internet of Things (IoT)
- Explain the advantages and disadvantages of social media
- Discuss good and bad practices on social media platforms
- Describe the limitations of fixed internet access
- Discuss mobile internet access in relation to Wi-FI hotspots, WiMAX, Bluetooth and mobile internet
- Differentiate between different email applications
- Describe the key factors that define the usability of websites and how websites link to word processing and forms

INTRODUCTION

The internet has changed the way we communicate with each other and the way we interact with the world. More people are making calls and reading their news online than ever before and the number keeps on growing.

In this chapter, you will learn about various forms of online communication, how the internet can be used for transactions such as banking, shopping and make bookings, and what the Internet of Things (IoT) is. You will also look at the advantages, disadvantages and best practices of social media and the different forms of internet access that are available. In the final two units, you will look at browser and email software, as well as what key factors make a website user-friendly.

UNIT

11.1 Internet communication

This unit examines different types of digital communication, such as VoIP and video conferencing, and discusses the advantages, disadvantages and best practices related to each of them.

VOICE OVER INTERNET PROTOCOL (VoIP)

VoIP is the technology that converts your voice into a digital signal, allowing you to make a call directly from a computer, a VoIP phone, or other data-driven devices.

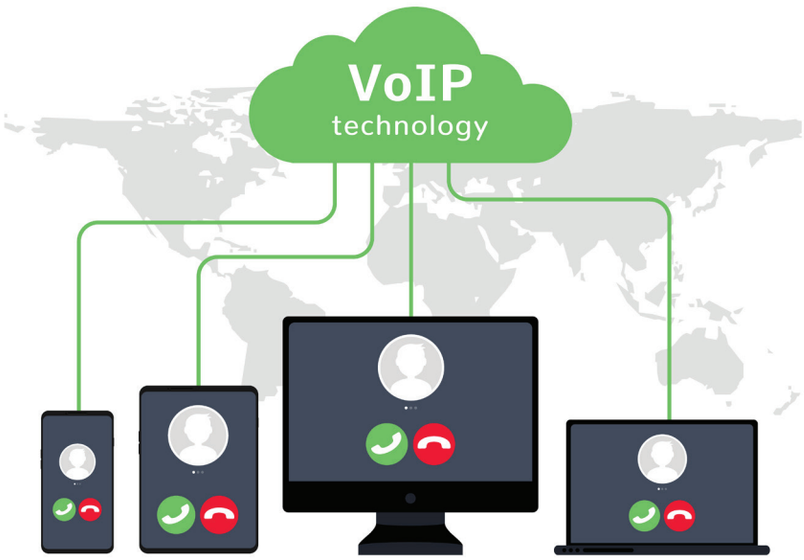


Figure 11.1: *Skype using a smartphone, tablet and computer*

VoIP has several key advantages over traditional telephone exchanges, for example:

- The set-up costs are lower.
- VoIP has all the same features as normal telephone networks, but also includes features such as call forwarding, call waiting, voicemail, three-way calling and more.
- VoIP services can be accessed by staff anywhere they need it and these services can be centrally controlled.

VoIP also has its disadvantages, such as:

- VoIP relies on you having internet.
- There are also security concerns around VoIP calls. The data packets themselves can be intercepted and tampered with, and users are vulnerable to identity theft when using online VoIP services.
- You should also make sure that your network prioritises your VoIP data packets.

VIDEO CONFERENCING

Video conferencing is linked to VoIP and is often offered as part of a VoIP contract. Video conferencing works by using an online platform to make or receive video calls. The most popular of these platforms is Skype, which is also a p opular VoIP platform.

Figure 11.2: *Video conferencing works by using an online platform*

Video conferencing has many benefits for businesses in particular, such as:

- Reduced travel costs.
- Screen- and file-sharing allow the people taking part in the call to see what others are working on, which is good for collaboration.
- Video conferencing is a visual communication medium, so you can see the facial expressions and body language of the people you are talking to.

A disadvantage of video conferencing is bad video or audio quality can make a video call very frustrating.

You should treat video calls as you would in-person conversations, so make sure to be polite and respectful and avoid talking over other people.

Activity 11.1

Answer the following questions in your own words.

1. Compare VoIP and video conferencing. Tabulate the information.
   a. What is each of the above?
   b. What is each one used for (main function)?
   c. What are the main advantages of each?
   d. What are the main disadvantages of each?
   e. Give an example of each.
2. What is the difference between VoIP and video conferencing?

11.2 Online transactions

The most popular is the EFT (electronic funds transfer), which allows you to log onto a banking website (or smartphone app) and send money from your account to another account.

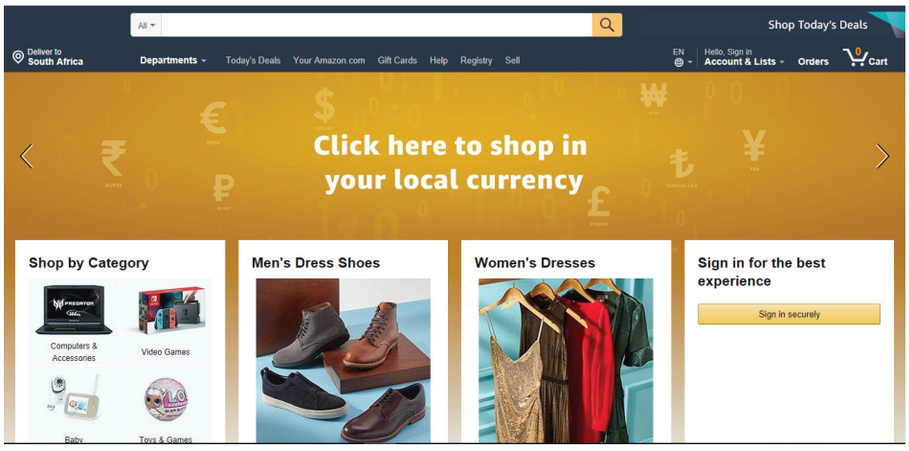
Another popular online transaction is shopping. Online shopping is convenient.

Most travel agencies, hotels and airlines have websites where you can book all you need for your trip. You can use the World Wide Web to search for specials. You can also use airline websites for online flight check-in before you get to the airport.

Buy tickets to see your favourite performer or sports team. It is more convenient to book online and pay well in advance. Take a look at the case study below to see how online transactions fit into our everyday lives.

SHOPPING AND MAKING BOOKINGS ONLINE

Harry wants to surprise his wife with tickets to see her favourite band perform. He checks the ticket website and sees that all the Johannesburg shows are sold out, but there are still tickets available in Cape Town. He buys the tickets and decides that they should make a short holiday of their trip. He then goes to a website that compares flight prices. Harry enters the dates for when he wants to fly down and return, and finds a result that matches his budget. He books two tickets for those flights. Then he realises they will need somewhere to stay. Harry goes to an accommodation comparison site and enters the dates to check for availability. He sees that a lovely hotel close to the concert venue is offering an early booking special, so he books a room for a week. He logs onto his banking app and transfers his booking fee and deposit to the hotel. He also takes the time to reserve a rental car for the week. Following this, Harry decides to buy his wife a birthday gift while he is online and visits some shopping websites to look for a purchase. All of this takes him an hour from the comfort of his couch.



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SHOPPING AND MAKING BOOKINGS ONLINE

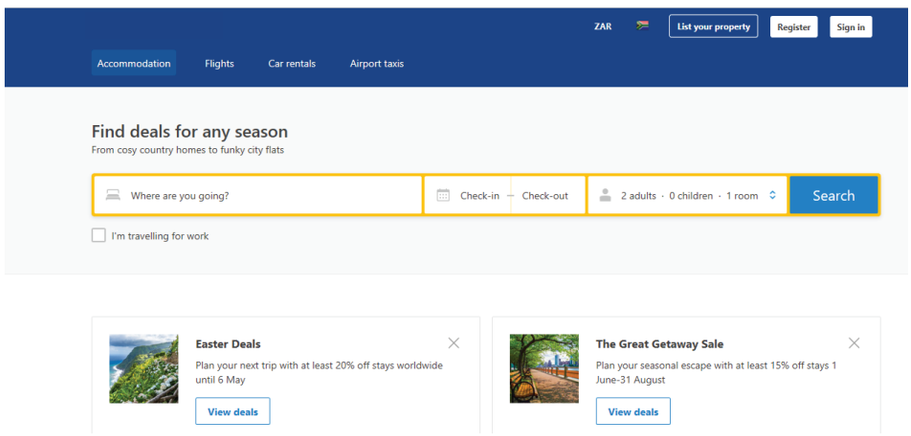


Figure 11.3: *Examples of online shopping and booking sites*

Activity 11.2

1. Why would a person use online banking for EFTs?
   a. Would you use it? Why or why not?
2. What are some of the drawbacks of online shopping?
   a. Have you done online shopping? Write a paragraph on your experience. Or explain why you do or do not like online shopping.
3. Give three examples of different online transactions (not banking or shopping).

11.3 The Internet of Things (IoT)

THE INTERNET OF THINGS

More and more devices are able to access the internet. Various devices like fridges and washing machines have the potential to connect to each other through the internet. This has led to the rise of something called the Internet of Things, or IoT.

Everything that can be switched on and off can be connected in the IoT, from smartphones, coffee-makers and washing machines, to headphones, lamps and wearable devices. This also applies to components of machines, for example a jet engine of an airplane or the drill of an oil rig.

BENEFITS OF IoT

The IoT can be used to connect "smart homes", where you can use your smartphone to control everything from the temperature of the air-conditioners to the music that plays when you walk in the door.

The IoT can also be used to build "smart cities", where transportation and the movement of people can be controlled and monitored and made more efficient.

Figure 11.4: *Areas where IoT can be beneficial*

INTERNET OF THINGS EXPLAINED

https://www.youtube.com/watch?v=uEsKZGOxNKw

HOW IT WORKS: INTERNET OF THINGS

https://www.youtube.com/watch?v=QSIPNhOiMoE

Smart buildings can reduce energy costs by using sensors that detect how many occupants are in a room. The temperature can adjust automatically – for example, turning the air conditioner on if sensors detect a conference room is full or turning the heat down if everyone in the office has gone home.

In agriculture, IoT-based smart farming systems can help monitor, for instance, light, temperature, humidity and soil moisture of crop fields using connected sensors. IoT is also instrumental in automating irrigation systems.

In a smart city, IoT sensors and deployments, such as smart streetlights and smart meters, can help alleviate traffic, conserve energy, monitor and address environmental concerns, and improve sanitation.

Activity 11.3

Read the extract below and answer the questions that follow:

WITH SMART CITIES, YOUR EVERY STEP WILL BE RECORDED

By Sara Degli-Esposti & Siraj Ahmed Shaikh | 17 April 2018

Modern cities are brimming with objects that receive, collect and transmit data. This includes mobile phones but also objects actually embedded into our cities, such as traffic lights and air pollution stations. Even something as simple as a garbage bin can now be connected to the internet, meaning that it forms part of what is called the internet of things (IoT). A smart city collects the data from these digital objects, and uses it to create new products and services that make cities more liveable.

Although they have huge potential to make life better, the possibility of increasingly smarter cities also raises serious privacy concerns. Through sensors embedded into our cities, and the smartphones in our pockets, smart cities will have the power to constantly identify where people are, who they are meeting and even perhaps what they are doing.

Following revelations that 87 million people's Facebook data was allegedly breached and used to influence electoral voting behaviour, it is ever more important to properly scrutinise where our data goes and how it is used. Similarly, as more and more critical infrastructure falls victim to cyber-attacks, we need to consider that our cities are not only becoming smarter, they are also becoming more vulnerable to cyber-attacks.

Extract from https://theconversation.com/with-smart-cities-your-every-step-will-be-recorded-94527

1. What does the term Internet of Things (IoT) refer to?
2. Refer to paragraph 1. Many examples of IoT are given that could improve "liveability" in a city. Elaborate on any TWO of these examples (or give your own) by describing how they would improve citizens' lives.
3. How do the Internet of Things and Big data relate to each other?
4. Discuss two challenges a city would face when trying to implement the systems necessary to create smart cities, besides the challenge of funding such a project?
5. Many citizens of such smart cities say that privacy concerns are only relevant to people who have something to hide. Do you agree or disagree with this statement? Motivate your answer in a short paragraph.
6. Describe a scenario of the type of cyber-attack that could be launched on a smart city.

UNIT

11.4 Fourth Industrial Revolution (4IR)

Globalisation can be defined as a process of connection, interaction and integration among people, companies, and governments. This process is driven by international trade, investment, technology and big data. This has resulted in:

- An efficient market where there is an equilibrium between what buyers are willing to pay for a good or service and what sellers are willing to sell for a good or service.
- Increased competition between companies, which improves the service and quality of goods or services delivered to the consumers.
- Security as countries' economies are intertwined and dependant on each other.
- Wealth equality throughout the world as poorer nations have more job opportunities.

Society has gone through various stages. These are:

- The First Industrial Revolution, in the late 18th to early 19th centuries, is famous for industrialising agricultural work.
- The Second Industrial Revolution, in the late 19th and early 20th century, brought iron and steel into industry.
- The Third Industrial Revolution is the Digital Revolution with the age of the computer and the internet.
- The Fourth Industrial Revolution sees the digitisation of our society.

Globalisation and technology are intertwined as the movement of people, goods and ideas is accelerated and broadened by new forms of transport and communication. The spread of the internet and the relatively low cost of digital technology connect more people with the world. For example, small traders in shanties on the outskirts of Nairobi export across east Africa. In China, "Taobao villages" allow previously cut-off rural populations to sell goods on Alibaba's trading platform.

Sectors which the Fourth Industrial Revolution has impacted greatly includes:

- **Agricultural sector:** AI-powered machine vision systems can measure crop populations and detect weeds or plant pests and use robotic sprayers to precisely apply herbicides.
- **Healthcare sector:** Precision medicine helps doctors analyse a patient's genome sequence, medical history, and lifestyle, making a diagnosis more reliable.

THE FOURTH INDUSTRIAL REVOLUTION

https://m.youtube.com/watch?v=ChbjZHW2Wwk

Activity 11.4

In small groups, research the influences of the Fourth Industrial Revolution on the following sectors:

- Retail
- Building
- Social
- Travel

Activity 11.5

Answer the following questions in your own words.

1. Answer the following questions.
   a. Name three types of technologies from the 3IR that you have personally come into contact with.
   b. Name three types of technologies from the 4IR that you have personally come into contact with.

… continued

Activity 11.5

… continued

c. Do you think any technologies from the first three industrial revolutions can be replaced by technologies from the 4IR? Motivate your answer. Note: You can use an example to help you motivate your answer.

2. The internet is playing a large role in the lives of 60% of the total South African population, with 51% accessing it through their mobiles. Find out what the situation is in your school.
   - How many learners have access to the internet?
   - How many learners access the internet through their smartphones?
   - What brands of smartphones do they have?
   - How much time do they spend on their phones?
   - What are they doing on their phones?
   - What social media platforms are they using?
   - How does this compare to the world-wide trends?

   a. Create your own task definition using the knowledge you have gained in this section.
   b. Share it with the rest of the class.

UNIT

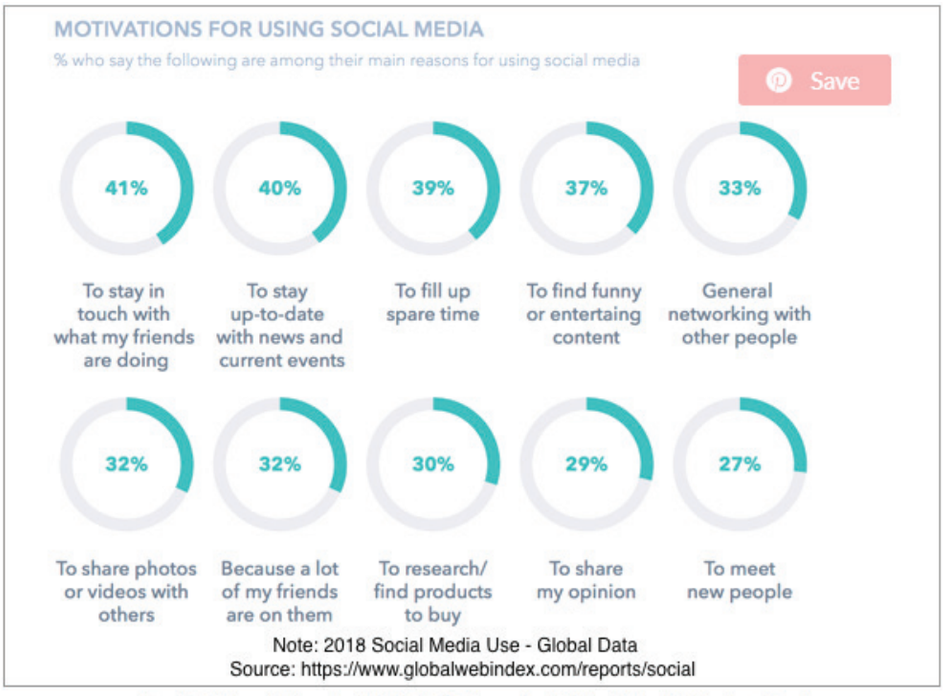
11.5 Social media

Social media has become a staple of our digital lives, from tweeting your thoughts on Twitter, to sharing pictures of your life on Instagram. Social media is used to market products, make announcements and stay in touch with the people who matter to you.

Something to know

Some interesting statistics on the use of social media

- There were 3,03 billion active social media users in the world in 2018.
- Facebook: 500 000 new users are added every day; that means six new profiles every second.
- Twitter: 500 million tweets are posted every day; this means 6 000 tweets every second.
- YouTube: 300 YouTube videos are uploaded every minute and 1 billion hours of videos are watched every day.
- Instagram: More than 95 million photos are uploaded every day.
- Pinterest: There are 200 million active users each month.
- Snapchat: There are 187 million active users every day.



How Participants Use Social Media Platforms In 2018 – GlobalWebIndex Chart

Figure 11.5: *The reasons why people used social media in 2018*

This section looks at the advantages and disadvantages of social media, good practices to use on social media and what to avoid doing when you are online.

ADVANTAGES

You can connect with anyone, anywhere in the world, staying in touch with friends who have moved away or family members who live in other countries.

