

SAMPLE CHAPTER

INTERACT

WITH

INFORMATION TECHNOLOGY

New Edition

Roland Birbal
Michele Taylor

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The parts of a computer system

* Objectives

At the end of the chapter, you will be able to:

- ❑ explain the terms 'computer', 'computer system', 'multimedia', 'hardware' and 'software'
- ❑ differentiate between a computer and a computer system
- ❑ describe the difference between data and information
- ❑ explain the difference between hardware and software
- ❑ explain the difference between application software and system software
- ❑ explain the stages involved in computer processing
- ❑ explain the functions of the central processing unit, control unit, arithmetic and logic unit, and registers
- ❑ state some of the reasons for using computers
- ❑ explain how technology tools impact productivity in the home, school, community and workplace.

What is a computer?

A **computer** is a programmable electronic device that processes data by following a set of instructions. The action of **processing** data produces information that can be output or stored for future use. Electronic devices use tiny electric currents, flowing through circuits, to perform their operations. These currents are formed by electrons, which is where we get the term 'electron-ic'.

An example of a fairly simple computer is a calculator. It can process data and output the information from the processing. For example, adding '2 + 6' (the processing) produces '8' (the information). Other computers are much more sophisticated, as you will see in Chapter 2.

A **computer system** refers to the complete computer, which includes all the hardware and software required for the computer to work. A computer system allows users to input, process, output and store data. Figure 1.1 shows the parts of a computer system.



Figure 1.1 Parts of a computer system

What is the difference between data and information?

Data is all the raw facts and figures that a computer processes by following a set of instructions called a program. Data by itself has no meaning; it can be in the form of letters (a, b, c, d ... x, y, z, and so on), numbers (1, 2, 3, 15, 456, and so on), pictures, sounds or symbols. It is only when we attach meaning to data that we get **information**. For example, if you collect the temperature of your classroom each day for a month, you have collected data.

Note!

Can you think of other types of data you can collect in your class that the computer can process to give information?

When you instruct a computer to arrange (sort) this data, you could get the following types of information:

- * The highest temperature over the period
- * The lowest temperature over the period
- * The mean (average) temperature over the period.

This information may then be useful, for example, to determine whether a classroom is too hot or too cold for comfortable working. If the information was just raw data, it would not be easy to interpret. Therefore, the computer has helped you to look at a real-life situation or **problem** and make some sense of it.

Did you know?

The term 'multimedia' refers to content that uses a combination of different forms such as text, audio, images, animations, video and interactive content.

Hardware and software

A computer needs both hardware and software to process data. The hardware and software are interdependent and must work together to manipulate data effectively and produce useful output.

Hardware

Hardware is all the physical parts of the computer system that you can see and touch. These physical parts include all the devices that make up the computer system. The internal hardware devices that make up a computer and ensure that it functions correctly are **components**. The hardware devices that are not essential to a computer's function are called **peripherals**. Keyboards, printers, speakers, mice and hard drives are **peripheral devices**.

Hardware devices can be divided into five categories: Input, output, storage, processing and communication. Table 1.1 shows examples of the different devices in each category.

Table 1.1 Categories of hardware devices

Hardware devices				
Input devices	Output devices	Storage devices	Processing	Communication
Keyboard, scanner, touch screen, joystick, mouse	VDU, monitor/ screen, speaker, plotter, printer	Hard disk drive, CD/DVD, USB flash drive	CPU	Modem, webcam

Did you know?

Did you know that an app you download to your smartphone is software? Can you think of apps that you or a friend use or are familiar with?

Software

Software is a set of instructions (called a **program**) that a computer needs to carry out its tasks. For example, if you want to use the computer to type a letter, draw a picture or do some accounting work, you would need different types of software to carry out these tasks. Examples of software include word processors, spreadsheets, graphics packages and database packages.

Software can be classified into two major categories:

- * Application software
- * System software.

Application software

Application software consists of programs that have been developed to carry out specific tasks or solve particular problems. For example, if you want to type a letter, you would need to use a word processor. If you want to create a highly decorated birthday card, you would need some type of graphics package. Word processors and graphics packages are examples of application software.

