

Computer Science

Form 2



John Batani
Mercy Chinyuku
Tavengwa Masamha
Paidamoyo Mastara
Mary Muhonde

TOPIC 1

HARDWARE AND SOFTWARE

SAMPLE

Objectives

- Identify types of application software
- Use utility software and tools



Introduction

In Book 1 we learnt about types of computers and the numerous computer hardware used by end users to perform tasks. We also learnt that all hardware needs software for it to work. This means hardware on its own is not incomplete. Hardware depends on software for it to be useful, just like a cell phone need a SIM card for it to work. On the other hand software on its own is of no value until it is installed in a computer. So hardware and software depend on each other. In other words hardware and software are complementary. In this chapter we will learn about software in greater detail.

Activity 1.1 In pairs

1. Define the term “computer hardware”.
2. Give the types of computer hardware and two examples of each.
3. Describe the relationship between computer hardware and computer software.

Software

In Book 1 we discussed the hardware (input, processing, output and storage devices) component of a component of a computer system. However, hardware on its own does not work until it gets instructions on what to do. Software refers the instructions that a computer needs in order to process data given to it. Software is a term that refers to the programs that make a computer functional.

Programming is the process of writing (developing) computer instructions (software) and the person who does that is known as a programmer. A programming language is a language understood by computers that is used to write software, examples are: Java, Visual Basic, Python and C to mention a few. The two classes of software are Systems software and Application software.

Application software

Applications software refers to programs that enable the user to achieve specific objectives like creating documents, using databases, producing spreadsheets or designing buildings. This is software meant to be “applied” to a specific task. In other words, application software basically solves user problems. Tasks can include creating a word document or spreadsheet.

Application software can be classified into:

- General application packages and
- Special purpose application software

General purpose software

This is a group of software that performs general tasks. These are tasks that can be done by anyone regardless of their profession or area of specialisation. In this category belong the following:

- Word processing software e.g. Microsoft (MS) Word
- Spreadsheets e.g. Microsoft (MS) Excel
- Database Management Software e.g. Microsoft (MS) Access
- Presentation graphics e.g. Microsoft (MS) Power point
- Web browsers e.g. Firefox, Opera, Google Chrome



Special purpose software

Special purpose software refers to application software that is meant for use by professionals in specific industries like mining, hospitality, transport, agriculture, banking and insurance, retail and medical. Note that in addition to this special purpose software, people in the mining sector, for example, will also need general purpose software to perform certain tasks such as word processing or presentation graphics. These programs are dedicated to very specific functions within a knowledge area or profession. Examples include, but are not limited to:

- Accounting programs for accounts and finance professionals
- Design software for architects, engineers and other designers
- Hotel programs for hotels and restaurants
- Process control software for the manufacturing sector
- Fleet control for transport and logistics professions
- Statistical analysis software for researchers

Activity 1.2 Practical

With the teacher's assistance, work in groups to do the following:

1. Identify the application software running on your computer.
2. State whether the software identified in a) above is general purpose software or specialised software.

Off the shelf Software and Customised software

There are two ways of acquiring application software. One way is through buying ready-made software, called off the shelf software. The second method is by writing / developing the software yourself, called custom made software. A company or an individual normally considers the pros and cons of each way of acquiring software before deciding on a particular method of doing so.

a) Off the shelf software

Off the shelf software refers to ready-made software that you purchase. Examples are Microsoft Office e.g. Microsoft Word, Microsoft Excel and others.

Off the shelf software is characterised by the following:

- Sold in stores or it can be sold on the internet.
- Installation can be standard or custom.
- Can be purchased, installed & used immediately
- Written to solve a specific problem.
- Can be designed to do one particular task e.g. order entry, payroll, stock control, appointments.

Advantages of buying an off-the-shelf software

- Generally less expensive than custom-written because of economies of scale.
- Readily available since it can be bought from a shop or the Internet and installed straight away.
- Large established user-base that is available in the form of advice forums, 3rd party books and training courses. In addition staff may already be familiar with software.
- The software is tried and tested therefore there are fewer bugs than newly written software.
- Software runs on a wide range of hardware.



Disadvantages of buying an off-the-shelf package

- Total cost of ownership can be high due to licence fees and upgrades that are usually expensive.
- The software may not completely fit the task since it would have been developed for a wide range of customers.
- Software may have too many additional, unwanted extras.