Using social media keeps you up to date with what is happening in the world in real time. This is especially true of sites such as Twitter, where those on the ground at major events can tweet what is happening as it happens.

Social media platforms can be used to promote awareness and causes. Social activists use social media to inform people about issues and engage them in conversations about those issues.

Social media builds communities. Like-minded people can come together and discuss the things that interest or influence them.

DISADVANTAGES

Something called the social media bubble draws people to communities where their views (and only their views) are supported and encouraged. This can lead to people being misinformed about the world or only getting one opinion on an issue.

There is also a psychological effect on social media users. Since most people only share the positives in their lives on social media, others may compare their lives to the digital lives of their friends and family and find them lacking in something. Studies have shown that using social media can lead to depression.

Cyberbullying is also a big problem on social media and can cause great emotional harm to victims.

Social media is also used as a platform to scam or steal from people, especially older people who are not always internet literate and are more often likely to be the victims of 419 scams.

BEST PRACTICES

There are several good, common-sense practices you can follow when using social networking sites:

- **Manage your privacy settings:** Learn about and use the privacy and security settings on your social networking sites. They help you control who sees what you post and manage your online experience in a positive way.
- **Keep personal info personal:** Be careful how much personal information you provide on social networking sites. The more information you post, the easier it may be for someone to use that information to steal your identity, access your data, or commit other crimes such as stalking. Restrict who can have access to different types of information on your profile. Avoid publishing personal information like email addresses, home address and phone numbers.
- Think carefully about who you allow to become a “friend”.

- **Restrict the amount of time you spend on social networking sites:** Many companies and schools block social media websites as a result of the abuse of resources like bandwidth, especially by downloading and uploading large files, photographs and videos.

Activity 11.6

Answer the following questions in your own words.

1. List three social media websites you use. Also explain why you use each of them.
2. Mention three advantages and three disadvantages of social media websites for you.
3. Mention three things you must do and three things you must not do when using social media. Also give the reasons why you think that.
4. Why should you investigate news articles before you share them?
5. Do you know of any examples of fake news? Discuss what you know about it and how it can affect people who read it.

11.6 Internet access

Being able to access the internet allows you to access a world of information with a simple search and the click of a button. This unit will look at the limitations of fixed-line internet access and the different types of portable internet access and connections available, such as Wi-Fi hotspots, Bluetooth and mobile internet connections.

MOBILE INTERNET ACCESS

There are many types of mobile internet access, such as cellular data signal, Wi-Fi hotspots and WiMAX. This unit will look at several different types of mobile internet access and where each one is usually used.

WI-FI HOTSPOTS

A Wi-Fi hotspot is a wireless access point that you can connect to using the wireless connectors in your computing device. When we talk about Wi-Fi hotspots, we are usually talking about the publicly accessible connection points that businesses supply (usually for free) to their customers.

You can also create a wireless hotspot in your home by using a router with a wireless connector, or on the go by using your cellular phone or other devices capable of connecting to the internet.

Wi-Fi hotspots can usually be found in coffee shops, airports and hotels. Some Wi-Fi hotspots can also be provided as a public service, for example, the city of Tshwane in Gauteng offers a service called TshWiFi.

Your wireless capable device (laptop or smartphone) can search for and connect to Wi-Fi hotspots nearby.

WiMAX

WIMax is used to connect multiple devices over a longer range than Wi-Fi could and as a replacement for the GSM connections standards for mobile devices. WiMAX can cover long distances (like a cellphone signal network) and deliver high-speed internet access (like broadband connections).

More devices have Wi-Fi connectors built in than they do WiMAX connectors and most mobile carriers choose to use Long-Term Evolution (LTE) instead of WiMAX in their networks.

BLUETOOTH

Bluetooth is a wireless communication standard that allows electronic devices to connect to and interact with each other wirelessly. Bluetooth does not rely on mobile data, cellular signal or Wi-Fi to connect, as long as the devices that want to connect are within range of each other (and have each other's pass codes), they can connect.

MORE ON BLUETOOTH

Watch this video if you want to learn more about Bluetooth.

https://youtu.be/jzxZUJm0u30

Bluetooth can be used for many different things, like connecting Bluetooth-enabled devices such as keyboards, mice and speakers to your computer or headphones to your smartphone. You can also use it to send documents to Bluetooth-enabled printers or connect your smartphone to your car's Bluetooth system to make hands-free calls, listen to music or listen to text messages out loud and send them using text-to-speech input.

NFC

NFC (Near field communication) is a method of wireless data transfer that detects and then enables technology in close proximity to communicate without the need for an internet connection.

You can use NFC at a local supermarket, train station, taxi or coffee shop that supports contactless payments via your phone's NFC chip.

MOBILE INTERNET

Mobile internet (or mobile broadband) is the term used to describe the wireless internet access you can get through cell phone towers and other digital devices that use portable modems (such as tablets and smartphones).

Mobile internet lets smartphone users connect to the internet wherever they have decent network signal. Most cellular service providers also offer mobile internet packages where you use a small modem (called a dongle) to connect to the cellular network. These dongles can either plug directly into your computer (using USB) or can be used to create a Wi-Fi hotspot.

It is also an alternative to fixed-line internet connections (such as ADSL) and is useful in areas where ADSL services are not available or for users who do not want to have a telephone line installed.

There are different types of mobile internet connections. The most common are 3G (which stands for Third Generation) and LTE or 4G. LTE is the current standard for mobile internet. It is faster than 3G and can support things like high-definition video streaming. Looking to the future, 5G promises to be even faster than 4G and will become the new standard in internet connection for mobile devices.

With mobile internet, you can use your smartphone as a modem. You can turn your smartphone into a Wi-Fi dongle to connect other devices to the internet using something called tethering. Using your smartphone as a modem gives you access to the internet in areas where there are no Wi-Fi hotspots.

MORE ON 5G

Watch this video if you want to learn more about 5G.

https://m.youtube.com/watch?v=MC_Sfkh5-zQ

Figure 11.6 shows an example of the tethering screen on an Android device.

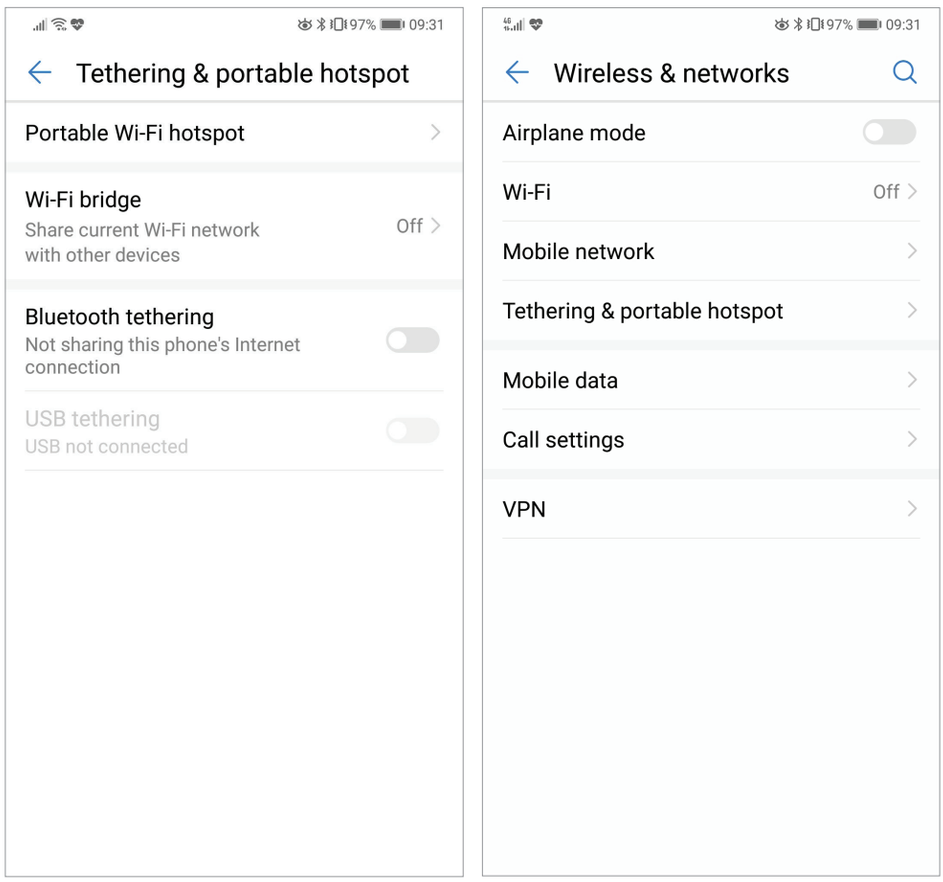


Figure 11.6: *Tethering settings on an Android device*

Activity 11.7

Answer the following questions in your own words.

1. Briefly discuss the limitations of fixed internet access, paying particular attention to the South African context.
2. What is a Wi-Fi hotspot and give an example of one?
3. What does WiMAX stand for?
4. What is Bluetooth and how does it work?
5. List the two most common types of mobile internet connections and describe how they differ from each other.

UNIT

11.7 Browser and email software

There is a huge range of internet browsers available for you to choose from. Browsers are simply the software you use to access the websites on the World Wide Web.

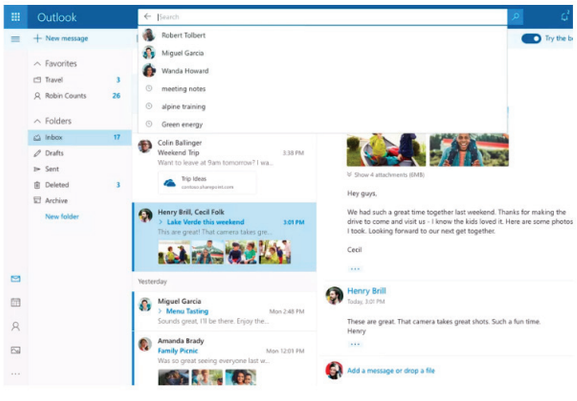
Some browsers are specifically linked to a manufacturer or operating system, such as Safari for Apple devices with iOS and MacOS, or Microsoft Edge for devices with Windows OS. This is not to say that you cannot download browser software from the internet and use it instead of the browser that comes standard with your device.

EMAIL

Email is a widely used form of communication. It consists of software for creating, sending, receiving and organising electronic mail (or email). Modern desktop email clients like Microsoft Outlook, Windows Live Mail and Mozilla Thunderbird offer advanced features for managing email, including WYSIWYG editors for composing email messages, anti-spam and anti-phishing security protection, advanced search capabilities, and rules and filters for more efficiently handling and organising messages and email folders.

A large number of online email services, called webmail, exist with features and functionality for managing email similar to their desktop email software counterparts. Some of the more popular online email services are Yahoo! Mail, Gmail, Hotmail (Windows Live Mail) and AOL Mail.

Figure 11.7: *The Gmail, Outlook and Apple Mail application logos*



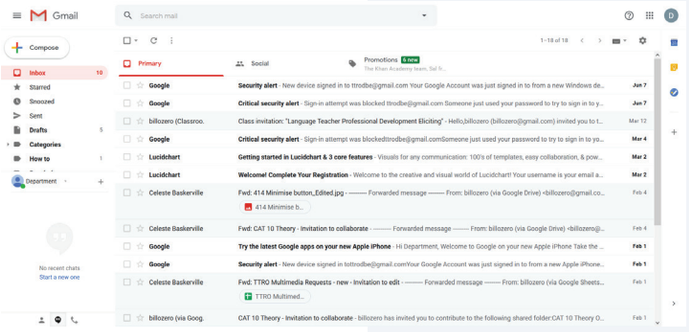


Figure 11.8: *Email user interfaces*

11.8 Usability of web pages and websites

Website usability looks at how user-friendly a website or web page is. There are five key factors that determine the usability of a site:

- **Readability:** This feature is one of the more important aspects of web design usability. Readable text affects how users process the information from the content. Poor readability scares readers away from the content. On the other hand, done correctly, readability allows users to efficiently read and process the information in the text. You want users to be able to read your content and absorb it easily.
- **Navigation:** Navigation is very important to ensure users are able to find what they are looking for easily and intuitively. The structure of the navigation should be simple and the main links (or menu system) should be easy to locate and identify. They should always appear in a consistent position on the website. Links should be short and it should be simple to figure out what the link is leading to. Web designers should ensure that no broken links occur on the site.
- **Consistency:** This feature affects both usability and readability. Consistency means, for example, that all headers of the same importance should be treated the same in terms of size, colour and font etc. For example, all <h1> headers in an article should look identical. This consistency provides users with a familiar focus point when they are scanning the text, and it helps to organise the content.
- **Layout:** Layout refers to how the various elements (text, graphics, buttons, etc.) are arranged on a web page. Pages should be designed and laid out in a way best suited to their intended audience or readers. Text and graphic objects on the page should be adapted to fit standard monitor sizes and resolutions.
- **Typography:** Typography refers to fonts and how they are put together. The font you use on your website needs to meet two specific criteria:
  1. How easy is it to read?
  2. Can it be rendered in HTML?

Each of these factors covers a single aspect of the website and they all need to work together to create a user-friendly website.

LINK TO WORD PROCESSING AND FORMS

Websites can link to word processors and word-processing forms in a few ways:

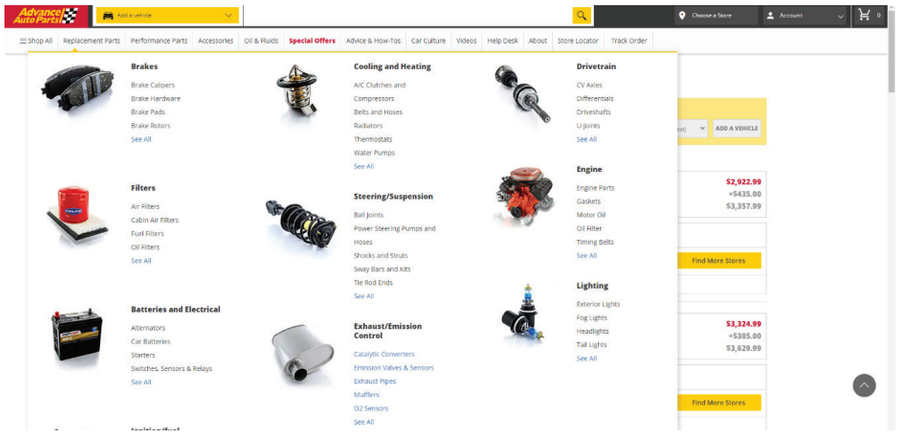
1. It is possible to create basic web pages in some word processors (such as Microsoft Word).
2. You can use word processors to create content for your websites.
3. You can use word processors to create forms for your websites.

Activity 11.8

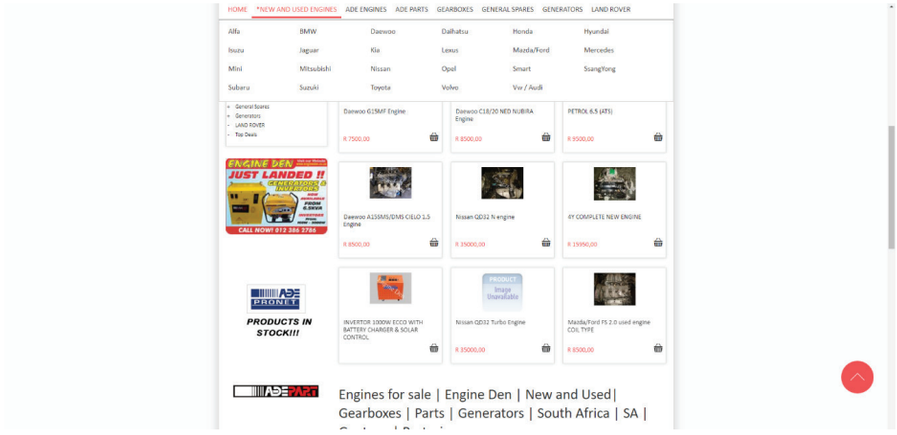
Answer the following questions in your own words.

1. Below are two websites that sell car engines. Look at the navigation designs of these websites and answer the following questions.

Website A



Website B



   a. Which website has the best readability? Give two reasons for your answer.
   b. Which website has the best navigation? Give two reasons for your answer.
   c. Which website has the best consistency? Give two reasons for your answer.
   d. Which website has the best layout? Give two reasons for your answer.
   e. Which website has the best typography? Give two reasons for your answer.

2. Based on your comparisons of the two websites, which website do you prefer. Give two reasons for your answer.
3. Name two things that can be done to improve the website you least prefer.

REVISION ACTIVITY

QUESTION 1: MULTIPLE CHOICE

1.1 Which of the following cannot be done with VoIP? (1)

- **A.** Voicemail
- **B.** Call forwarding
- **C.** Call waiting
- **D.** Instant messaging

1.2 Which of the following is not a disadvantage of video conferencing? (1)

- **A.** Lagging caused by bad internet connections
- **B.** Technology can fail during a call
- **C.** Remote access
- **D.** Bad audio quality

1.3 What does EFT stand for? (1)

- **A.** Electronic Financial Transfer
- **B.** Electronic Funds Transfer
- **C.** Electric Finance Transfer
- **D.** Electric Fund Transfer

1.4 Which of the following is an example of e-commerce? (1)

- **A.** Online shopping
- **B.** Online banking
- **C.** Online government services
- **D.** Online gaming

1.5 Smart fridges use embedded _____ to connect to the internet. (1)

- **A.** Network adapters
- **B.** Network cables
- **C.** Wi-Fi
- **D.** Interface cards

QUESTION 2: TRUE OR FALSE

Choose the answer and write True or False next to the question number. Correct the statement if it is FALSE. Change the underlined word(s) to make the statement TRUE. (You may not simply use the word NOT to change the statement.)

a. VoIP converts digital signals to analogue signals. (1)

b. VoIP can work with an unstable internet. (1)

c. Data packets are protected from internet attacks. (1)

d. The Internet of Things is a system in which everyday appliances connect to computers. (1)

QUESTION 3: MATCHING ITEMS

Choose a term/concept from Column B that matches a description in Column A. Write only the letter next to the question number (e.g. 1J). (5)

COLUMN A	COLUMN B
1. A washing machine that can be turned on remotely.	**A.** Cyberbullying
2. A website where 1 billion hours of video are watched each day.	**B.** YouTube
3. An application that people can use to make video telephone calls.	**C.** Online banking
4. A technique used to pay for online purchases.	**D.** Internet of Things
5. Emotionally abusing people online.	**E.** Cybercrime
	F. Vimeo
	G. Big data
	H. VoIP
	I. EFT
	J. Facebook

... continued

REVISION ACTIVITY

… continued

QUESTION 4: FILL IN THE MISSING WORDS

Fill in the missing word(s) in the following statements. Provide only one word for each space.

a. EFTs allow you to log onto a _____ website and send money from your account to another account. (1)
b. If you do not have physical money on you, you can make a payment by _____. (1)
c. Any object that makes use of a(n) _____ source can connect to the Internet of Things. (1)
d. _____ is the most popular social network. (1)
e. Social media _____ things and people together. (1)

QUESTION 5: CASE STUDY

Read the extract below and answer the questions that follow:

WITH SMART CITIES, YOUR EVERY STEP WILL BE RECORDED

By Sara Degli-Esposti & Siraj Ahmed Shaikh | 17 April 2018

Modern cities are brimming with objects that receive, collect and transmit data. This includes mobile phones but also objects actually embedded into our cities, such as traffic lights and air pollution stations. Even something as simple as a garbage bin can now be connected to the internet, meaning that it forms part of what is called the Internet of Things (IoT). A smart city collects the data from these digital objects, and uses it to create new products and services that make cities more liveable.