Many different types of application software are available for sale. Each type of software is designed for a particular type of activity. Selecting the right application software to perform a task makes it easier to accomplish the task, and will greatly improve the final outcome or result. When you buy a new computer, it is usually sold with system software and some application software. However, depending on your needs, you may have to purchase additional application software. Application software includes:

- * entertainment software, such as games
- * home or personal software, such as encyclopaedias
- * productivity software, such as word processing and spreadsheet packages
- * specialist software such as desktop publishing and graphics packages.

Application software can also be divided into the following categories:

- * General-purpose software
- * Integrated software
- * Customised software
- * Custom-written (tailor-made) software packages.

System software

System software consists of programs that manage and support the resources and operations of a computer system. These programs enable the application software to run and the management of the system resources. Four major categories of system software are the:

- * operating system
- * utility programs
- * device drivers
- * language translators.

System software acts as a buffer between the hardware and the application software. Figure 1.2 shows a conceptual arrangement of hardware, system software, application software and the user.

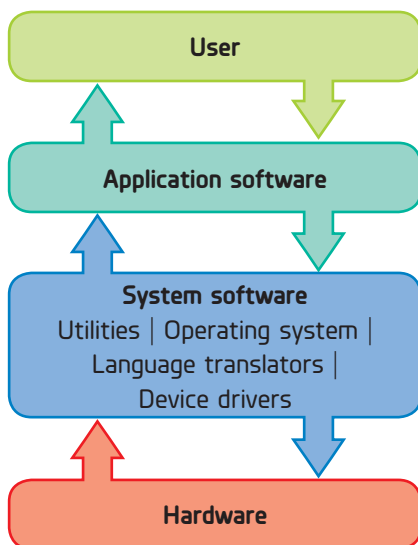


Figure 1.2 Conceptual arrangement of hardware, system software, application software and the user

Stages of processing

To accomplish its tasks, a computer has to process the data. Processing data to get information involves the following three stages:

- * input
- * processing
- * output.

These three stages together are called the data-processing cycle.

Note!

Do you know the type and speed of the processor that is used in your computer or your school's computer?

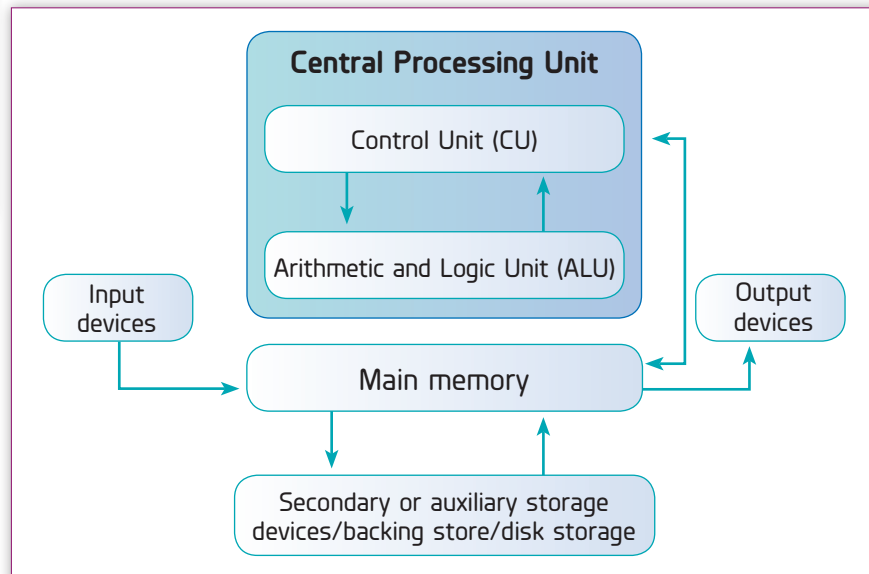


Figure 1.3 Stages of processing

Did you know?

The mouse was invented in 1963 by Douglas Engelbart. It is called a 'mouse' because it has a basic mouse shape and the cable that attaches it to the computer looks like a tail. When referring to more than one device, both 'mice' and 'mouses' are acceptable.

Did you know?