Customised/Custom software

Customised/Custom software is software that is specifically developed for some specific organization or other user. It is also known as tailor-made, bespoke software. Customised software is characterized by the following:

- Takes a lot of time to write and test since requirements would be unique.
- Designed and written specifically for one company.

Advantages of customised software

- Designed to do exactly what the user wants.
- Can be written to run on user-specified hardware.
- Can be integrated with existing software

Disadvantages of customised software

- Time consuming to have it developed.
- Expensive since the one customer has to pay for all expenses. There are no economies of scale.
- There is limited support since nobody else would be using that software. 3rd party books not likely to be available.
- New staff unlikely to be familiar with software.

Having said all this for customised and off the shelf software, so which of the two should a company opt for? The choice for a company depends on their requirements. If a company's processes are standard and similar to those of others in industry, then off the shelf software would be ideal. However if a company has unique requirements then custom software would be way to go.

ICT Activity 1.3

In pairs, using MS Word, write a report to your school head suggesting the software that your school needs for learning purpose. Clearly state the function of each software and also indicate whether it is custom made or off the shelf

ICT Activity 1.4

In pairs, find out the version of the:

1. Operating system on your computer or laptop.
2. Application software installed on your computer or laptop.



a) Stand-alone Operating Systems

A stand-alone OS is one that works on a desktop. This type is the opposite of a Network Operating System. A stand-alone OS provides its services to just one computer at a time. Examples of Network Operating Systems are: Windows 2000 Professional edition, MS-DOS and Windows ME to mention a few.

b) Network Operating Systems (network OS or NOS)

These are designed to support computers and peripheral devices e.g. keyboard, that are connected in network. Such Operating Systems enable the sharing of data files, application programs and other services such as printing, over a Local Area network (LAN). Examples of Network Operating Systems are: Windows 2000 Server, UNIX, Netware, LINUX, and Windows .NET server to mention a few.

c) Embedded Operating Systems

These are operating systems designed for embedded systems. Embedded systems are specially designed computers that are found inside other gadgets or equipment. Examples of embedded systems are mobile phones, washing machines, microwave oven, ATM and digital cameras to mention a few. Therefore operating systems that run in such devices are known as embedded operating systems. Examples of embedded operating systems are Palm OS, Android OS, Windows CE, iOS, Symbian OS, Blackberry OS and Pocket PC 2002.

It is important to know the name and type of the Operating system running on your computer, laptop or smart phone.

Activity 1.5 Practical

1. With the assistance of your teacher, work in pairs to:
 - a) Identify the name of the Operating System on your computer or laptop.
 - b) Identify the manufacturer of your computer or laptop.
2. Ask your parents to help you identify the operating system running on their smart phone.

Utilities

These are software programs that are used for effectively managing a computer system. These can be referred to as "house-keeping tools". In other words utility software are programs which either improve the functioning of the operating system or supply missing or additional functionality. Utility software performs tasks such as:

- Backing up files.
- Compressing files e.g. WinRAR, WinZip.
- Decreasing the size of files, resulting in faster downloads.
- Searching for and managing files.
- File management functions such as : Copy files; Determine how and where files are stored and Delete files
- Search utility—enables you to locate files.
- Providing anti-virus protection - antivirus software protects the computer from viruses. Examples of antivirus programs are BitDefender, Kaspersky, Norton, and ESET Nod32 Antivirus.
- Help utility - used to provide tutorial assistance. Help can be in the form of general help or context-specific help



Questions

1. Name one African country that heavily uses pirated software.
2. Identify one crime that is closely related with software piracy.
3. List three ways of identifying pirated software.
4. Give reasons why software piracy is high in Zimbabwe and low in the United States.
5. Suggest two measures that can be implemented by a software developer that prevent copying of software.

Glossary

Applications software: programs that enable the user to achieve specific objectives such as create a document, use a database, produce a spreadsheet or design a building.

Custom software: software that is specifically developed for some specific organization or other user.

Freeware: copyrighted software given away for free by the author and is distributed without its source code so that users cannot modify it.

Off the shelf software: ready-made software that you purchase. Examples are Microsoft Office e.g. Microsoft Word, Microsoft Excel and others.

Open Source Software: computer software whose source code is available under a license that permits users to use, change, and improve the software, and to redistribute it in modified or unmodified form.

Operating System (OS): part of systems software that provides a communication medium between application software and computer hardware. Examples are Windows 10, LINUX, MacOS, Android

Programming: the process of writing (developing) computer instructions (software) and the person who does that is known as a programmer.

Proprietary software: non-free software, is software with restrictions on using, copying and modifying as specified by the proprietor (owner).