Although they have huge potential to make life better, the possibility of increasingly smarter cities also raises serious privacy concerns. Through sensors embedded into our cities, and the smartphones in our pockets, smart cities will have the power to constantly identify where people are, who they are meeting and even perhaps what they are doing.

Following revelations that 87 million people's Facebook data was allegedly breached and used to influence electoral voting behaviour, it is ever more important to properly scrutinise where our data goes and how it is used. Similarly, as more and more critical infrastructure falls victim to cyber-attacks, we need to consider that our cities are not only becoming smarter, they are also becoming more vulnerable to cyber-attacks.

Extract from https://theconversation.com/with-smart-cities-your-every-step-will-be-recorded-94527

5.1 What does the term Internet of Things (IoT) refer to? (2)
5.2 Refer to paragraph 1. Many examples of IoT are given that could improve "liveability" in a city. Elaborate on any TWO of these examples (or give your own) by describing how they would improve citizens' lives. (2)
5.3 How do the Internet of Things and big data relate to each other? (2)
5.4 Discuss two challenges a city would face when trying to implement the systems necessary to create smart cities, besides the challenge of funding such a project? (2)
5.5 Many citizens of such smart cities say that privacy concerns are only relevant to people who have something to hide. Do you agree or disagree with this statement? Motivate your answer in a short paragraph. (2)

QUESTION 6: SCENARIO-BASED QUESTIONS

Like many of his friends, Zike likes to stay up to date with the current affairs of the world, gossip and the media. Zike's teacher has noticed that a lot of his learners get distracted by their smartphones and as a result do not pay attention in class.

6.1 What three dangers are the learners most vulnerable to through social media websites such as Facebook? (3)

… continued

REVISION ACTIVITY

… continued

6.2 What four best practices should Zike's teacher suggest to the learners to help them navigate the social media they are regularly exposed to? (4)

6.3 Recently, Zike has started to notice that someone has been stalking him online.

a. Mention one thing he can do to solve the problem.

b. Mention one thing he should avoid to prevent the problem from getting worse. (2)

6.4 Briefly explain why Zike needs to know what data cap is. (2)

TOTAL: [40]

AT THE END OF THE CHAPTER

NO	CAN YOU ...	YES	NO
1.	Describe and discuss what VoIP and video conferencing are?		
2.	Discuss the advantages and disadvantages of VoIP and video conferencing?		
3.	Describe the different types of transactions you can perform online?		
4.	Define the Internet of Things?		
5.	Explain the advantages and disadvantages of social media?		
6.	Discuss good and bad practices on social media platforms?		
7.	Describe the limitations of fixed internet access?		
8.	Discuss mobile internet access in relation to Wi-FI hotspots, WiMAX, Bluetooth and mobile internet?		
9.	Differentiate between different email applications?		
10.	Describe the key factors that define the usability of websites and how websites link to word processing and forms?		

TERM 4

CHAPTER 12

E-COMMUNICATIONS

CHAPTER OVERVIEW

By the end of this chapter, you will be able to:

- Describe how to manage email inboxes in relation to organising by using folders or labels
- Prioritise emails in your inbox
- Create a distribution list
- Register a web-based email address

INTRODUCTION

An electronic communication device refers to any type of computerised device (instrument, equipment or machine) or software that can compose, read or send any electronic message using radio, optical or other electromagnetic systems. An electronic message can be a text message, electronic mail, an instant message like WhatsApp, teleconferencing, social networking, Skype, blogs or even access to an internet site.

UNIT

12.1 Register a web-based email address

Having an email address is a must in this day and age. You will use your email address for many online activities, such as signing up for a social media account or filling out online applications. Luckily, creating an email account using a web-based service is relatively easy. In this section, you will learn how to create a Gmail account.

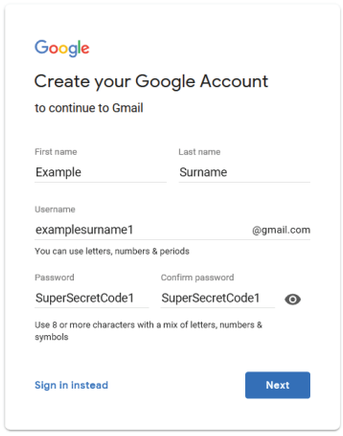
TIPS FOR OPENING A GMAIL ACCOUNT

Learn how to create a Gmail account

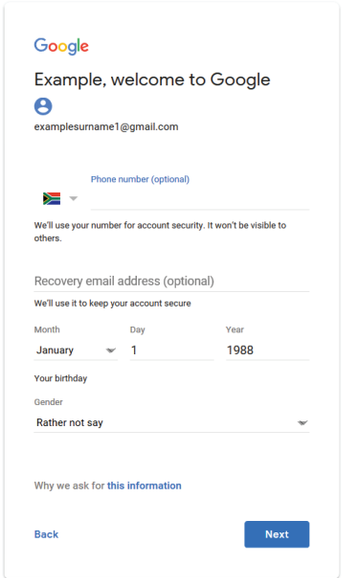
https://support.google.com/

Guided Activity 12.1

1. Use your web browser to go to the Gmail website (www.gmail.com).
2. Click on the *Create an Account* button. A new page should now open.
3. Enter your name and surname.
4. Choose a username for your account.
5. Enter a password for your account and enter the same password in the *Confirm password* space.
6. Click the *Next* button.



7. Pay careful attention to the items on the sign-up form that are optional. You can skip these items if you want to. For Google, submitting a phone number or recovery email address allows Google to help you recover your password if you forget it.
8. Fill in your birthday and gender before clicking next.

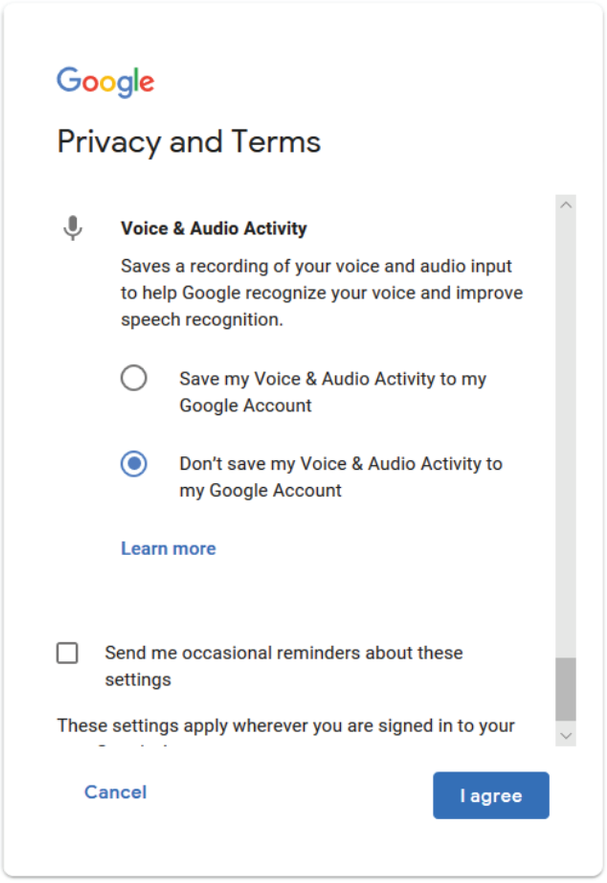


... continued

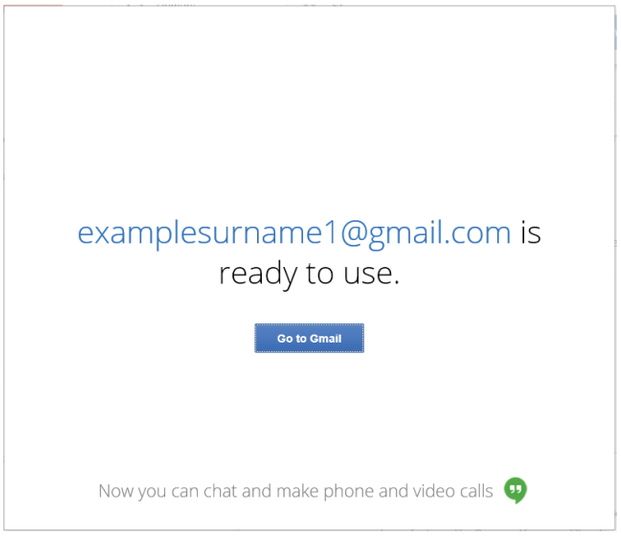
Guided Activity 12.1

… continued

9. Read through Google's *Privacy and Terms* agreement.
10. Read through the custom options and select which information Google is allowed to record about you.
11. Once you have selected options you are comfortable with, click *I agree*.



12. The moment you click *I agree*, Google will create your new email account for you.



DO'S AND DONT'S FOR WRITING AN EMAIL

Learn about the Do's and Dont's of writing an email

Bowvalleycollege.libguides.com

DO'S AND DON'TS WHEN WRITING AN EMAIL

There are certain "rules" to follow when you are writing an email, such as:

- Always make sure that your subject line is a clean and brief indication (summary) of what the email is about.
- Use a more professional **salutation**. If you do not know the person you are writing to, start your email with "Dear (insert name)". If the situation is not as formal, you can use "Hi" or "Hello" instead. NEVER use any slang form of greeting such as "Yo" or "Howzit" in an email.
- Do not try to be funny when writing an email. It can easily be misunderstood and seldom works out the way you want it to. Remember, the recipient cannot see your facial expressions.
- Always proofread your message before you send it. Use your spellchecker to make sure that there are no spelling mistakes or typos. People are judged by the way their emails look.
- Do not assume that the recipient knows what you are talking about. Even if you think that they should know, make sure that your email can be read and understood without pre-knowledge. It can be very frustrating to look back through a whole string of emails to try and find something that was said previously.
- Always reply to an email. Even if you do not have the answer right away, let the recipient know that you have received their mail and will get back to them.
- Do not overuse exclamation marks. People interpret this as aggressive behaviour and seldom respond positively.
- Never send an email when you are angry. First think about what you want to say and how you want to say it. You can even save the email in the Drafts folder and go back to it after you have cooled down. Bad emails can never be retracted.
- Do not copy the whole world in your email. Send it only to the people who would really be interested in it.
- Do not play email ping-pong. If you have to reply more than twice to the same topic, rather pick up the phone and call the person.
- Do not send large attachments. Rather send a link to download the file or compress it before attaching it.

Activity 12.1

Using a computer in class:

1. Create a Gmail account.
2. Create a distribution list.
3. Organise your emails by creating labels.
4. Set up filters in Gmail.
5. Apply the Gmail star system to your emails.
6. Prioritise your emails.

Answer the following in your own words:

1. Describe how you create a Gmail account.
2. Give five examples of good email experiences you have had. Give a reason for why you found each experience good.
3. Give five examples of bad email experiences you have had. Give a reason for why you found each experience bad.
4. Based on your experiences, make your own list of five email do's and don'ts.

UNIT

12.2 Managing email

Dealing with emails is one of the most time-consuming tasks in a work environment. In 2018, it was estimated that dealing with emails was taking up almost 11 hours of the work week.

In this chapter, you will learn how to work with Gmail, but the process is the same for most other web-based email applications, such as Outlook.com or Hotmail.com.

ORGANISE USING LABELS

Gmail is a label-based system where the labels are the same as folders.

Labels are a great way to organise Gmail. They are like tags you can add to emails you send or receive. Unlike folders, you can add more than one label to an email. You can also colour-code these labels to make it easier to see into which category an email falls.

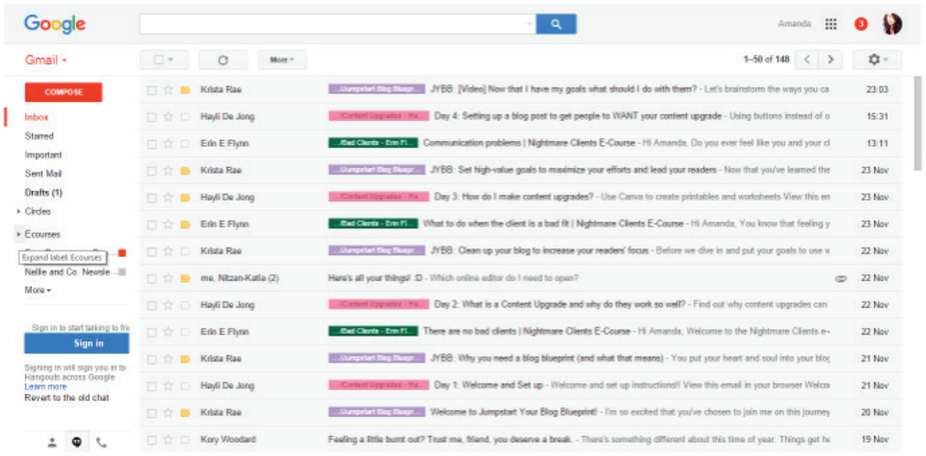


Figure 12.1: *Emails can be colour-coded according to their labels*

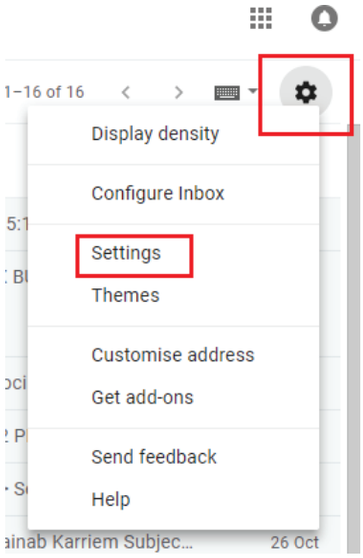
It is important to keep your system as easy and simple as possible. Do not have too many labels or categories. For example, you can create labels for:

- family
- friends
- school
- activities.

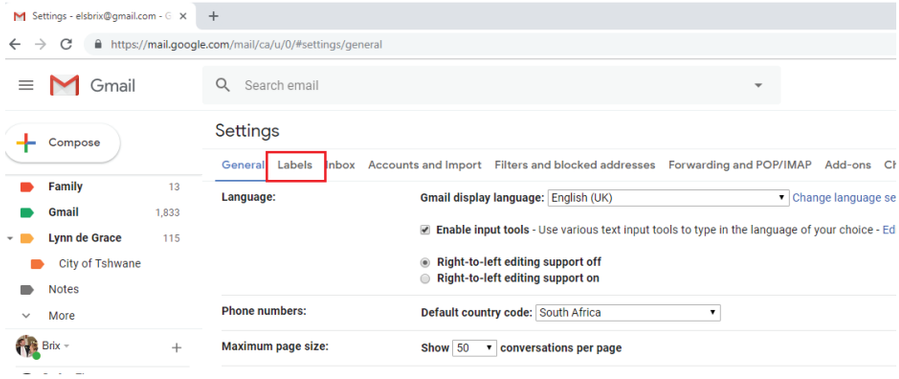
Also remember, you can add more than one label to your emails. An email coming from your school about an upcoming swimming event can be labelled both *School* and *Activities*.

Guided Activity 12.2

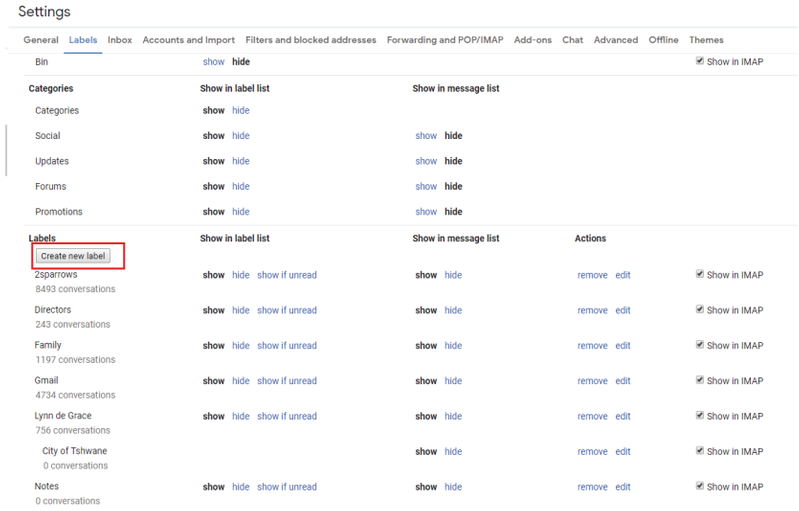
1. Open your Gmail account.
2. Click the *Settings* gear icon near the top right corner of the Gmail screen.