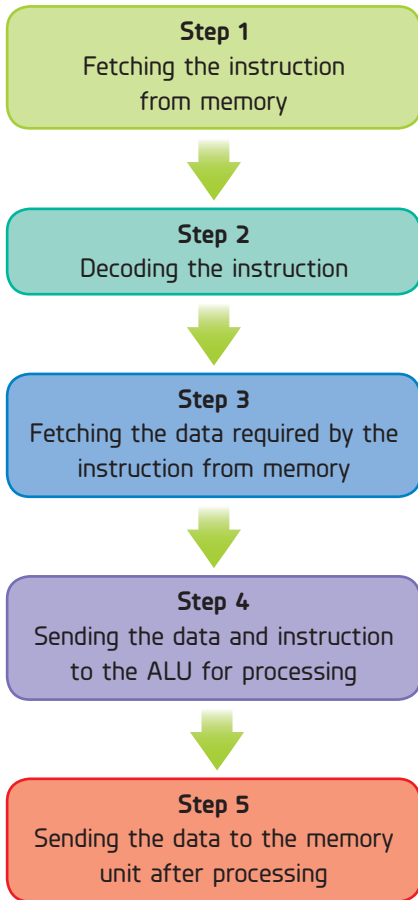
Did you know that the unit 'hertz' (Hz) is named in honour of the German physicist Heinrich Rudolf Hertz (1857–1894). Hertz laid the groundwork for the development of the vacuum tube. He also discovered electromagnetic waves.

Input devices

Input devices such as keyboards, joysticks, mice and scanners are used to get the data and instructions into the computer for processing.

Processing

The processing takes place in that part of the computer called the **central processing unit (CPU)**. The CPU, also known as the **processor**, is the 'brain' of the computer. It takes raw data and, following a set of instructions (programs), converts it into information. The speed at which a CPU processes data to convert it, is measured in megahertz (millions of machine cycles per second) or, for newer machines, in gigahertz (GHz) (billions of machine cycles per second). A machine cycle is the sequence of instructions that the CPU performs to execute one program instruction. A computer that is used for gaming requires a very fast processor. One of the fastest processors for **personal computers** is the Intel Core i9-7980XE with a speed of 4.4 GHz.



The control unit

The **control unit (CU)** is the main part of the CPU. It directs and coordinates all the activities within the CPU. The control unit determines the sequence in which instructions are executed, but it does not execute these instructions itself. Instead, it sends the data and instructions to the **arithmetic and logic unit (ALU)** for processing. The CPU is primarily responsible for movement of data and instructions from itself to the main memory and ALU and back. The CU executes an instruction by performing the Steps 1 to 5 to the left. These steps make up the data-processing cycle.

The control unit contains a number of **registers**. A register is a temporary storage location that holds a single instruction or data item. Registers are used to store data and instructions that are needed immediately and frequently.

The arithmetic and logic unit (ALU)

The arithmetic and logic unit (ALU) performs all the arithmetic and logic functions in a computer. For example, if an instruction involves an arithmetic operation such as addition, subtraction, multiplication or division, or the comparison of data, the control unit sends the data to the ALU for processing.

Some of the logic functions are comparisons, such as the following:

Equal to	=	Greater than	>
Less than	<	Greater than or equal to	>=
Less than or equal to	<=	Not equal to	<>

For example, using the 'equal to' logic function, the ALU compares two values to determine if they are equal. Other logical operations performed by the ALU are AND, OR and NOT.

Main memory

The **main memory** (also called immediate access store or IMAS), which is directly accessible to the CPU, holds data and instructions that the computer is processing at the time. Therefore, the data collected in the example about the temperature of the classroom would be placed in main memory while it is being processed.

Output devices

Output devices translate information processed by the computer into a form that the user can understand. After processing, the data and information can be either stored in a secondary storage device, such as the computer's hard disk drive, or sent to an output device such as a printer or a computer screen.