Shareware: software that is freely distributed for a trial period, for example 14 days or 30 days, after which one is required to pay for a license.

Software: instructions that a computer needs in order to process data given to it.

Software counterfeiting: making imitations of software. Such software is usually copied onto CD-ROMS / DVD-ROMS.

Software licensing: describes the legal rights concerning the authorized use and distribution of software. It comes in two forms, namely, Proprietary software and Open source software.

Software piracy: the illegal copying of copyrighted software.

Systems software: a group of programs (software) that is almost always sold together with the computer. In other words it helps you manage and control the hardware of your computer system.

Utility software: computer programs that are used for effectively managing a computer system. These can be referred to as "house-keeping tools". Examples are the Help utility, file management functions, for example, copy files, delete files.



Figure 2.3 Use of computers in airlines

Figures above both show the cockpit of a plane. This is where the pilots will be seated. All the controls and control information is given on the screen as seen in the pictures. Notice that there are several small display screens and control buttons used by the pilot.

Traffic lights: we find many intersections in towns being controlled by robots or traffic lights. Computers are used to control those lights and their sequence.

Public transport: here computers work in more or the same way as in airplanes. In this section we are looking at transport such as buses, rail transport, trains, and ships. Computers are used to monitor problems, seat reservations and electronic payment. We now no longer need to physically go to the station to buy a ticket. Tickets can now be bought online in the comfort of your home or office using the Internet and credit cards. We also now have cars that can drive themselves using the computers built inside them. Computers also enable us to be entertained whilst travelling as shown in figure 2.4.



Figure 2.4 Computerised plane chairs

2. **X-rays and CT Scans:** Computers are used to produce images of a patient's internal structure. You have heard of people talking of having an x-ray when they have a broken hand, leg or back bone. These x-rays help the doctors to see the internal parts of your body e.g. where the fracture may be located or how a baby is situated inside the mother's womb. See figure 2.6.
3. **Monitoring patients:** Computers record blood pressure, pulse rate and oxygen levels. They compare the records to the normal expectations and report any differences so that the doctor or nurse can take corrective action. This is possible because computers now have inbuilt intelligence. Internal computers inside machines interpret data and give information for decision making. Such systems include hospital bed beeping and alarm systems which sound to alert nurses of a serious bed condition.
4. **Surgery:** Computer systems enable surgeons to use computer and software technology for controlling and moving surgical instruments through one or more tiny incisions in the patient's body. You will develop a better understanding of this a later in the chapter when we will be looking at robotics.
5. **Internet connectivity:** Computer networks provide real-time consultations. Networks provide faster communications between doctor and patient. Doctors in different places can work together and share important information quickly.
6. **Diagnostic Databases:** Computers can store diagnostic information for patients. This information can then be used as reference in future cases.
7. **Medical research:** We use computers and the internet to develop new knowledge in the field. We discussed the use of computer science in chapter 2 of our book one.

Computers in environmental management

Our environment is very important. It is the natural world around us. Imagine living on your own with no people to interact with, no animals, plants, air and water. Surely there will be no life to talk about. We therefore, need to take good care of our environment so that our lives will be enjoyable.

Environmental issues that need management

- Population growth has led to an increase in industrial activity which in turn has led to environmental pollution (air, water and soil)
- Severe weather events. These are caused by climate change. Climate change is caused by global warming. Global warming is caused by an increase in greenhouse gas emission from human activity such as industries, cars and deforestation. ICTs may reduce climate change by developing more energy efficient devices, applications and networks. Environmental friendly design of computers is also a good development in the management of our environment.

Activity 2.8 Discussion

Study figure 2.8 and discuss with your friend what is taking place in each picture. Write down your answers.



Figure 2.8 Environmental sustainability targets

Introduction

Computer networks have become part of lives. Since computers were able to communicate with each, especially on a global scale, human life has been revolutionised. Social media has dramatically changed communication and interactions between people. Which social media do you constantly use, and for what purpose? List any five examples of social media that you know. In Book 1, we covered networking concepts, types of networks, network topologies and internet services. In this book, we shall look at data transmission modes and media, types of networks and ISPs.

Activity 4.1 Research

Using your phone, tablet or computer, visit the link <https://www.google.co.zw/> and search for the definitions of *computer network*, *transmission media*, *Internet Service Provider*. Rewrite the definitions in your own understanding.