3. Follow the *Settings* link in the menu that comes up.



4. Go to the *Labels* tab shown above.
5. Click *Create new label* in the *Labels* section.



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Guided Activity 12.2

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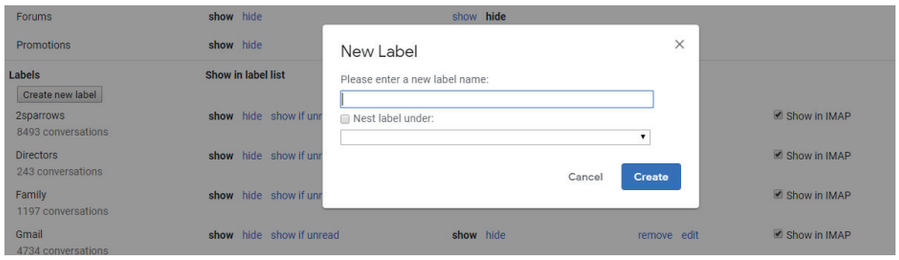
6. Type the new label's desired name under *Please enter a new label name.*

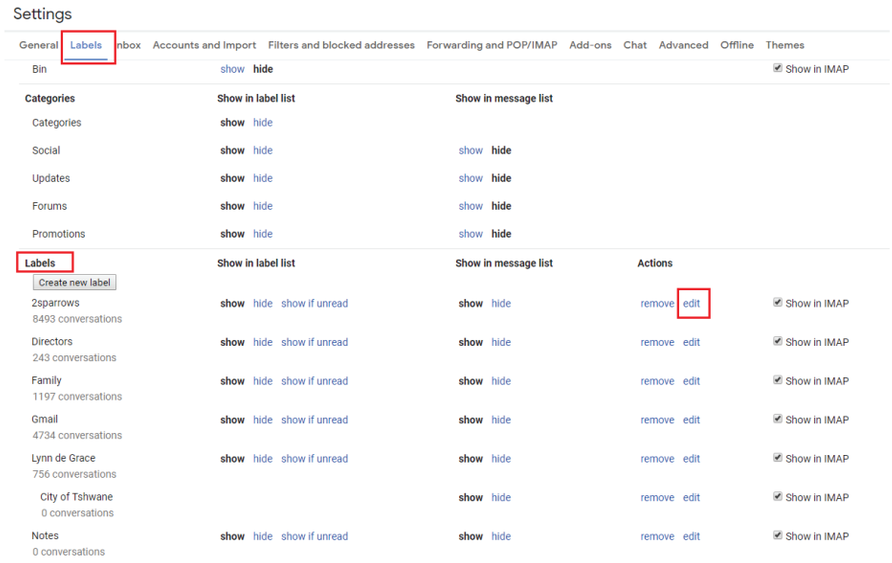


7. Check *Nest label under*: and select a label from the drop-down menu.

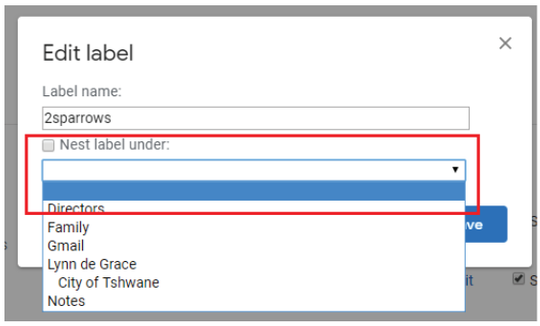
Guided Activity 12.3

To move an existing label beneath another label:

1. In the section of the *Labels* tab, click *Edit* in the *Actions* column for the label you want to move.



2. Check *Nest label under* and select a destination from the drop-down menu.

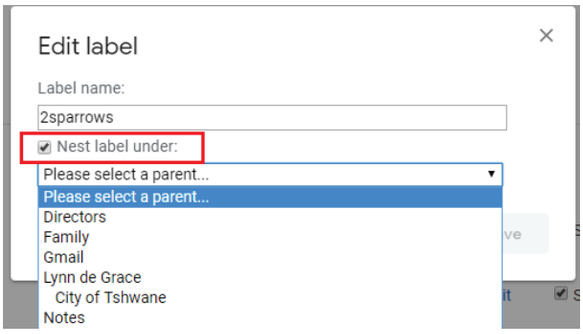


3. Click *Create* or *Save*.

Guided Activity 12.4

To move a Gmail folder to the top or turn it into a subfolder:

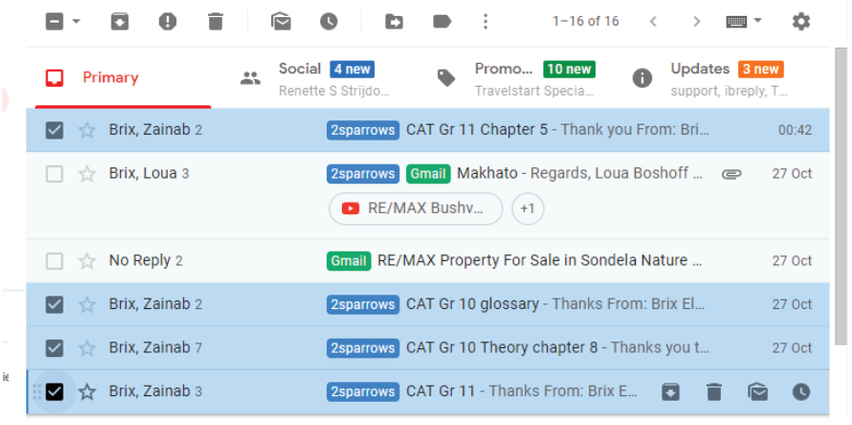
1. In the section of the *Labels* tab, click *Edit* in the *Actions* column for the label you want to move.
2. To move the label beneath another label:
   a. Make sure *Nest label under*: is checked.
   b. Select the label under which you want to move the label from the drop-down menu.



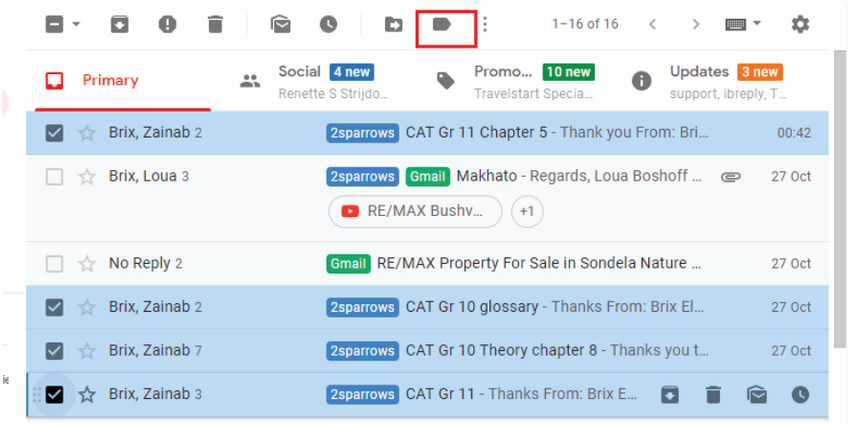
3. To move the label to the top, make sure *Nest label under*: is not checked.
4. Click *Save*.

Guided Activity 12.5

1. Select each message by checking the box to the left of each message you want to label.



2. Click the *Labels* icon in the menu.



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Guided Activity 12.5

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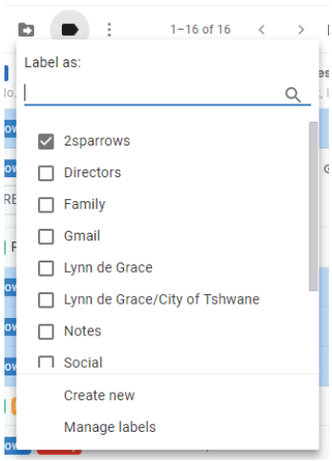
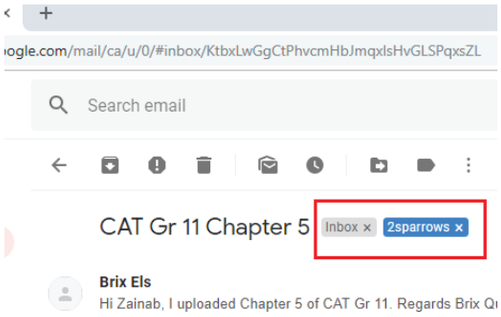
3. Check the boxes next to each label you want to assign to your selected messages or click *Create new* to assign a new label to the messages.



Guided Activity 12.6

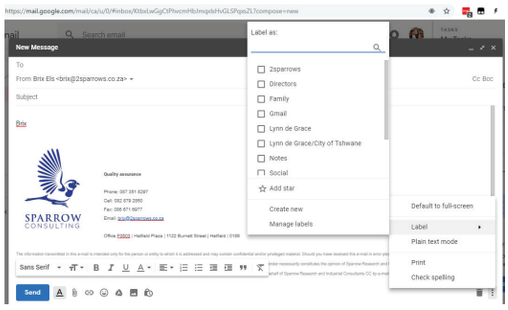
1. Select and open the email.
2. Click the X on each label you want to remove from the email.



Guided Activity 12.7

To label a message you are composing:

1. Click the *Menu* button in the lower right corner of the message.
2. Move the pointer down to *Labels*.
   A slide-out menu will show you labels you have already created, if any, and give you the option of creating a new label.



Guided Activity 12.8

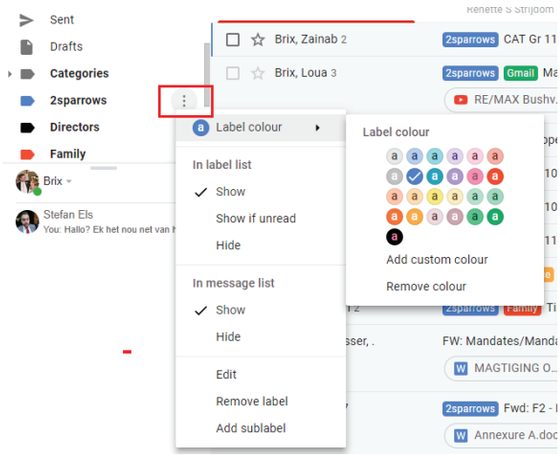
You can delete an entire label you no longer want at any time. Doing so will not delete the emails that carry that label, however. To delete a label:

1. Open or select any message or conversation in Gmail.
2. Click the *Labels* icon in the toolbar.
3. In the menu, click *Manage labels*.
4. Scroll down to the *Labels* section and under the *Actions* column, click REMOVE.
5. Click *Delete* to confirm the action. Gmail will delete the label and it will be removed from any messages it applies to.

Guided Activity 12.9

All labels are coloured by dark grey text on a light grey background. To customise your label colours, you must do the following:

1. Move your mouse over the chosen label.
2. Click on the *Menu* (three vertical dots in a grey circle). The *Label colour* drop-down box will appear.
3. Move your mouse over the *Label colour* option and select a text and colour combination by clicking on it.



PRIORITISING EMAILS

You can use the Gmail star system to prioritise your emails so that you can easily find the most important ones later.

By default, the Gmail stars are yellow. You can, however, change the colour as well as the type of the stars to suit your own needs.

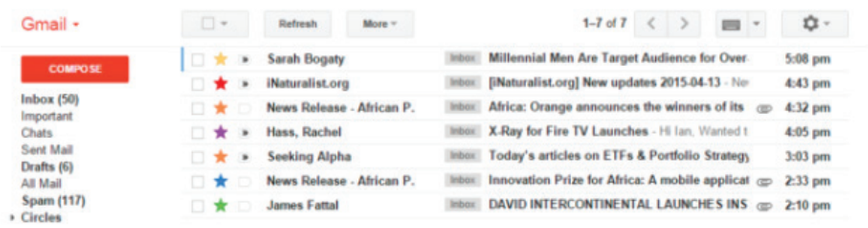
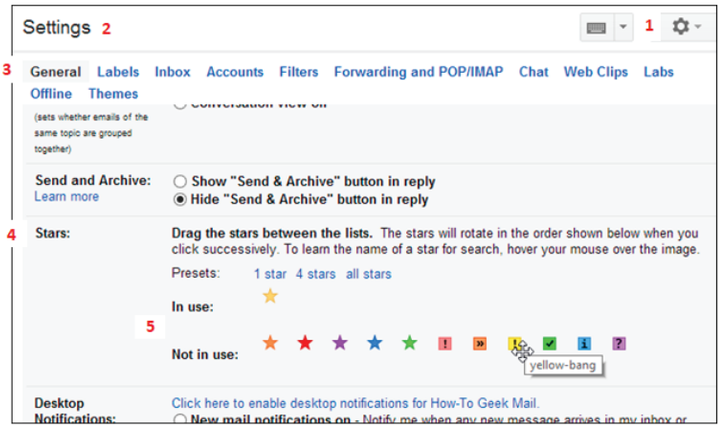


Figure 12.2: *Gmail's star system*

Guided Activity 12.10

To use the Gmail star system, set up your stars:

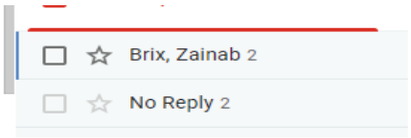
1. Click the *Settings* gear icon.
2. Choose *Settings*.
3. Click on the *General* tag.
4. Scroll down to *Stars*.



5. Drag icons from the *Not in use* section to the *In use* section to add different types of stars.

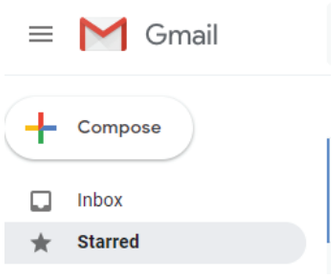
Guided Activity 12.11

1. Add a star to a message by clicking on the star next to the email.

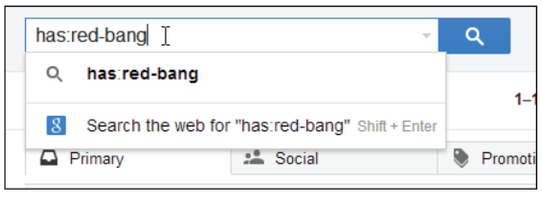


If you click it once, you will get the default yellow star. By cycling through the stars (clicking), you can choose which star to add. If you star a message while it is open, only the first star type is applied.

2. To find a starred message, click the Starred label on the left side of the main Gmail window.



3. To find a message with a particular type of star, search using "has:" with the star's name (e.g. "has:red-bang").

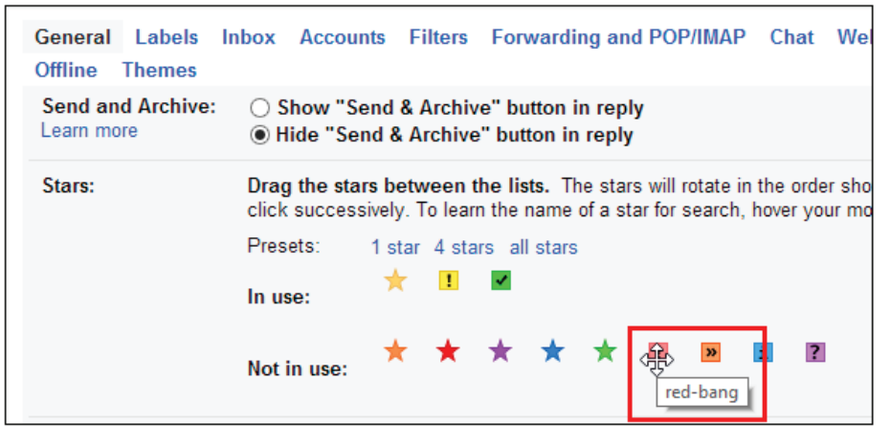


... continued

Guided Activity 12.11

... continued

4. To find out what the name of the star is:
   a. Click the *Settings* gear icon.
   b. Choose *Settings*.
   c. Click on the *General* tag.
   d. Scroll down to *Stars*.
   e. Hover your mouse over the specific type of star.



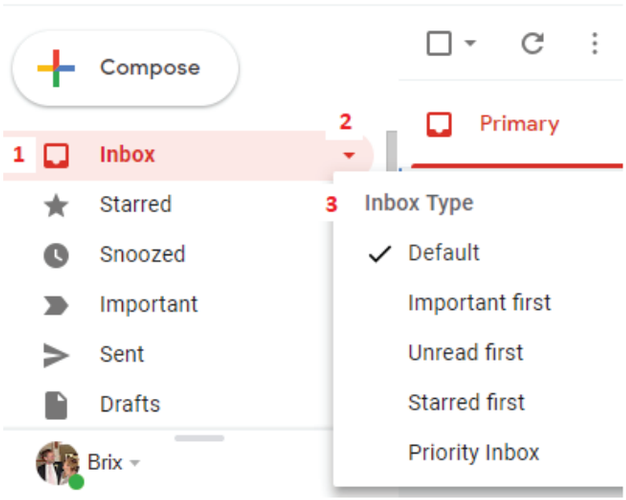
Gmail's inbox will help you to sort out your incoming emails by setting priorities. There are five sections, namely:

1. Default: You can choose which emails you want to see first.
2. Important first: Puts all email marked important at the top of your inbox.
3. Unread first: Puts all unread email at the top of your inbox.
4. Starred first: Puts all starred email at the top of your inbox.
5. Priority inbox: This option lets Gmail sort and prioritise emails for you.

Guided Activity 12.12

To decide which type of email you want to see at the top of your inbox:

1. Open your Gmail inbox.
2. Click on the down arrow on the left.
3. Choose an option.



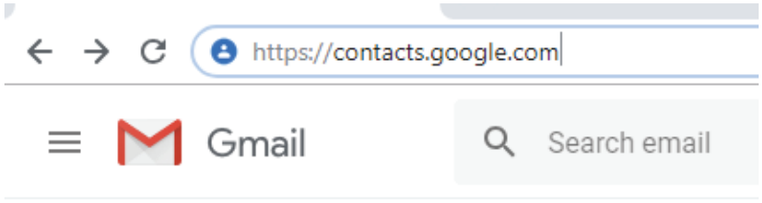
DISTRIBUTION LISTS

A contact group (formerly called a "distribution list") consists of a list of email addresses without having to add each name to the To, Cc, or Bcc lines of an email individually. Its main purpose is to allow a user to automatically share a message to all the recipients on the distribution list at the same time.

You can, for example, have a personal distribution list called "family" that includes the email addresses of all your relatives. Rather than typing or selecting each address, you just use the list address. A distribution list is different from an email list in that members cannot directly send emails to other members who are on it.