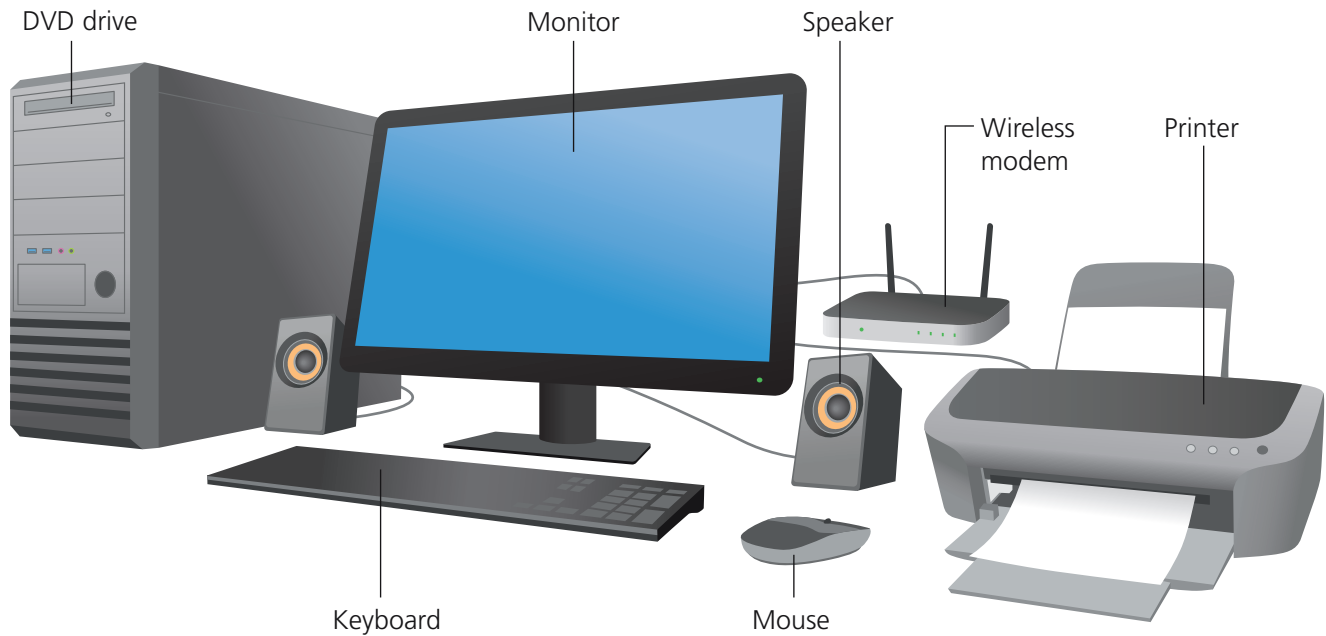


Figure 1.4 The components of a basic computer system

Why do we use computers?

We use computers for the following reasons:

- * **For their data-processing speed:** Computers are very fast; they can perform tens of millions of operations per second. With this speed comes the power to undertake many different tasks such as predicting weather forecasts, performing scientific research and producing thousands of bills for utility companies.
- * **For their data-processing accuracy:** Computers are very accurate. Errors only occur if there is an error in the way in which the hardware and software have been set up, or if there are errors in the data that has been inputted into the system. Therefore, errors usually occur because of some human error. Computers can only do what they are set up and programmed to do.
- * **For storing large amounts of information in a small space:** Many types of computer storage media can be used to store large volumes of data and information. For example, a single CD-ROM disk or flash drive can hold the equivalent of a shelf of library books in electronic form.
- * **For their ability to work continuously:** Computers can work continuously for very long periods – only needing to stop for upgrading or maintenance checks. In fact, most modern computers can be left switched on all the time if desired, to continuously process data 24 hours a day and seven days a week.



Figure 1.5 Computers can work continuously for long periods with very little maintenance.

The impact of technology in homes, schools, community and the workplace

In the modern world, technology fills almost every aspect of our daily lives. Technology tools are in our homes, schools, communities and workplaces. We cannot escape the impact of technology on society, which can be both positive and negative.

Technology in the home

In today's evolving world, families are consistently searching for opportunities to help them obtain a better balance of professional and family life. One of the ways that parents try to achieve this balance is through the use of technology in their day-to-day lives.

Keeping in touch

Technology can help busy families stay connected with one another. Parents can check in with children at all times to see where they are and what they are doing. Families can check in with one another using text or phone calls, or through the use of video-conferencing, such as Skype, Facetime or WhatsApp.

Entertainment

Modern technology has had a huge impact in the way we enjoy entertainment at home. In addition to cable and satellite television, new gaming consoles, computer technology and high-speed broadband have added to the ability to enjoy a wide range of entertainment at home. These technologies have made it possible for home owners to enjoy online gaming, as well as an enormous selection of streamed movies and music, all in the comfort of their homes. In addition, people who like to read can access ebooks, online magazines and online newspapers.

Convenience

Technology that enables online banking, online shopping and the ability to pay bills online has made many of these daily tasks much simpler, safer and more convenient. You no longer have to go to a bank to withdraw money or transfer it to someone. Companies like PayPal have created a platform where people can send and receive money from any location using the **internet**. Paying bills has also been simplified thanks to technology. You do not have to carry cash with you when you go shopping. You can use your cell phone and a banking app to do all your necessary bill payments online. In addition, general housekeeping such as vacuuming can be done using automated robots. These devices can help busy householders, as well as people who aren't able to clean their own floors, to keep their floors clean and dust-free.