Case study

Form 1 boarding school applications now open

(by Nqobile Tshili, Bulawayo Bureau, 13 November 2017)

GOVERNMENT has opened online applications for 2018 Form One boarding school places with limited places on offer. Parents and guardians can start applying online today for their children intending to go to boarding school next year. Government introduced online applications last year after realising that parents were being short-changed by some schools.

In a statement yesterday, the Ministry of Primary and Secondary Education said there are only 24 246 Form One boarding school places against a potential demand of 367 629. "The Ministry of Primary and Secondary Education successfully launched (EMAP) Electronic Ministry's Application Platform for Form One boarding places enrolment in 2016. The advantages of using the platform among others include, time efficiency, corruption minimisation, zero registration cost and convenience of applying online safely and securely without leaving the comfort of your home. Parents/guardians who wish to send their children to boarding schools are advised to start applying through the platform (www.emap.co.zw) with effect from Monday November, 13, 2017," reads the ministry's statement. There is vast gap between the demand for boarding places and the number of boarding places available in the country. The total number of Form One boarding places available for the 2018 is 24 246 and the potential number of applications is 367 629."

The ministry said applicants can only apply at five schools and once offered a place in one of the schools, they will not be considered at the other schools. Successful applicants will be notified when 2017 Grade Seven Zimbabwe School Examinations Council (ZIMSEC) results are released. "Enrolment by school heads will only start when the Grade 7 results are published by ZIMSEC. Successful applicants will be notified through short message service (SMS) by the representative school heads," reads the ministry's statement.

[Source: <https://www.herald.co.zw/form-1-boarding-school-applications-now-open/>]



Transmission media can also be referred to as communication media. In computer communication, transmission media are broadly classified into two – bounded and unbounded media. Bounded media is also called guided media whereas unbounded media is also known as unguided media.

Bounded Transmission Media

Bounded media is synonymous with guided media or wired media. Bounded transmission medium refers to any data transmission medium that confines data signals to a specific path using wire or cable. It is therefore, also referred to as wired medium. Any data signals traversing bounded media are directed and contained by the physical limits of the transmission media. Examples of bounded media are fibre-optic cable, coaxial cable and twisted pair cables.

Twisted Pair Cable

Copper wires are commonly used for signal transmission due to their good performance and low cost. However, they are susceptible to signal interference if there are at least two wires lying together. This signal interference is called electromagnetic interference and may result in distortion of communication. To reduce electromagnetic interference in copper cables, pairs of copper wires are twisted together, hence the name twisted pair cables.



Figure 4.2 Twisted Pair Cable

Characteristics of Twisted Pair Cable

1. It is relatively cheaper – twisted pair cable is the cheapest compared to coaxial and fibre optic cables.
2. It has low noise immunity.
3. It can be affected by external magnetic interference.
4. It has the lowest bandwidth compared to coaxial and fibre optic cables.
5. The maximum cable length between hub and computer is 100 metres.

Coaxial Cable

It is an insulated copper wire with mesh wire shielding and insulating cover. It may be referred to as coax. It has high capacitance, meaning, it has good signal propagation. Moreover, it has low electromagnetic interference (low noise), it is bulky and stiff to bend.



Figure 4.3 Coaxial cable

Characteristics of Coaxial Cable

1. It has higher immunity to noise than twisted pair cable.
2. It is less affected by external magnetic field.
3. It is more expensive than twisted pair cable but less expensive than fibre optic cable.
4. It has higher bandwidth compared to twisted pair cable but lower than that of fibre optic cable.
5. The maximum cable length between hub and computer is 500 metres.

Fibre-optic Cable

Optical fibre cable is similar in construction to the coaxial cable, but it is faster and more expensive. It has a very narrow strand of glass called glass core, plastic buffer, Kevlar cushion and plastic shield. It has very high transmission speed and very high capacity.



Figure 4.4 Fibre optic cable

Services Offered by ISPs

1. They act as an interface between their clients' computer systems and the Internet. This is usually done through dial up service, DSL (Digital Subscriber Line) service and cellular data service)
2. Provision of a direct link between an organisation's network and the Internet.
3. Provision of Internet services such as electronic mail (e-mail), web hosting and also web designing.
4. They connect their clients to the nearest Internet gateway.
5. Provide a modem (modulator-demodulator) for dial up connections.
6. Provide security to their clients. This is achieved by stopping the spread of viruses and other malware by applying antivirus systems for their customers.

Glossary

Bounded transmission medium: any data transmission medium that confines data signals to a specific path using wire or cable.

Duplex transmission mode: one that is both bidirectional and simultaneous.