Guided Activity 12.13

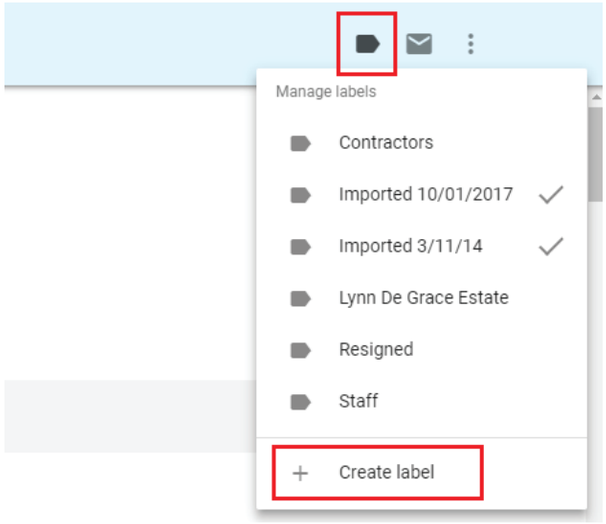
1. Open the Google contacts page by typing https://contacts.google.com/ in your web browser.



This will open a page with all your contacts' details on it.

2. Select your contacts by hovering your mouse over each contact's profile picture or placeholder.

3. Click the checkbox that appears below your cursor and repeat this process for each contact you want to add.
4. Click the *Labels* icon in the upper right corner of the page. A dropdown menu will appear.



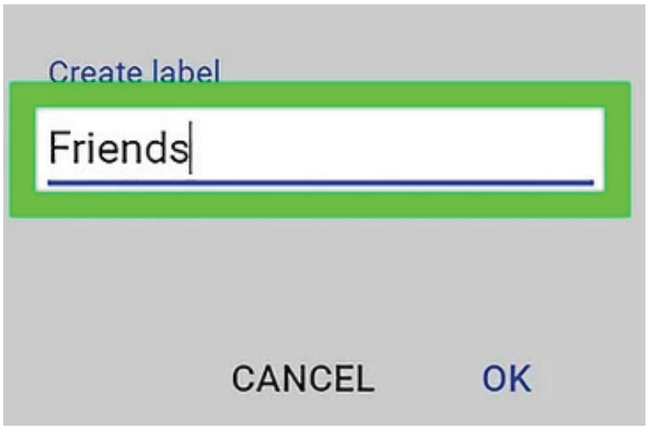
... continued

Something to know

This can also be done by clicking on the waffle icon (⋮⋮⋮) and then clicking on *Contacts*. You may need to click on *More* first to see the link to your contacts.

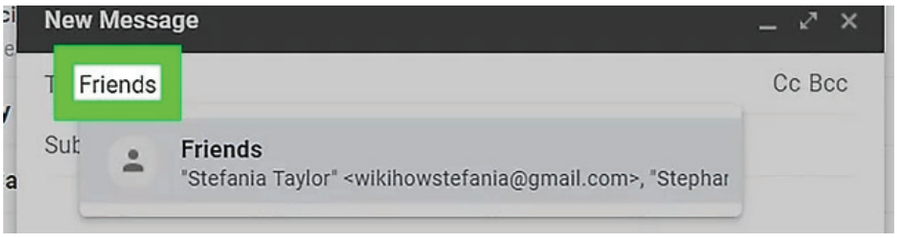
Guided Activity 12.13 *… continued*

5. Click on *Create label*. This prompts a pop-up window.



6. Type in the name of the distribution list, for example "Friends". This is the name that you will use in the *To* field when you want to send an email.
7. Click *OK* at the bottom right corner of the pop-up window. This will save your list of contacts as a label.

To send an email to your distribution list, you will follow the normal email procedures, typing in "Friends" in the *TO* field.



FILTERS

Filters help you to set up rules for how Gmail should handle your incoming emails, for example it can send an email to a label, or it can archive, delete, star or automatically forward the email.

Filters are relatively easy to set up using search criteria in Gmail itself.

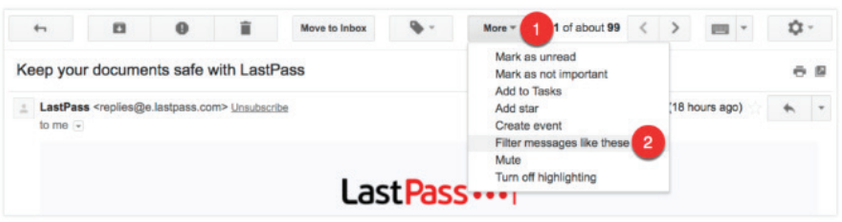
Guided Activity 12.14

1. Click the *Settings* gear icon near the top right corner of the Gmail screen.
2. Follow the *Settings* link in the menu that comes up.

3. Select the *Filters* and *Blocked Addresses*.
4. Click the *Create a new filter* link.
5. Complete the filter creation form.

1. *From*: Filter emails sent from a specific email address.
2. *To*: Filter emails sent to a specific email address.
3. *Subject*: Filter emails that use a specific subject line.
4. *Has the words*: Filter emails that contain specified keywords.
5. *Doesn't have*: Filter emails that don't contain specified keywords.
6. *Has attachment*: Filter emails that include an attachment.
7. *Don't include chats*: Ignore Hangouts chats when applying filters.
8. *Size*: Filter emails larger or smaller than a specific size.

You can also filter specific messages by opening the email, clicking the More button and selecting Filter messages like these.

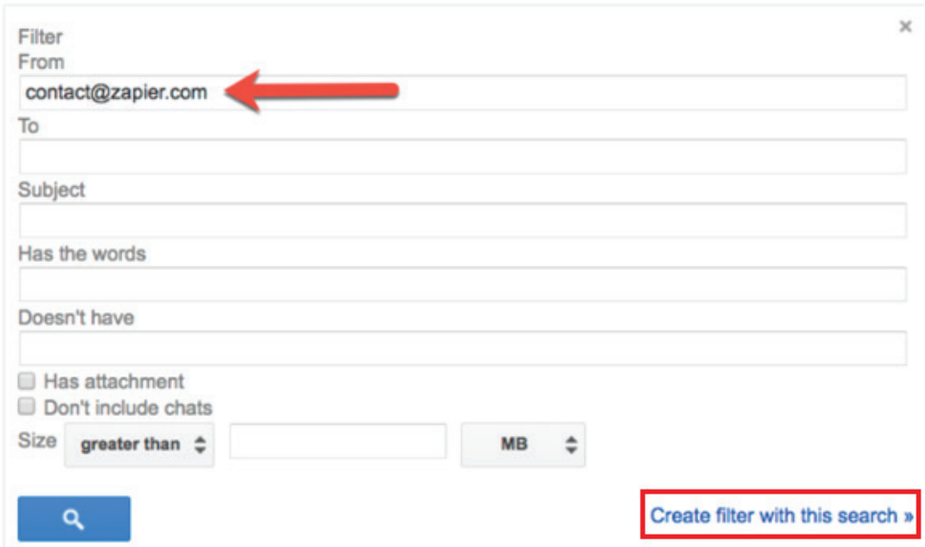


... continued

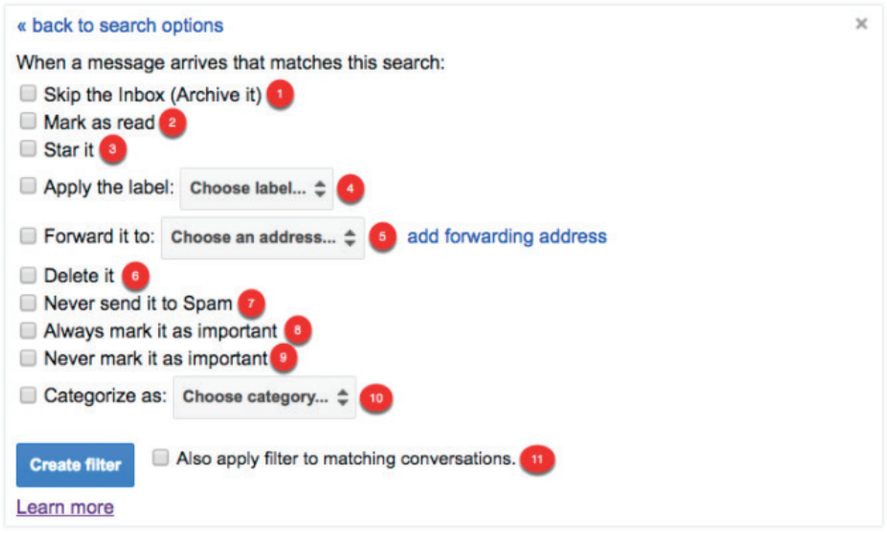
Guided Activity 12.14

... continued

If you used this option while in a specific email, Gmail automatically fills in the "from" email address for you:

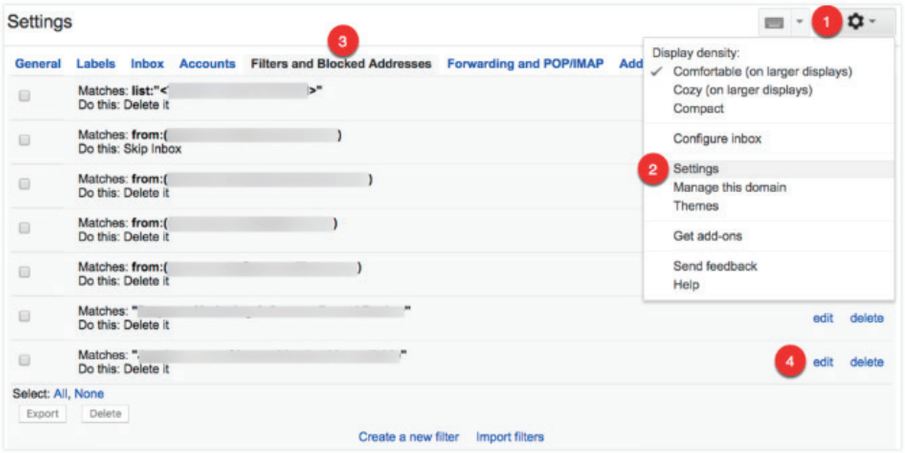


6. After selecting the criteria for your filter, click the *Create filter with this search* link to specify what Gmail must do with emails that match this filter.



1. *Skip the inbox*: Archive the email so that it does not appear in your inbox.
2. *Mark as read*: Have the email appear in your inbox as an already-read item.
3. *Star it*: Automatically star the email.
4. *Apply the label*: Apply a specific label to the email.
5. *Forward it to*: Automatically forward the email to a different email address.
6. *Delete it*: Send the email to the trash.
7. *Never send it to Spam*: Prevent Gmail from tagging the email as spam.
8. *Always mark it as important*: Automatically tag filtered emails as important.
9. *Never mark it as important*: Tell Gmail not to tag filtered emails as important.
10. *Categorise as*: Automatically categorise filtered emails.
11. *Also apply filter to matching conversations*: Automatically applies the selected conditions to every email in your account that matches the selected filter criteria.

Guided Activity 12.15



1. Click the *Settings* gear icon.
2. Choose *Settings*.
3. Select the *Filters* and *Blocked Addresses* tab.
   Find the filter you want to edit or delete.
4. Click the *Edit* link to update the filter criteria and behaviour or click the *Delete* link to delete it.

Activity 12.2

Answer the following in your own words:

1. Give three examples of email applications.
2. What are the benefits of using labels in Gmail?
3. Describe how you set up a filter in Gmail.

REVISION ACTIVITY

QUESTION 1: MULTIPLE CHOICE

1.1 Which of the following is NOT electronic communication? (1)

A. Instant messaging **B.** Teleconferencing
C. Faxing **D.** Social networking

1.2 Which of the following can be done with Gmail labels? (1)

A. Creating filters
B. Prioritising emails
C. Archiving emails
D. Organising emails

1.3 What does the following process show? (1)

Step 1: In the section of the *Labels* tab, click *Edit* in the *Actions* column for the label you want to move.
Step 2: Check *Nest label under* and select a destination from the drop-down menu.
Step 3: Click *Create* or *Save*.

A. How to move a label under another label
B. How to filter your inbox
C. How to move an email under a label
D. How to star an email

... continued

REVISION ACTIVITY

... continued

1.4 When would you use the Gmail star system? (1)

- **A.** To highlight all your important emails
- **B.** To delete an email
- **C.** To organise all your emails
- **D.** To find a specific email

1.5 You and a specific group of your friends share inspirational quotes with each other every day by email. Which of the following make this process easier? (1)

- **A.** Star system
- **B.** Labels
- **C.** Distribution list
- **D.** Filters

QUESTION 2: TRUE OR FALSE

Choose the answer and write True or False next to the question number. Correct the statement if it is FALSE. Change the underlined word(s) to make the statement TRUE. (You may not simply use the word NOT to change the statement.)

a. When it comes to a password, try to choose a password that is short and easy to remember. (1)

b. Artificial intelligence is a type of electronic communication. (1)

c. To keep your system simple and easy add all the labels and categories you need. (1)

d. You can remove a label from an email by clicking on the "Remove" option on the label you do not want. (1)

e. All labels are coloured by a dark grey text on a light grey background. (1)

QUESTION 3: MATCHING ITEMS

Choose a term/concept from Column B that matches a description in Column A. Write only the letter next to the question number (e.g. 1A). (5)

COLUMN A	COLUMN B
3.1 Gert wants all his unstarred emails at the bottom of his inbox.	**A.** Sent inbox
3.2 Bianca uses this to manage the prioritisation of her emails.	**B.** Default
3.3 When Malusi opens his email he wants specific emails to appear first.	**C.** Important first
3.4 Priyanka wants to make sure that all her new emails are at the top of her inbox.	**D.** Inbox
3.5 Gina wants to put all her important email at the top of her inbox.	**E.** Unread first
	F. Starred second
	G. Priority inbox
	H. Starred first

QUESTION 4: FILL IN THE MISSING WORDS

Fill in the missing word(s) in the following statements. Provide only one word for each space.

a. A distribution list consists of a list of email addresses in a standard email program or on a
i) _____ system. Its main purpose is to allow a user to automatically
ii) _____ a message to all the recipients on the distribution list at the same time.

b. When someone sends you an email, you need to **iii)** _____ to the email, since the **iv)** _____ will not automatically know if you received the email or not. (4)

... continued

REVISION ACTIVITY

... continued

QUESTION 5: SCENARIO-BASED QUESTIONS

Nandini is a website designer. She has not maintained her email account for a long time. But recently a client of hers has requested that she forward them an email that shows confirmation for a bank account payment. With more than 600 emails to sift through, to find the exact email her client is looking for will take time.

5.1 Mention one thing that Nandini can do to better manage her emails. (1)

5.2 Nandini wants to organise and separate all her emails under the following labels:

- Clients
- Personal
- Family
- Friends

a. What process must Nandini follow to create a filter that will mark all her clients' emails as important? (6)

b. What process must Nandini follow if she wants to create a label for all her clients' emails? (6)

c. What process must Nandini follow if she wants to create a distribution list for her following clients? (8)

- mpumi4sure@gmail.com
- Jared.masters@creativedesigns.co.za

TOTAL: [40]

AT THE END OF THE CHAPTER

NO	CAN YOU ...	YES	NO
1.	Describe how to manage email inboxes in relation to organising by using folders or labels?		
2.	Prioritise emails in your inbox?		
3.	Create a distribution list?		
4.	Register a web-based email address?		

TERMS 2, 3, 4

CHAPTER 13

INFORMATION MANAGEMENT

CHAPTER OVERVIEW	
Unit 13.1	Defining the task
Unit 13.2	Finding information
Unit 13.3	Quality control of information
Unit 13.4	Spreadsheets and databases in data handling
Unit 13.5	Processing data
Unit 13.6	Analysing data and information

By the end of this chapter, you will be able to:

- Create a task definition
- Gather data and information using various tools
- Describe how to evaluate data to ensure that it is reliable and accurate
- Discuss how to evaluate the validity of a website as a source of information
- Evaluate information for accuracy and validity
- Describe the role of spreadsheets and databases in data handling
- Discuss tools and techniques for data handling and how to extract data
- Describe how to analyse trends and patterns in data

INTRODUCTION

Data is all around us and we create data with our every action, both online and in the real world. Data can be used in various industries to draw many insights into the way people shop, travel and interact with companies, brands and other people.

The process of collecting, processing and presenting data and information is called information management and consists of three main steps:

1. Input: This is the first step of the information management process, consisting of the identification of the main problems and collecting relevant data.
2. Process and analyse: Once all the data has been gathered, it is converted to information by processing and analysing the data.
3. Output: This is the final step in the process and consists of presenting the information in such a way that it can be easily understood by other people.

Solving problems successfully or completing work on time largely depends on your ability to find, process and present the correct information. Before you start looking for information, though, you will need to work through your task to make sure that you understand it fully and that you know what information you need and where to find it. You can do this by following the steps in the information cycle shown in Figure 13.1.

Figure 13.1: *The information cycle steps*

You need to keep in mind that the order of this cycle is not set in stone and you may need to go back to refine or redo previous steps, but the further along in the cycle you get, the harder it is to go back and do earlier steps. This is why it is important that you do steps one and two as well as possible before moving on.

If you do not have the right information, you will not be able to solve your problem or complete your task properly, be it completing your PAT or even writing this textbook.

In this section, we are going to focus on the following steps of the cycle:

1. Defining the task
2. Formulating the questions
3. Identifying and evaluating questions, information and information sources (such as websites)
4. Analysing and processing the data

UNIT

13.1 Defining the task

It may seem obvious but before you can successfully complete any task or investigation, you need to understand exactly what it is that you are going to do. This is why you need to carefully consider the task you have been given by breaking it down into smaller sections and describing it in your own words, called the task definition.

To understand what is expected of you, you must do the following:

1. Read the instructions. Does the task call for a report? How will you gather the information?
2. Rewrite the question in your own words. Get to the core of the question. Rewriting helps you understand exactly what you need to do so that you do not waste time looking for the wrong data. It also helps you decide what type of data you need and how to gather it.
3. Identify the key terms. Look for verbs or subject-specific terms in the task (verbs like "report back" give guidelines on how you should present information).