Figure 1.6 Technology allows families to do their shopping online.



Safety and security

WiFi-enabled smoke and carbon monoxide monitors connected first to a WiFi network and then over to a centralised system can alert someone if there is a problem. Home security cameras can allow home owners to monitor their homes even when they are not at home.

Efficiency

Smart switches, plug adapters and timers allow home owners to switch off the power without even being in the room. With the new types of smart light bulbs, you can set individual timings for all the lights in your home. This enables you to save electricity and makes sure that you only use the lights you really need at home.

Technology in schools

Technology has also improved education and learning processes. Many schools have started integrating educational technologies into their schools to improve the way in which students learn. Many activities in a school day take up too much of a teacher's time and productivity. Various tasks, such as preparing resources, grading and returning papers, preparing supplemental instructional material, and notifying and posting assignments, can be done easily using technology. Technology can also assist the teacher in the following ways:

- * **Tracking student progress:** Integrated learner systems can be used to capture, analyse and present data on students' progress.
- * **Linking students to learning tools:** The ability of technology to link students with one another and with online resources has the potential to support instruction and enhance learning.
- * **Empowering teachers to provide more focused, personalised instruction:** The ability to deliver high-quality content via technology can allow teachers to spend more time creating innovative experiences and coaching students one-on-one in more targeted and focused ways.
- * **Giving teachers a window into what is working:** Teachers can use technology-based assessments to inform their instruction. These assessments can quickly produce data and surface patterns that help teachers to identify where students are faltering and to intervene with targeted coaching immediately, before the student falls too far behind. Teachers can also use this information to revise their lessons plans and teaching approaches.
- * **Reaching more students in more places:** Technology solutions have the potential to reach many more students at a relatively low cost, especially as smartphones, broadband and cellular coverage are available everywhere and have become more affordable. Even in low-income communities across the world, an increasing number of students, teachers and classrooms are equipped with computers, tablets, and smartphones.

Did you know?

Technologies such as smart whiteboards, computers, cell phones, iPad®, projectors and the internet are being used in classrooms to motivate students to learn, and to enhance teaching and learning.



Figure 1.7 Technology allows students to access online resources that enhance learning.

Technology in the community

Technology and human life cannot be separated, as we use technology and depend on technology in most aspects of our daily life. For example, people use technology to travel, to communicate, to learn, to do business and to live in comfort.

Transport

Technology has improved transportation, as it provides mobility for people and goods. In recent times, we have seen the growth of the taxi transport apps. These apps allow users to book a taxi in many countries in the world. The user puts in a destination and the app maps a route, calculates a cost and gives the user several drivers from which to choose.

Agriculture

Modern agricultural technology allows a small number of people to grow vast quantities of food in a short period of time with less input, which results in high yields and returns on investment. The use of technology in agriculture has also resulted in the development of genetically modified crops, which can grow quickly and are resistant to many pests and diseases.

Communication

People use technology to communicate with one another. Electronic media such as radio, television, the internet and social media have improved the way we exchange ideas, which can develop our communities. In many countries, radio and television express the concerns of society, and live forums are organised where the community can contribute through cell phones or text service systems like Twitter. During political elections, leaders use radio, television and internet media to reach the people they want to serve.



Figure 1.8 The use of technology has created genetically modified crops that are resistant to many pests and diseases, which improves crop yield.



Figure 1.9 Satellite technology allows television and radio broadcasts to reach many people and communities.



Technology in the workplace

The introduction of new technology has enhanced productivity and enabled greater collaboration, organisation and flexibility in businesses.

Greater collaboration

Productivity and engagement in the office is a vital factor to an organisation's success. The right technology not only simplifies how people work, but also increases cooperation between staff and allows employers to have the best data on hand to make suitable business decisions for business success. For example, software such as 'GoToMeeting', which is an online video-conferencing software, allows users to schedule meetings and share screens. Additionally, collaboration tools such as 'Google Docs™' and 'Google Sheets™', allow teams to work individually on a shared document, edit files at the same time and save their changes automatically.