Half-duplex transmission mode: one in which sending and receiving of signals is bidirectional on a single channel but not simultaneous.

Local Area Network (LAN): computer network that covers a small geographical area such as an office, classroom, laboratory, home or a small group of buildings such as a school, university, hotel or airport.

Personal Area Network (PAN): an interconnection of personal devices (for example cell phones, tablets, cordless mice, cordless keyboards and laptop) over a small area surrounding a single user.

Simplex transmission: the transmission mode in which the flow of data signals is unidirectional.

Transmission media: communication media.

Unguided medium: transmission medium in which data signals flow through the air. It is often referred to as wireless transmission.

Wide area network (WAN): computer network that covers a broad geographical area, that is, any computer network whose communication links span across city (town/metropolitan), regional or national boundaries.

Summary

- The Internet has become an integral part of our everyday lives.
- The mechanism of transferring data between networked devices is called a data transmission mode.
- There are basically three modes of data transmission namely simplex, duplex and half-duplex transmission modes. The differences between these modes are on the direction of data flow and whether there is simultaneous sending and transmission using the same channel.
- In simplex transmission, the flow of data signals is unidirectional whereas in a half-duplex transmission mode the sending and receiving of signals is bidirectional on a single channel but not simultaneous. On the contrary, a duplex transmission mode allows bidirectional and simultaneous transmission on the same channel.



End of term one assessment

Paper 1: multiple choice

1 Hour

Each question carries 1 mark

1. Which of the following is not an operating system?
A. Linux B. Windows 10 C. UNIX D. Microsoft Office
2. Which of the following is not a Microsoft product?
A. Windows 10 B. MS- Access C. ASCUDA D. MS- DOS
3. Microsoft Excel is an example of
A. An operating system B. A processing device
C. Application software D. An input device
4. A program designed to perform a specific task is known as.....
A. System software B. Application software
C. Utility programs D. Operating systems
5. Tasks usually performed by the computer include?
A. Drawing a picture, typing a letter and perform calculations.
B. Word processors, spreadsheets and graphic packages.
C. Hardware and software used to process data.
D. All of the above.
6. The following is an example of a computer peripheral?
A. The CPU B. The Motherboard C. The Keyboard D. RAM.
7. Why do people use computers?
A. For their data processing speeds, accuracy, storage capacity and ability to work for long periods.
B. Computers are very fast and not very accurate.
C. Computers work for long periods without the need for maintenance.
D. Computers stores large amounts of data.
8. Which of the following is NOT a type of operating system software?
A. Windows B. Linux
C. Macintosh D. Communications and Organization
9. The term "click" means.....
A. turning the computer on. B. pressing the left mouse button one time.
C. turning the computer off. D. the sound a hard drive makes.
10. The Windows 7 operating system uses a GUI, which stands for:
A. guided user interaction B. graphical user interface.
C. graphics utility interface. D. graphical utility interaction.





Types of feasibility study

There are different types of feasibility study and all have to be carried out every time a new idea is implemented. These are technical feasibility, economic feasibility, social feasibility, legal feasibility and operational feasibility. Let us now look at each of these types of feasibility study one by one.

Activity 6.2 Individual work

Write down what you think we will be looking for when carrying out each of the different types of feasibility study.

Technical feasibility

This type of feasibility study details how the product will be delivered; the study includes materials, labour, transportation, technology used. We need to establish whether it is possible to develop the system with the current technology. We then identify any technical risks that are likely to be encountered. In technical feasibility, we also establish the availability of the technology. We ask ourselves if the technical resources needed are available. In other words, we check if the required resources can be obtained locally, do we have the money to pay for them? We need also to find out whether the new system will be compatible with other systems in the organisation. The other questions that we need to answer in doing technical feasibility are;

- Do we have the necessary technology?
- Do we have the necessary expertise in form of the people who will develop and use it?
- Does the company have the technological resources to undertake the project?
- Are the processes and procedures conducive to project success?
- Do the hardware and software available have the ability to support the new system?

Economic feasibility

In carrying out economic feasibility we ask ourselves one main question; is the project possible given the resources available mainly money. The main task of this type of feasibility is to identify and quantify all the benefits that will be derived from the project and all the expenses in obtaining the system.

Benefits

- Identify all tangible and intangible benefits from the system.
- Quantify all these benefits (that is put the benefits in term of cost).

Expenses

- Identify all expenses in coming up with the system (development costs and operational costs) and put them in monetary terms.