DEFINING THE TASK

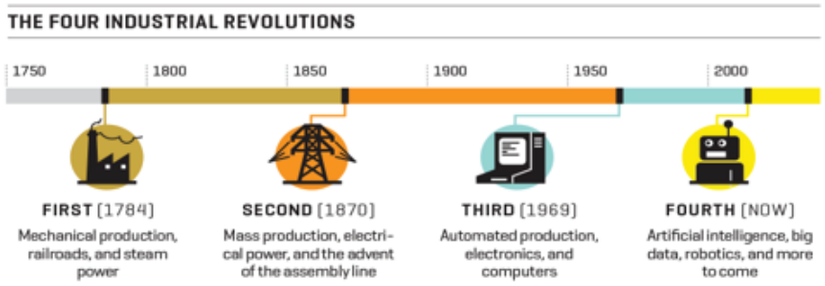
Look at the image below, taken from the 2018 PAT.

TECHNOLOGY AND SKILLS FOR A CHANGING WORLD

"While our current world is shaped fundamentally by math and science, which we learn in school, our future world will be a digital world, where our lives aTinkaped by computers and connected devices." ~ Tink Tank

The ***focus question*** that you are required to answer is:

How does the Fourth Industrial Revolution (4IR) impact our daily lives and what would the roles of technologies and trends such as the Internet of Things (IoT), Augmented Reality (AR) and Artificial Intelligence (AI) be?



Source: *http://fortune.com/2016/03/08/davos-new-industrial-revolution/*

Your task is to:

- Investigate the impact of the 4IR in terms of any TWO of the following: IoT, AR and AI. Questions that you may want to answer:
  - What do each of the two terms/concepts entail?
  - What technology is involved?
  - How does each of the two work?
  - For each of the two, choose and discuss one place where it is implemented in detail, e.g. education
  - Where is it used? For each, choose and discuss one area in detail, e.g. education, manufacturing
  - What skills will be required?
  - Advantages/disadvantages
- Gather and analyse data relevant to the investigation
- Identify a suitable audience (such as the learners in your class) and present your research and findings using a report that would be suitable for use by the specific audience

Looking at the task outline, you can begin to define what you need to do. In this case, you would need to choose two technologies from the Fourth Industrial Revolution (4IR) and investigate their impact on modern life.

The task outlines various questions you can ask yourself to further refine your search for information. You are then instructed to gather the data and analyse it and, finally, to present your findings in a report. With this information, you will be able to start your research.

Something to know

Your PAT task description should be about 200 words.

To understand how important it is to make sure that you know what you are being asked to do, read through the scenario below.

UNDERSTANDING TASKS

Julia, Mbali and Shiven are on the organising committee for the Grade 12 dance. They have each been given a task to complete to better help the organisers understand what the Grade 12s want:

- Julia has been asked to find out how many Grade 12s would be interested in bringing a partner from outside the school to the dance and to give a report to the teacher supervisor, Mr Smith.
- Mbali has been asked to find out what theme the Grade 12s want for the dance so that she can let the decorating committee know what they need to buy.
- Shiven has been asked to find out about the music.

Julia begins by breaking down her task. She decides that the best way to go about gathering the information is through an online survey. She first has to design the survey and then distribute it. She decides to use Google Forms for her survey and sends the link to the Grade 12 WhatsApp group. She asks people to please fill in her survey by Friday. Once she has this information, she downloads the report that Google Forms generates and gives it to Mr Smith.

Mbali also decides to break down her task but immediately runs into a problem. She has no clear idea of what the decorating committee is willing to spend on decor and they have not given her suggestions for themes. Mbali realises that if she were to ask the Grade 12s what theme they would want, she would end up with a different response for each person.

Mbali will need to get more information before she can complete her task. She decides to ask the decorating committee the following questions:

- Are there any theme suggestions?
- Is there a budget and how does that limit the theme?

The decorating committee tells her that they have three theme ideas. Now that she has this information, she can define her task. She decides a simple survey will also help her get the information the decorating committee needs.

Shiven's task is too vague. He will need to get more information on the following:

- Is the school willing to pay for a band or DJ? Or should he ask for a learner volunteer?
- Will there be sound equipment available or will the performers need to provide their own?
- What kind of music do the Grade 12s want at the dance?
- What kind of music will the school not allow?

Only when he has this information, will he be able to define his task and give the appropriate solution.

Activity 13.1

Define a task definition and a focus question for the 2018PAT.

INFORMATION-GATHERING TOOLS

After you have identified the task definition, you will have to gather data and information. In this phase, you must consult different types of information sources to understand the subject of your investigation better.

Information can be gathered using the following tools:

- Electronically: internet
- Printed media
- Surveys and questionnaires

Activity 13.2

Using the task definition you created in Activity 13.1, answer the following questions to determine how you will research the topic and obtain the information you need for the task you defined.

1. Which type of information gathering tools will you use?
2. Identify at least two websites on the subject that you can use to compare your findings against.
3. Develop a questionnaire with 10 questions that you can use to obtain school-specific information.
4. How will you assess that the information you get is accurate, sufficient, valid, current and objective?
5. Discuss your work with another group and compare results.

UNIT

13.3 Quality control of information

A large majority of the content on the World Wide Web is user-generated, meaning it is created by people of any age, educational background and experience. This means that when you are using the WWW to research your PAT, you will need to carefully evaluate the information you find. In this chapter, you will learn about how to evaluate information to make sure that it is reliable and accurate.

EVALUATE QUESTIONS

When you are looking for the data you need to complete your task, you can ask yourself questions to guide you. There are two main types of questions, namely open-ended and closed-ended questions.

Closed-ended questions have a limited set of possible answers, such as "yes", "no" or "A", while open-ended questions need more complex answers. You should not make the mistake of thinking that closed-ended questions are simple. Some closed-ended questions, for example "Are amoebas single-celled organisms?" have a specific answer, but not everyone can answer them.

While both types of questions are good for gathering data, closed-ended questions are only useful in the early stages of the data gathering process when you are trying to find as much data related to your topic as possible. This is because they put an end to the conversation. Closed-ended questions are good for surveys or where your respondents do not have the time to spend thinking about their answers.

When using closed-ended questions for research, ask yourself: "Does this data match my topic?" If it does, make a note of it, if it does not, discard it. You will then use open-ended questions to refine the data further and make sure that what you have found helps you complete your task.

In order to refine your data using open-ended questions, you need to decide what type of open-ended questions you will ask. There are several types of open-ended questions, for example:

- Questions that can be answered explicitly by facts, for example, questions starting with words such as "what", "when", "where", "who", or "how many".
- Questions that will help you to examine, explore and query, such as questions starting with "why" and "how".
- Questions that will help you to adjust, change or predict, such as questions starting with "if", or "what if".
- Questions that will help you to make a judgment, critique, review or find meaning of some sort, such as questions starting with "would it be better if", "what recommendation", "how can I determine", or "what would be the best way".
- Open-ended questions allow you to get more from the data than you anticipated when you use these questions to interrogate that data.

You can also use a combination of open-ended and closed-ended questions in questionnaires. You will most likely be asked to create a questionnaire for your PAT, so knowing how to ask these questions when you are researching will help you to set them when the time comes.

Tips for asking questions:

- Always start an open question with "how" or with questions beginning with "w": "what", "where", "when", "which" or "who".
- Try to avoid "why" questions, because human nature leads people to make up a rational reason even when they don't have one. If you want to get more information, rather say "please tell me more about that".
- Do not start with "was" or forms of the verbs "to be" and "to do".
- Try to get the person you are asking a question to tell a story, rather than giving one- or two-word answers.
- If you cannot avoid asking a closed-ended question, follow it up with an open-ended question such as "what else can you tell me about it".
- You can get an open-ended answer from a multiple-choice question if you add "other" as an option.

EVALUATE INFORMATION SOURCES

Once you have defined your task, you can begin to gather your data and put it together to turn it into information. To do this you will need to know what types of questions to ask to get the information you need, as well as evaluate the quality of the information and the websites where you find it.

EVALUATE WEBSITES

When you are doing research online, it is important to think about the websites you are using. Not all websites are created equal and many may contain misleading, or even false, information. Much as you evaluate the quality of the information you receive, you must also evaluate the quality of the websites you visit and use.

There are some key questions you can ask yourself about the websites you are visiting and using, for example:

- Who supports this website?
- Who is this website aimed at?
- Who is the author? What are their credentials?
- How is the content organised? Do all the links on the pages work?
- How easy is it to navigate around the website? Is the design pleasing and attractive? How quickly does the site load?
- What is the grammar and spelling like?
- Is the content objective or does it support a single opinion?

These are all important questions to ask when looking at a website. Let us look at each point in detail to understand why you should ask these questions.

- Authority: Look at the web address of the website. The domain name can help you determine if the information has been published by a credible source, for example .ac says that it is published by a university, .gov refers to the government, etc.
- Look for the author's name. If they choose to remain anonymous, ask yourself why. A quick Google search will also show you if they have any qualifications in the field they are writing about. This is especially important in scientific or technical articles, since you would want an expert telling you how to do something or explaining something to you.

Something to know

Low-quality websites might not only give you bad information, they could also be a way for malicious software such as viruses, spyware or malware to get onto your computer.

- The grammar and spelling on the site are also extremely important. If a website is filled with grammar and spelling errors, it may not be the most authoritative or authentic source for the information you are looking for.
- Affiliation and objectivity: You should always be aware of who owns or financially supports it. This could be a good indicator of whether there will be bias in the information. Take a close look at the content and try to work out if it is **biased** or supports one opinion too heavily. Biased content is the opposite of high-quality content, as it has a very narrow view on a subject.
- Try to use websites supported by, or linked to, established institutions such as government agencies, non-profit organisations or educational institutions. Remember, objective sites present information with a minimum of bias.
- Audience: You should also make sure that the website's target audience (the people it is aiming its content at) is appropriate for your needs. A website aimed at young children will not help a university student with their research, while a website aimed at giving information to doctors will not help an engineer in their research. Make sure that the content you are looking at is appropriate for your needs.
- Content: Another important thing to look at is how the content of the website is arranged. Does it make sense or is the information scattered all over the place? Is it easy to find what you are looking for or do you have to spend ages trying to figure out the website's navigation? Also check to see if all the links work, in articles and on the website itself. Broken links are often a sign of a badly maintained or spammy website.
- Currency and design: Is the website designed well and does it look professional? If not, this could be a sign that the website is old and outdated or just badly designed, which could mean that the information you find there will be the same. Apart from being very frustrating, websites that load slowly are often badly designed. This could be an indicator of badly written or inaccurate information.

EVALUATE INFORMATION

It is most likely that your primary source of information will be the internet. Understanding the quality of information is important, since the internet is a place where anyone can upload information or make claims. You will need to look carefully at the information you use to discuss the task. You should look at the source of the information and try to find out who has an interest in this data (this is especially important when it comes to scientific papers). You should also think about what people will gain by spreading certain types of information on the internet.

There are five key things that determine the quality of information:

- **Authority:** This is based on who created the information. If the video you are watching was not created by someone with knowledge in the field, then the information they are giving you might not be the best out there. Always do research on the people who give you information. Authority also indicates that the information is accurate.
- **Accuracy:** Look for how complete the information is and compare the information from one source against the information from a few others. If the facts match, you can be fairly sure that the information is accurate. Make sure that there is something backing up the facts you receive. Check the source of those facts as well.
- **Currency:** Check how current the information is. More up-to-date information tends to be more accurate. A technology blog from 2010 will be less relevant, and therefore less accurate, to your research than one from 2017. Information from the last ten years is seen as current.

- **Objectivity:** Make sure that the author is being objective. Look out for information that is sponsored by a company (that is, if it is a type of long-form advertisement called a sponsored post). This information may be biased towards the facts that the sponsor wants to represent to make their product or information seem like the best.
- **Relevance:** Lastly, look at how well the information covers the topic you are researching. If the information only covers a small portion of the topic, then it is possibly not the best information to use. You need to look for information that answers about 80% of any question you are trying to find the answer for.

Once you understand how to evaluate the quality of information, you can be confident that you will present your information accurately and reliably.

Activity 13.3

Answer the following questions in your own words.

1. What are the key questions to ask when evaluating a website?
2. Why must you evaluate information?
3. What are the five key things that determine the quality of information?
4. Determine if the following questions are open-ended or closed-ended. Change the closed-ended questions into open-ended questions.
   a. Is it hot outside?
   b. Have you already completed your homework?
   c. How does this make you feel?
   d. Do you have plans for the December holidays?
   e. What are your plans for when you finish school?
   f. Do you like that person?
   g. How do you book tickets for a flight?
   h. Is that your final answer?
   i. Are you satisfied with the results?
   j. Did you know that…?

UNIT

13.4 Spreadsheets and databases in data handling

Spreadsheets are documents that have numbered rows and lettered columns that structure data. Examples of spreadsheet software include Microsoft Excel, Google Sheets, LibreOffice Calc and iWork Numbers. You can use spreadsheets to manipulate and organise raw data before putting it in a database, as well as to:

- Do mathematical calculations (adding totals, working out averages and percentages, etc.)
- Display data using charts and graphs
- Define and refine data by breaking it down or splitting it (for example, taking a single row and column of data and splitting it into many columns using a function)

Spreadsheets can also be used as a modelling tool, that is, you can use them to predict **trends**. As an example, if a company wants to find out what would happen if it reduced the price of one of its products, it could use a spreadsheet to analyse the changes to its profit margins.

Databases, on the other hand, can do exactly what a spreadsheet can, but with more data, since spreadsheets are limited in the amount of data they can hold. Databases are also usually kept on a server, so they can use the bigger processing power of the server to do large and complex procedures and calculations with the data faster than a spreadsheet can.

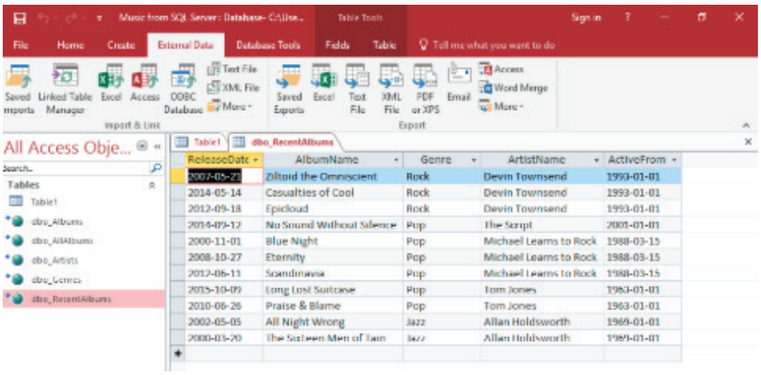


Figure 13.2: *MS Access database*

Databases can also better analyse and connect data than spreadsheets, which makes it easier for users to search for, and extract information from, the data. Databases are also designed to connect data more easily across multiple tables.

However, other than the amount of data and the speed of processing, databases and spreadsheets are very similar. In fact, most reports are generated in a database and then exported to a spreadsheet to be displayed. Some website databases need data to be uploaded in spreadsheets saved in a special format called comma separated values (*.csv).

Activity 13.4

Answer the following questions in your own words.

1. What is the main difference between a database and a spreadsheet?
2. When will you use a database rather than a spreadsheet?
3. What is data handling?
4. Give three examples of what you can use spreadsheets for.
5. What can databases do better than spreadsheets?

13.5 Processing data

You need to process data or manipulate raw data to draw information from it, that is, you need to **crawl** through and analyse the data to draw the most relevant/appropriate information from the data.

There are several techniques or tools you can use to do this. These will be discussed below.

TOOLS AND TECHNIQUES

Manipulating data is the process of **sorting**, arranging or moving the data without changing it. To manipulate data, you should first keep the following in mind:

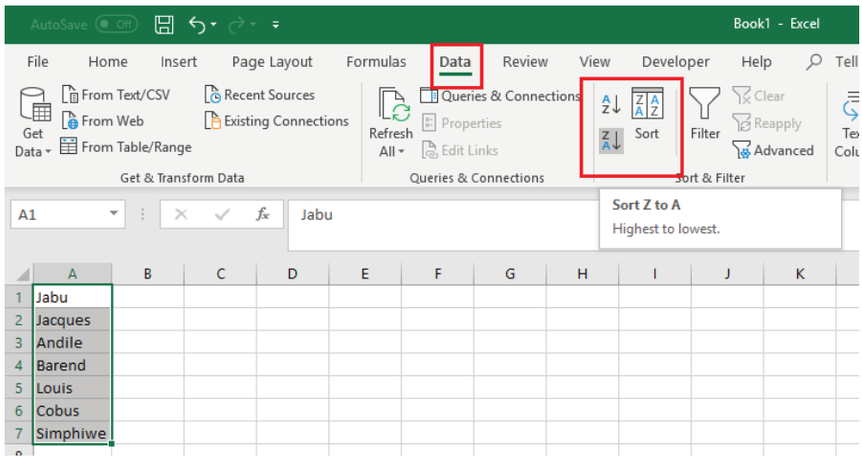
- You need to know the features of the programs you are using and how to use them.
- Make sure that the data is in the correct format for what you need to do. If it is not, you will need to reformat it or export it into the most appropriate format.
- You might have to use more than one tool to process the data correctly.
- The tools you can use include sorting, formulae and functions and queries. Sorting changes the order of the data. It can be done to numerical data (sorting numbers from lowest to highest) or strings (sorting text alphabetically). This is mostly done in spreadsheets.

Guided Activity 13.1

This is an important function to use in Excel as you might want to arrange data alphabetically, from highest to lowest, or order it by colour or icon. This will help you to visualise and understand your data better.

You can, for example, sort text from A to Z or Z to A, numbers from smallest to largest or vice versa, and dates from oldest to newest, or newest to oldest. You can also sort according to your own custom list or format.