Better organisation

Implementing appropriate technology solutions allows everyone to understand how the business works. For example, having all the data in a centralised, easily accessible location enables staff to be more organised and allows for better communication.

Greater flexibility

Workers are becoming more mobile and this development has reached a point where most staff can work from a remote location with little difference to physically being at the office. This allows a continual flow of ideas and solutions across staff, strengthening the team, the decision-making processes and the overall effectiveness of the business.

Enhanced productivity

The use of computer-aided design (CAD) and manufacturing in manufacturing companies has resulted in faster production of goods. The internet has resulted in greater sales, faster distribution and better after-sale customer service.



Figure 1.10 Technology in manufacturing allows goods to be produced more quickly.

Summary 1

- 1** A computer is a programmable electronic device that processes data following a set of instructions.
- 2** A computer system refers to the complete computer, which includes all the hardware and software required for the computer to work.
- 3** Data is all the raw facts and figures that a computer processes by following a set of instructions (called a program) to produce information.
- 4** Hardware is all the parts of the computer system you can see and touch, for example printer, keyboard, mouse, system unit.
- 5** Software is a set of instructions (program) that a computer needs to carry out its tasks.
- 6** Application software programs carry out specific tasks or solve particular problems.
- 7** System software is software that manages and supports the resources and operations of a computer system.
- 8** Input, processing and output are the three stages of processing.
- 9** Input devices are used to get data and instructions into the computer for processing.
- 10** The central processing unit (CPU) is the 'brain' of the computer. It consists of two smaller units known as the control unit (CU) and the arithmetic and logic unit (ALU).
- 11** The control unit is the main part of the CPU. It directs and coordinates all the activities within the CPU.
- 12** A register is a temporary storage location that holds a single instruction or data item.
- 13** The arithmetic and logic unit (ALU) performs all the arithmetic and logic functions in a computer.
- 14** The main memory holds data and instructions that the computer is processing at the time.
- 15** Output devices translate information processed by the computer into a form that the user can understand.
- 16** Computers are used because of their great speed, accuracy, large storage capacity and ability to work continuously in solving a variety of problems that would otherwise require many human hours of work.
- 17** Technology tools are in our homes, schools, community and in the workplace.
- 18** In our homes, technology helps families to keep in touch, provide entertainment, provide convenience for many daily tasks, improves efficiency by managing utilities, such as electricity, and enhances safety and security through the use of monitoring devices.
- 19** Technology has resulted in enhanced productivity, greater collaboration, organisation and flexibility in businesses.
- 20** Technology has improved education and learning processes by tracking student progress, linking students to learning tools, empowering teachers to provide more focused, personalised instruction, giving teachers a window into what's working, reaching more students in more places.
- 21** Technology has improved the community by providing better transport systems, communication systems and agricultural systems.

Questions 1

Copy and fill in the blanks questions

- 1 A set of instructions that a computer needs to carry out its tasks is known as a _____.
- 2 _____ is a set of raw facts and figures.
- 3 _____ are used to get the data and instructions into the computer for processing.
- 4 A computer system consists of both _____ and _____.
- 5 Processing takes place in the part of the computer known as the _____.
- 6 The _____ directs and coordinates all the activities within the CPU.
- 7 A _____ is the sequence of instructions performed to execute one program instruction.
- 8 The _____ performs all the arithmetic and logic functions in a computer.
- 9 _____ holds data and instructions that the computer is processing at the time.
- 10 _____ translate information processed by the computer into a form that the user can understand.

True or false questions

- 1 Data and information are the same.
- 2 The CPU is the brain of the computer.
- 3 All the data is processed in the memory unit.
- 4 The control unit sends data from the memory to the ALU for processing.
- 5 Output devices translate information processed by the computer into a form that the user can understand.
- 6 A computer that is required for gaming does not need a fast processor.

- 7 Input, processing and output are the three stages of data processing.
- 8 A register is a permanent storage location.
- 9 Technology has improved communities by providing better communication systems.

Multiple-choice questions

Choose the **best** answer to each question.

- 1 Which is not an example of a peripheral device?
 - a Keyboard
 - b Mouse
 - c Register
 - d Speakers
- 2 A program is a:
 - a hardware device.
 - b memory device.
 - c set of instructions.
 - d register.
- 3 Which is not found in the CPU?
 - a ALU
 - b Control unit
 - c Memory
 - d Printer
- 4 The ALU processes data and stores it in:
 - a a flash drive.
 - b the main memory.
 - c a sound card.
 - d modem.