1. To sort text:
   a. Select a cell in the column you want to sort.
   b. On the *Data* tab, in the *Sort & Filter* group, do one of the following:



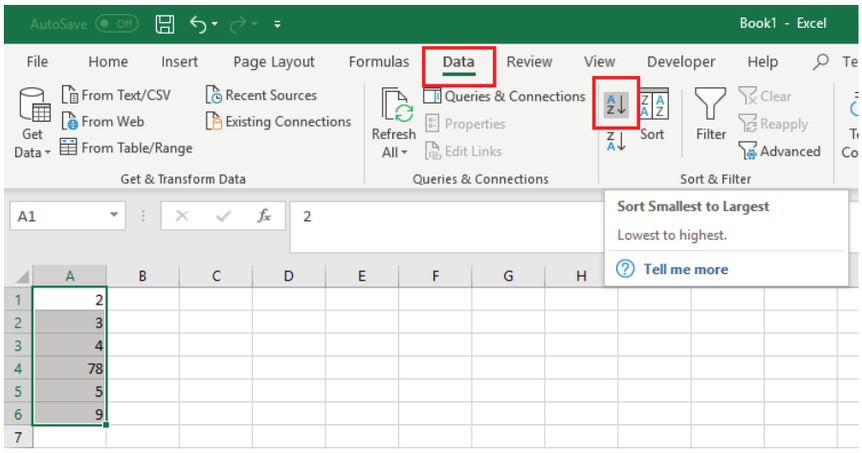
- To quick sort in **ascending order**, click (Sort *A* to *Z*).
- To quick sort in **descending order**, click (Sort *Z* to *A*).

... continued

Guided Activity 13.1

… continued

2. To sort numbers:
   a. Follow steps one and two above.



   - To sort from low to high, click (Sort *Smallest* to *Largest*).
   - To sort from high to low, click (Sort *Largest* to *Smallest*).

3. To sort dates and time:
   a. Follow the same procedures as above.
4. To sort more than one row or column:
   a. Select any cell in the data range.
   Note: For the best results, the range of cells that you sort should have column headings.

	A	B
1	Name	Department
2	Pruitt, Barbara	Sales
3	Fife, Grant	Marketing
4	Snook, Anthony	Operations
5	Horn, Frances	Finance
6	Barrett, Alicia	Credit
7	Larson, Lynn	Payroll
8	Brown, Charity	Sales
9	Bartels, Freddy	Marketing
10	Harding, Marcella	Operations
11	Reuter, Randall	Finance
12	McDaniel, Evelyn	Credit
13	Totten, Carlos	Payroll
14	Hull, Felecia	Sales
15	Hume, Merle	Marketing
16	Bradley, Kristi	Operations
17	Carbajal, Scotty	Finance
18	Foster, Heather	Credit
19	Harris, Corinne	Payroll
20	Erickson, Tara	Sales
21	Huntington, Jon	Marketing

   b. On the *Data* tab, in the *Sort & Filter* group, click *Sort*.

… continued

Guided Activity 13.1

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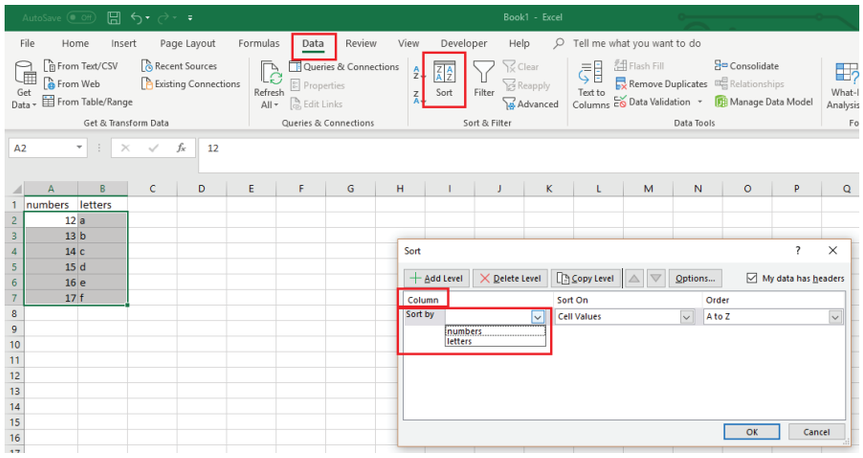
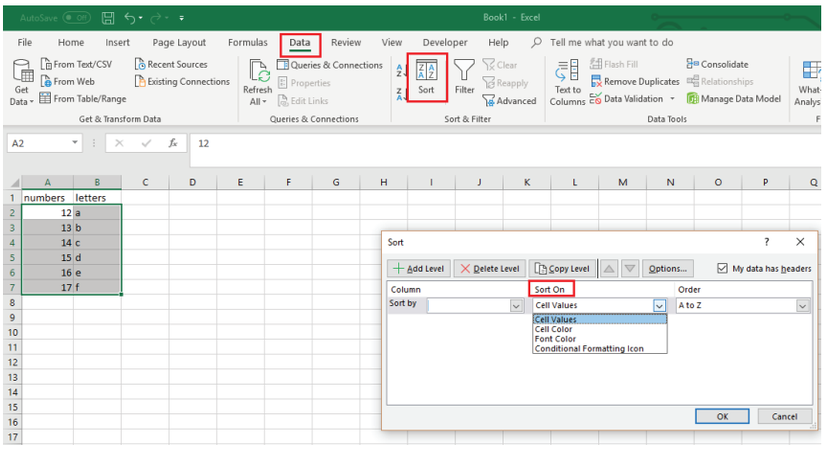
c. In the *Sort* dialog box, under *Column*, in the *Sort by* box, select the first column that you want to sort.



d. Under *Sort On*, select the type of sort. Do one of the following:

i. To sort by text, number, or date and time, select *Values*.

ii. To sort by format, select *Cell Color*, *Font Color*, or *Cell Icon*.



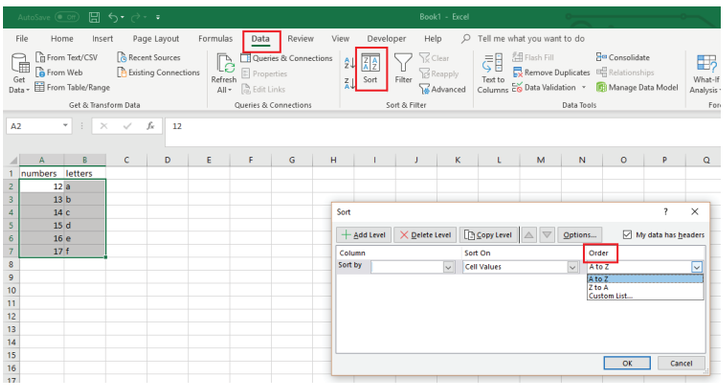
e. Under *Order*, select how you want to sort. Do one of the following:

i. For text values, select *A to Z* or *Z to A*.

ii. For number values, select *Smallest to Largest* or *Largest to Smallest*.

iii. For date or time values, select *Oldest to Newest* or *Newest to Oldest*.

iv. To sort based on a custom list, select *Custom List*.



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Guided Activity 13.1

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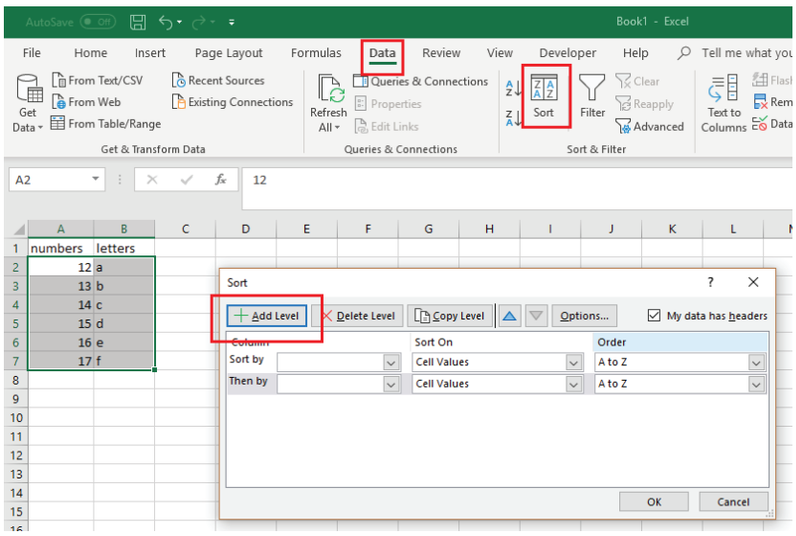
f. To add another column to sort by, click *Add Level*, then repeat steps c. to e.



You can also use the various formulae and functions in a spreadsheet program (such as Microsoft Excel) to help you process data. You will have seen most of the functions in action in your practical lessons on Excel; but a list of functions is included below:

- SUM calculates the total of a range of numbers.
- AVERAGE gives the average of a range of values.
- MIN returns the minimum value in a list of values.
- MAX returns the maximum value in a list of values.
- COUNT counts the numbers in a list of values.
- COUNTIF is used for counting cells within a specified range that meet a certain condition.

These functions let you interpret large sets of data but are not very good for visualising the data. You can use charts and graphs to visualise data and analyse trends.

Something to know

Remember, all formulas begin with an = sign in Excel.

EXTRACTING APPROPRIATE INFORMATION

Within spreadsheets and **databases**, there are various tools and commands you can use to extract information, for example, for a big data set, you can use VLOOKUP in Excel.

To see how extracting information is different using Microsoft Excel and Microsoft Access, look at the case study below.

Case Study — Extracting information

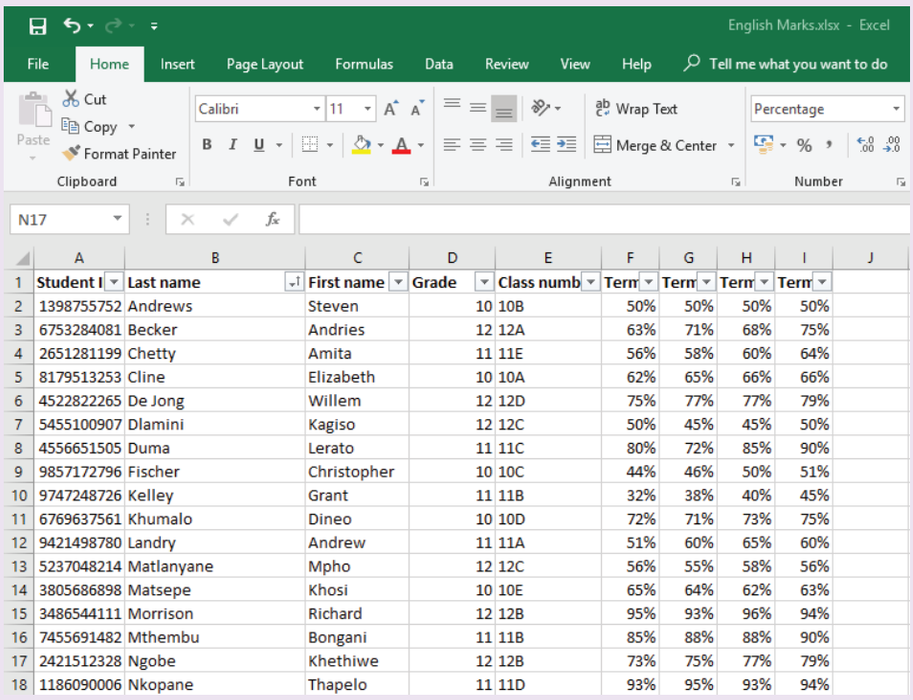
Mrs Dlamini is the administrative assistant at a school. The head of department for English has asked her to find the yearly average English mark for all Grade 11 learners for the previous year. The spreadsheet Mrs Dlamini is given contains the English marks for every assessment and assignment for every learner in Grade 10, Grade 11 and Grade 12.

... continued

Case Study Extracting information *… continued*

So how would Mrs Dlamini find the information?

First, she will need to look at the data she has. When she does this, she sees that the columns have a learner ID number, their full names, grade, class number and terms one, two, three and four marks (as you can see in Figure 13.3).



	A	B	C	D	E	F	G	H	I	J
1	Student I	Last name	First name	Grade	Class numb	Term	Term	Term	Term	
2	1398755752	Andrews	Steven	10	10B	50%	50%	50%	50%	
3	6753284081	Becker	Andries	12	12A	63%	71%	68%	75%	
4	2651281199	Chetty	Amita	11	11E	56%	58%	60%	64%	
5	8179513253	Cline	Elizabeth	10	10A	62%	65%	66%	66%	
6	4522822265	De Jong	Willem	12	12D	75%	77%	77%	79%	
7	5455100907	Dlamini	Kagiso	12	12C	50%	45%	45%	50%	
8	4556651505	Duma	Lerato	11	11C	80%	72%	85%	90%	
9	9857172796	Fischer	Christopher	10	10C	44%	46%	50%	51%	
10	9747248726	Kelley	Grant	11	11B	32%	38%	40%	45%	
11	6769637561	Khumalo	Dineo	10	10D	72%	71%	73%	75%	
12	9421498780	Landry	Andrew	11	11A	51%	60%	65%	60%	
13	5237048214	Matlanyane	Mpho	12	12C	56%	55%	58%	56%	
14	3805686898	Matsepe	Khosi	10	10E	65%	64%	62%	63%	
15	3486544111	Morrison	Richard	12	12B	95%	93%	96%	94%	
16	7455691482	Mthembu	Bongani	11	11B	85%	88%	88%	90%	
17	2421512328	Ngobe	Khethiwe	12	12B	73%	75%	77%	79%	
18	1186090006	Nkopane	Thapelo	11	11D	93%	95%	93%	94%	

Figure 13.3: *English marks for senior students*

Because this spreadsheet is sorted alphabetically, it is hard to tell which learner is in which grade. In Excel, Mrs Dlamini would need to use the filters on the columns to sort the learners by grade (column D) and then only display the Grade 11 learners. She would then have to use the *Average* function to work out each student's average mark for the year in column J. At the bottom of the data in column J, she would then need to use the *Average* function again to work out the yearly average for Grade 11.

If this spreadsheet was in a database, with the exact same headings and information, Mrs Dlamini would only need to use a single **query** to do exactly what she did on the spreadsheet.

13.6 Analysing data and information

After you have collected your data and formatted it, you will need to analyse your results and compare them to a question. But how do you do this? The best way to support or disprove your question is to look at trends and patterns. This section looks at how to verify and validate your data, how to add data questions to your data to help analyse it and how to analyse for trends and patterns.

ADDING DATA QUESTIONS

Once you have verified your data, you can begin to apply the data questions to it so that you can categorise and organise the data. As you learned in Grade 10, the data questions are:

- How many?
- What is most popular?
- What is least common?
- How many more than?
- What is the average?

TRENDS AND PATTERNS

The final step in data analysis is to look for trends and patterns. While these may seem like the same thing, they are not. Trends are the general tendency of data to move in one direction over time. In a trend, the data points may vary slightly, but they all still move in the same direction.

Think of global temperatures. We all know that the temperature of the Earth is getting higher each year, in fact, scientists have been recording and comparing surface temperatures on Earth for the last 100 years. Looking at this data, we can see that while there have been some very hot and very cold days, the overall trend for global temperatures is up. You can see this in the graph in Figure 13.4.

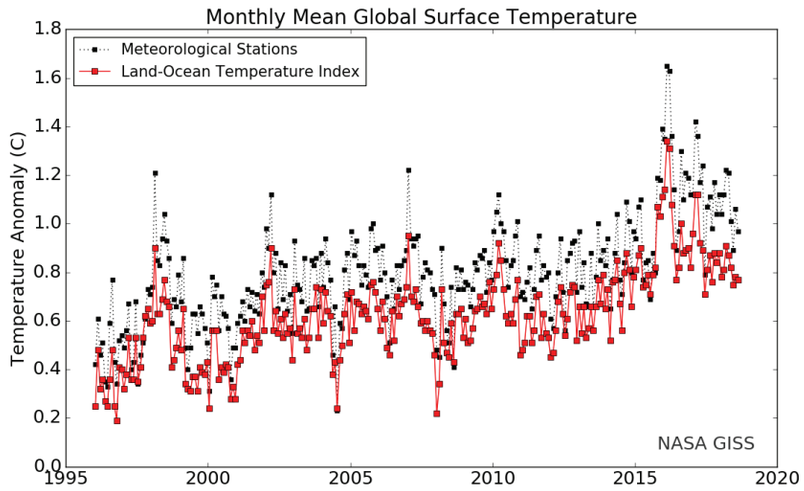


Figure 13.4: *Global surface temperature graph*

This type of trend is known as an **upward trend**.

Another type of trend is known as **downward trend** or downtrend. This happens when the data points move down, for example, the cost of computers and computing technology has decreased since the start of the computer age. If you look at the cost of the first home computers in the 1980s and compare that cost over time to now, you will see that the prices have come down.

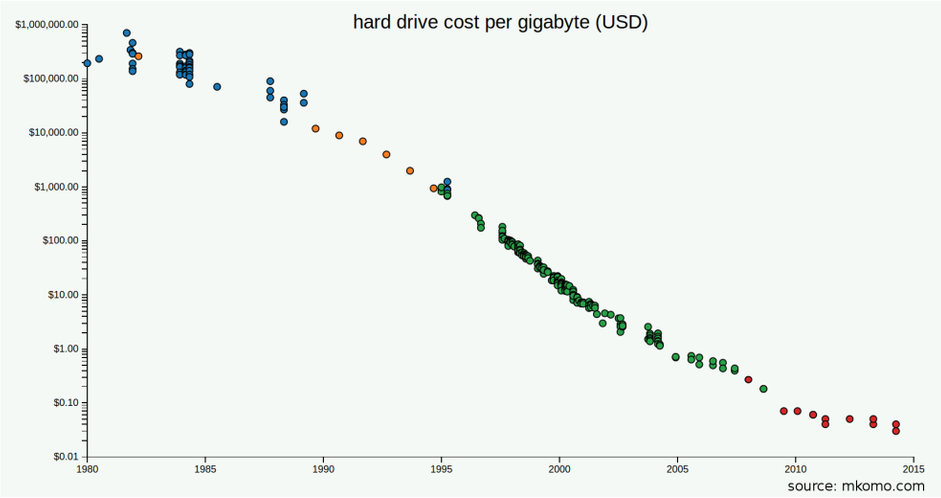


Figure 13.5: *The cost per gigabyte of hard drives in the United States of America*

You may also see a link between the cost of computing devices going down while their processing power and speed goes up as the technology improves over time. This is called a **correlation trend**.

Unlike upward or downward trends, which happen slowly over time, step changes show a massive increase or decrease in the trend. Think of the price of petrol, which can increase or decrease slowly or suddenly jump up or down depending on how much oil costs.

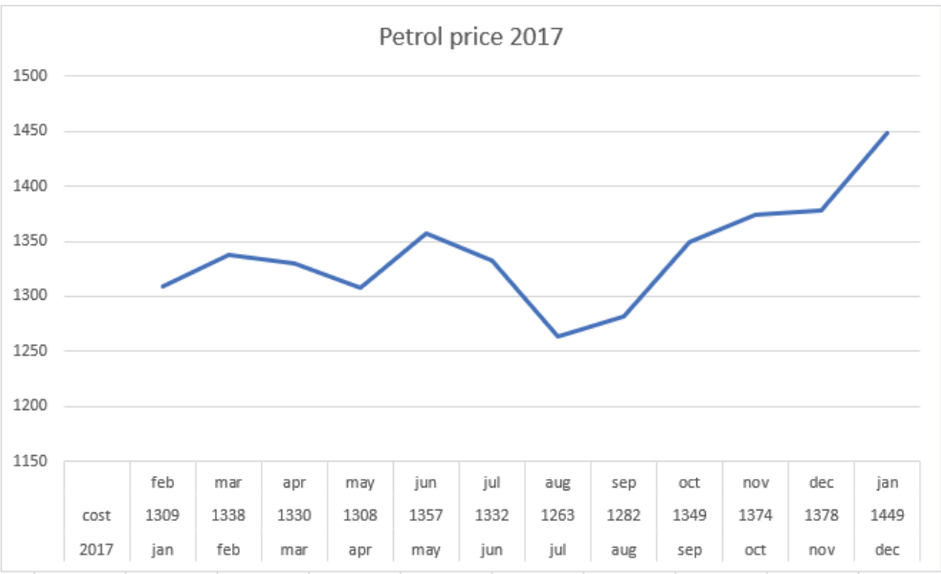
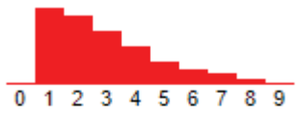
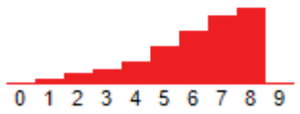


Figure 13.6: *Step chart showing the Inland price of 93 ULP in 2017*

Other trends include daily and seasonal cycles.

Patterns are a little different. Data does not always move up or down over time. Data can also repeat itself in a predictable way or form a shape when placed in a graph. This type of data pattern is usually described in terms of its features, like centred, spread or shape. Table 13.1 describes these patterns and gives an example of each.

Table 13.1: *Data pattern types*

TYPE	DEFINITION	EXAMPLE
Centred patterns	Pattern where the data has a value in the middle of a series of values arranged from smallest to largest (the median).	
Spread patterns	Pattern where the data varies over a range. If the range is wide, the spread is larger, if the range is small, the spread is smaller.	
Shaped patterns	The data forms a shape when plotted on a chart.	 Skewed right  Skewed left

Activity 13.5

Answer the following questions in your own words.

1. What is data verification?
2. Why do you use data verification?
3. Name four data validation techniques, describe how they work and give an example of each.
4. What are two main types of data entry mistakes?
5. Give three examples of trends and how they would be displayed in a report.
6. When analysing data, what is a "pattern"?
7. Analyse the data from Activity 13.4 and determine trends and patterns if any are present. Present your findings to the class.
8. Write a short paragraph to interpret the graph Petro Price 2017 in Figure 13.6 and derive a conclusion from it.

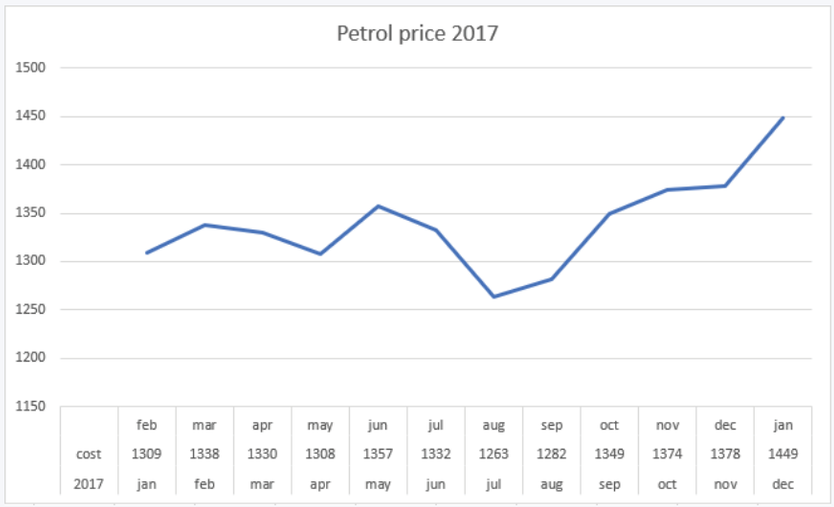
REVISION ACTIVITY

QUESTION 1: MULTIPLE CHOICE

1.1 Data handling can be used to do which of the following? (1)

A. Collect information
B. Organise data
C. Sort information
D. Analyse data

1.2 Which information can be gathered from the following data? (1)



A. The price of petrol in 2018
B. The components of petrol
C. The trend of petrol prices during the year
D. The amount of petrol produced in 2017

1.3 Which of the following is the last step of the information management process? (1)

A. Presenting information
B. Collecting data
C. Processing a database
D. Analysing results

1.4 When evaluating a website, which of the following questions must not be asked? (1)

A. Who supports this website?
B. Who is this website aimed at?
C. Which year was the website established?
D. Who is the author?

1.5 When evaluating information, which of the following must not be determined? (1)

A. Authority **B.** Accuracy
C. Objectivity **D.** Consistency

QUESTION 2: TRUE OR FALSE

Choose the answer and write True or False next to the question number. Correct the statement if it is FALSE. Change the underlined word(s) to make the statement TRUE. (You may not simply use the word NOT to change the statement.)

a. Spreadsheets store their data on a server. (1)
b. Databases are able to perform complex calculations on small amounts of data. (1)
c. Analysis is the first step of the information management process. (1)
d. Surveys and questionnaires can be electronic. (1)
e. If a website does not have the name of the author, it is a good website. (1)

… continued

REVISION ACTIVITY

… continued

QUESTION 3: CATEGORISATION QUESTIONS

3.1 Which of the following situations would use a database or spreadsheet? (3)

SCENARIO	DATABASE/SPREADSHEET
a. Mari wants to organise the music in her playlist from most favourite to least favourite and according to genre.	
b. Agnes wants to use the data from this year's soccer game data to predict who will win the next soccer match.	
c. Martinique wants to keep a record of all the products in her grocery store as well as all her sales and expenses.	

3.2 Which of the following types of graph would best represent the following scenario? (3)

A. Bar graph
B. Line graph
C. Histogram
D. Pie chart

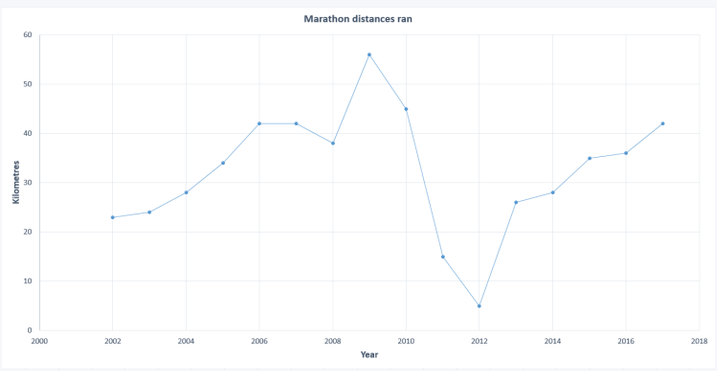
SCENARIO	TYPE OF GRAPH
a. Determining what percentage of the student votes went to each of the four class representatives.	
b. Determining who in the chess club has won the most chess games.	
c. Determining the trend of iPhone sales.	

QUESTION 4: SHORT QUESTIONS

4.1 List two tools you can use to gather data. (2)
4.2 What is the difference between a trend and a pattern? (2)
4.3 Why should you avoid questions that start with "Why"? Also mention how you can prevent this. (2)

QUESTION 5: SCENARIO-BASED QUESTIONS

In order to lose weight and become healthier, Greg decided to start jogging so that he could run in different marathons. Each year Greg recorded how many kilometres he ran. Look at the following graph and answer the questions that follow.



… continued

REVISION ACTIVITY

… continued

5.1 What type of graph is this? (1)
5.2 Does this graph represent data or information? Give an explanation for your answer. (2)
5.3 According to this graph, when did Greg run the longest distance? (1)
5.4 What is the trend from 2002 to 2009? (1)
5.5 Mention two things that this trend indicates about Greg's health. (2)
5.6 Greg badly injured his ankle during a marathon and was advised by the doctor not to run for the next year. According to this graph, in which year did this injury occur? (1)

Nomfundo had to do research on the different phone brands on sale at the Innovation Tech store. While doing this she found that they sold the following brands:

- Samsung
- Apple
- Nokia
- Blackberry
- Huawei
- LG

Now Nomfundo wants to use this information to figure out what the most popular phone brands are at her school so she can know if it would be a good idea to promote this store at her school.

5.7 Based on this scenario, identify the two problems Nomfundo must solve. (2)
5.8 What information-gathering method Nomfundo can use to solve this problem? Give a reason for why she should use this method, and a reason for why she cannot use the other two methods. (4)
5.9 What two tips would you give Nomfundo about creating questions? (2)
5.10 Create two questions that Nomfundo can ask her school peers to find the information she needs. (2)

TOTAL: [40]

AT THE END OF THE CHAPTER

NO	CAN YOU ...	YES	NO
1.	Create a task definition?		
2.	Gather data and information using various tools?		
3.	Describe how to evaluate data to ensure that it is reliable and accurate?		
4.	Discuss how to evaluate the validity of a website as a source of information?		
5.	Evaluate information for accuracy and validity?		
6.	Describe the role of spreadsheets and databases in data handling?		
7.	Discuss tools and techniques for data handling and how to extract data?		
8.	Describe how to analyse trends and patterns in data?		

Glossary

A

acceptable use policy (AUP) a document stipulating constraints and practices that a user must agree to for access to a corporate network or the internet

adware any software application that allows advertising banners to be displayed when another program is running

ALS a disease that gradually paralyses people

analogue signal a continuous signal. It is the opposite of a digital signal that sends information in groups

archive refers to materials (such as recordings, documents, or computer files) that have been stored on a system for easy access when needed

arithmetical deals with non-negative real numbers

ascending order from smallest to largest, increasing

auditory refers to hearing

authentication the process of working out whether something or someone is, in fact, who or what they claim to be

automated teller machine (ATM) an electronic banking outlet that allows customers to complete basic transactions without going into the bank

B

bandwidth a measurement of the ability of an electronic communications device or system (such as a computer network) to send and receive information

basic input/output system (BIOS) a ROM chip found on motherboards that allows you to access and set up your computer system at the most basic level

biased having or showing an unfair tendency to believe that some people, ideas, etc., are better than others

binary code a coding system using the binary digits 0 and 1 to represent a letter, digit, or other character in a computer or other electronic device

bit short for binary digit and is a single unit of information that can have a value of either 0 or 1

Bluetooth a specification that describes how devices such as mobile phones, computers, or personal digital assistants can communicate with one another

braille a system of writing for blind people in which letters are represented by raised dots

bring your own device (BYOD) the practice of allowing employees to purchase and use their own computing devices for work instead of the business supplying the device

bug refers to an error, flaw, failure or fault in a computer program or system

C

carpal tunnel syndrome a condition that causes pain and weakness in the wrist, hand, and fingers

Computer Aided Design (CAD) software used by architects, engineers, drafters, artists and others to create precision drawings or technical illustrations

copyright a legal means of protecting an author's work

correlation trend a statistical measure that indicates the extent to which two or more variables fluctuate together

crawl large data-sets developed to browse the WWW in a methodical, automated manner

credentials a piece of information that is sent from one computer to another to check that a user is who they claim to be

cyber-bullying the use of electronic communication to bully a person

cyber-stalking the repeated use of electronic communications to harass or frighten someone

D

data loss prevention policy a strategy for making sure that end users do not send sensitive or critical information outside the corporate network

database an organised collection of data, usually stored in the form of structured fields, tables and columns

defamation the act of damaging a person's reputation

defragmenting the process of reorganising a hard drive's data to help increase the time it takes to run a program and open files

descending order decreasing, from largest to smallest

disk fragmentation when information is deleted from a hard drive and small gaps are left behind to be filled by new data. As new data is saved to the computer, it is placed in these gaps. If the gaps are too small, the remainder of what needs to be saved is stored in remaining gaps

distributed denial of service (DDos) attacks a malicious attempt to interrupt traffic to a server, network or service by flooding it with internet traffic

dots per inch (dpi) a measure of the resolution of an image, both on screen and in print

downtime time during which a computer is out of action or unavailable for use

downward trend refers to a direction from higher to lower

doxing identifying or publishing private information about a person as a form of punishment

E

email spoofing the forgery of an email header so that the message appears to have originated from someone or somewhere other than the actual source

embedded videos videos used within an email for marketing purposes

Energy Star rating the government-backed symbol for energy efficiency

ergonomics a science that deals with designing and arranging things so that people can use them easily and safely

ethernet the standard way to connect computers on a network over a wired connection

ethical refers to doing things that won't do harm to people or the environment

export (data) refers to converting data into another format than the one it is currently in

F

file transfer protocol (FTP) a way to transfer data, particularly files, from one computer to another, usually over the internet but also over a local network

firewall a software program or hardware device that acts as a filter for data entering or leaving a network or computer

format (a disk) refers to preparing a disk to store data

fragmentation when you save a file onto your computer, the computer breaks the file up into smaller pieces in order to store the file on your hard drive

G

geolocation the identification or estimation of the real-world geographic location of an object

gigabit a unit of data size equal to 1 000 megabits

gigahertz (GHz) an indication of the processor's speed. As a general guideline: the higher the frequency, the better the CPU

graphics card a circuit board inside a computer that allows it to receive and show pictures and video

H

high-definition multimedia interface (HDMI) a digital interface used to transmit audio and video data in a single cable

hoax email a scam or trick in an email message, such as warning of a non-existent threat or a request for personal information

I

information and communication technology (ICT) a field of study related to computers and communication networks

import (data) refers to using data produced by another application

information processing cycle the sequence of events in processing information, which includes input, storage, processing, output and communication

installation wizard a feature that takes the user through the steps of installing or the setup of a software program or hardware device

internet protocol (IP) a standard set of rules for sending and receiving data over the internet

intranet a private network for a corporation or organisation that only those with permission can use

L

light emitting diode (LED) a device that lights up and displays information when electricity passes through it

local area network (LAN) a computer network that covers a small area in which the computers in the network share resources, such as internet connections, printers and server connections

live streaming a live transmission of an event over the internet

M

malware malicious software used by cybercriminals

megapixel the resolution of the amount of detail that a camera can capture

memory card a type of storage media

N

near field communication (NFC) a short-range wireless technology that enables simple and secure communication between electronic devices

netiquette refers to internet etiquette. It is a list of rules and guidelines about acceptable behaviour on the internet

network administrator someone responsible for the maintenance and operation of a network or server

non-conductive not able to conduct heat or electricity or sound

O

octa-core (processor) a processor with eight cores

P

passphrase a secret phrase that helps protect accounts, files, folders, and other confidential information

password a string of characters used for authenticating a user on a computer system

pattern refers to data that can also repeat itself in a predictable way or form a shape when placed in a graph

peripheral (equipment) equipment that is connected to a computer but not an essential part of it

phishing a method of trying to gather personal information(such as usernames and passwords) using deceptive emails and websites

pixel refers to any one of the very small dots that together form the picture on a television screen, computer monitor, etc.

pixels per inch (ppi) measures the number of pixels per line per inch in a digital photo

plagiarism the act of copying someone else's work and publishing it as your own

plug-and-play devices devices that can be connected to a computer and used immediately without needing specific driver software

portable refers to something being mobile and easy to carry around

power surge a short, fast rise in voltage that inherently causes an increase in electrical current or vice versa

prevalence something being practised often or over a wide area

Q

quad-core (processor) a processor with four cores

query a request for data or information from a database table or combination of tables

R

random-access memory (RAM) a very fast short-term data storage device that can only store a small amount of information at a time

read-only memory (ROM) stores the basic instructions for what needs to happen when the computer is switched on

really simple syndication (RSS) a way to easily distribute headlines, updates and content to many people at once

repetitive strain injury a painful medical condition that can cause damage to the hands, wrists, upper arms, and backs, especially of people who use computers

resolution the ability of a device to show an image clearly and with a lot of detail

S

salutation a greeting

secure sockets layer (SSL) an encrypted link between you and the server, making the data you and the server send and receive secure and private

social engineering the use of deception to manipulate individuals into giving away confidential or personal information that may be used for fraudulent purposes

sorting the process of arranging data into meaningful order so that you can analyse it more effectively

spam unwanted or irrelevant messages that are sent over the internet or through emails

spyware software installed on a computing device without the user's knowledge that is designed to gather data from that device

structured query language (SQL) a query language used for accessing and modifying information in a database

T

tertiary storage a third level of storage in a computer build to provide huge storage capacity at low cost

tone refers to a shade of colour

trend refers to the general tendency of data to move in one direction over time

U

upward trend means moving in a direction from lower to higher

V

validate the process of comparing data with a set of rules to find out if data is reasonable

verify the process of checking that the data entered exactly matches the original source to find out if data is accurate

video conferencing a live, visual connection between two or more people in separate locations for the purpose of communication

virtual keyboard a computer keyboard that is operated by typing on the screen rather than by pressing physical keys

Voice over Internet Protocol (VoIP) a telephone connection over the internet

volatile memory computer storage that only maintains its data while the device is powered

W

wireless access point (WAP) a wireless receiver that enables a user to connect wirelessly to a network or the internet

website spoofing the act of creating a website as a hoax, with the intention of misleading readers that the website has been created by a different person or organisation

wireless local area network (WLAN) a small network of computers covering a small area, such as a home, office building or school, but with the ability to connect wireless devices such as smartphones, laptops and tablets to the LAN