- 5** Which one of the following is not a function of the control unit?
- a** Fetches instructions from memory
 - b** Decodes instructions
 - c** Processes instructions
 - d** Fetches data for required instructions
- 6** The speed at which a CPU processes data to convert it, is measured in:
- a** megabytes.
 - b** gigahertz.
 - c** gigabytes.
 - d** terabytes.
- 7** Registers are used to store data and instructions that:
- a** are needed over a long period of time.
 - b** are needed immediately and frequently.
 - c** are needed at start up.
 - d** are needed to hold the program that is being used.
- 8** The main memory of a computer is also referred to as:
- a** immediate access store.
 - b** auxiliary storage.
 - c** secondary storage.
 - d** backup storage.
- 9** Which of the following is an example of technology use in the home?
- a** Keeping track of student progress
 - b** Greater collaboration
 - c** Entertainment
 - d** Enhanced productivity

Short-answer questions

- 1** Explain the difference between the terms 'computer' and 'computer system'.
- 2** Define the terms 'hardware' and 'software'.
- 3** Using examples, explain the difference between data and information.
- 4** Draw a diagram showing the three stages of processing.
- 5** Using an example explain the data-processing cycle.
- 6** Draw a block diagram to illustrate the main components of a computer system.
- 7** Describe the functions of the two main units found in the central processing unit.
- 8** Explain the purpose of the following devices:
- a** Input device
 - b** Output device
 - c** Main memory
- 9**
- a** Explain the difference between application software and system software.
 - b** Give two examples of application software and one example of system software.
- 10** State four reasons why computers are used.
- 11** Technology has permeated almost every aspect of our daily lives.
- a** List three ways technology has made our lives easier in our homes.
 - b** List three ways technology has enhanced productivity at the workplace.
- 12** Technology has improved education and learning processes.
- a** Explain two ways in which technology can be used to assist the teacher.
 - b** Describe an example of how you use technology to assist with your studies.

Research questions

- 1 Using the internet to conduct research, answer the following questions.
 - a State the names of three manufacturers of computer processors.
 - b Create a table with the name of the manufacturer and their latest processors.
- 2 Use the internet to conduct research to determine the negative impacts of computers in:
 - a the school.
 - b the home.
 - c the workplace.
 - d the community.
- 3 Collect data in your school to determine for what purposes students use their cell phone. Analyse the data and present the information to your teacher.

Crossword



Across

- 4 A set of instructions that a computer needs to carry out its tasks
- 5 Hardware devices that are not essential to a computer's function
- 6 The internal hardware devices that make up a computer and ensure its functionality
- 7 All the parts of a computer system that you can see and touch

Down

- 1 The part that holds data and instructions that the computer is processing at the time
- 2 All the raw facts and figures that a computer processes by following a program
- 3 Sometimes referred to as the 'brain' of the computer

STEM project

Your mother has given your grandmother a computer as a gift. Your grandmother lives in a country outside of the Caribbean. She is a retired typist and is familiar with an electronic typewriter, but she is not very familiar with computers. However, she is looking forward to learning about them. Your mother has asked you to write simple step-by-step guidelines to help your grandmother understand the parts of a computer and their functions, to gently get her started in its use. You decide to consult with your classmates to get help in writing these guidelines.

- 1 Write a precise statement on what the manual should do for your grandmother.
- 2 Decide on the content and format of the manual. What process did you and your classmates follow to decide on the content and format? Write a brief outline of this process.
- 3 Produce the manual and get an elderly non-computer-using adult to use it.
- 4 Were there any problems in the test use of the manual? How do you plan to improve the manual as a result?

Hints

- 1 How is a computer similar to an electronic typewriter? Do research on this.
- 2 What are the main features of a manual? Write up a table of contents.
- 3 A large, well-labelled diagram can be very effective in showing the parts of a computer.

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Roland Birbal is an Assistant Professor in Educational Technology and Instructional Design at the University of Trinidad and Tobago. He is also a former IT examiner and highly experienced teacher.

Michele Taylor is an IT lecturer at the School of Education, UWI, St Augustine, Trinidad and Tobago and is currently pursuing her doctorate. She is also a highly experienced IT and Computer Literacy secondary school teacher, pan-Caribbean curriculum writer and examiner.

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