Then compare the total benefits and total expenses.

That is: total benefits minus total expenses

If the benefits are more than the expenses then the project is economically feasible. If the expenses are more than the benefits then it is not worth carrying out the project. Economic feasibility is sometimes called cost/benefit analysis since we compare the two.



Case study

Your school is using a manual system for accepting payment of school fees and levies. Parents come and pay cash at the bursar's office. The bursar records the payment in the different receipt books (bus levy, school fees, practical fees, sports fees and so on). The School Administration headed by the School Head Mistress have decided to buy a new system that uses the computer to do all these activities. Parents will no longer come to school with cash, rather they make bank transfers using either their computers or smart phones. The computers and smart phones will have a software application that is linked to the school fees system in the Head Mistress' office. The bursar can access what is in that computer through her desktop computer. When making a payment, the parent will indicate the amounts and the accounts being paid. The computer system puts the amounts in their respective accounts for example school fees, sports fees and so on. The bursar or the Head can at any time command the computer to give a report of the fees paid and the amounts not yet paid. If a student wants to be cleared either for the purposes of getting different facilities in the school or transfer, the Head will simply enter the name and class of the student and the system shows the money that was paid for that student. If some of the money was not paid, then the student is asked to pay before given the facility or transfer.

1. Do a feasibility study for replacing the old system with a computerised one. Make sure you do the different types of feasibility.
2. Provide recommendations to the school administration.
3. Suggest any risks that are likely to occur if the new system was to be developed and implemented without a feasibility study.

ICT Link

<https://slideplayer.com/slide/4096709/>

<http://ecomputernotes.com/software-engineering/feasibilitystudy>

<http://www.bcanotes.com/Download/sad/System%20Analysis%20And%20Design/Feasibility%20Study.pdf>

Glossary

Cost/benefit analysis: a process of comparing the costs of building something and the benefits that will be obtained from its use. It is advisable to build only those things that have more benefits and less costs.

Environmental implications: effects that something has on the surrounding in most cases negative or a disadvantage.

Ethical approach: a way of doing things in a controlled way so that values of the profession or society are upheld. It ensures that the process or product does not harm the people.

Feasibility: viable or doable under the available conditions.

Feasibility report: a document that contains all the results of the feasibility study.

Introduction


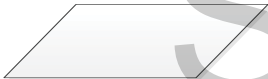
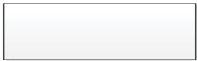
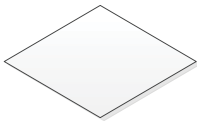


Algorithms are the building blocks of any computer program. Whether a computer performs tasks correctly or not is heavily dependent on the algorithm(s) implemented. Poorly designed algorithms can have detrimental effects depending on the criticality of the computer program. People may lose lives, institutions may make huge losses and a company may be sued because of computer programs that failed to work properly. In this chapter, you are going to learn about algorithm tools.

Algorithm Tools

To write algorithms, we can use flowcharts and/or pseudo code. In this section you are going to learn about pseudo code, flowcharts and selection statements.

Flowcharts

Algorithms can be represented using diagrams called flowcharts. A diagram that represents an algorithm or process is called a flowchart. There are basically six symbols that are used to draw flowcharts, and these are shown below.

Symbol	Symbol Name	Description
	Terminal (Start/Stop)	It indicates the beginning or ending of a program/ algorithm.
	Input/ Output (Data)	It is used to represent an Input/ Output (I/O) operation. It represents data needed or produced by the program, that is, input taking or output displaying.
	Process	It is used to represent any type of internal operations such as initialisation of variables, mathematical calculations
	Decision	It represents a branching condition. It is used for asking questions that can be answered as TRUE/FALSE or YES/NO. A different course of action will be taken depending upon the answer. If both of answers (YES and NO) lead to the same course of action, then there is no need to have a decision.
	Control flow/ Direction	This shows the direction of flow from the start to the end of a program/ algorithm.
	Connector	Its use is to connect breaks in flowcharts

ICT Link

For further reading about guidelines for modularisation, you can visit the following links (URLs):

https://www.eecs.yorku.ca/course_archive/2013-14/F/3311/slides/14-Modularity.pdf

<https://www.dre.vanderbilt.edu/~schmidt/PDF/dp4.pdf>

Writing Modularised Programs in VB.Net

Visual Basic.Net (VB.Net) supports the writing of programs in modules and/or classes. In other words, it supports modularisation of programs. A VB.Net program can be thought of as a hierarchical arrangement of containers that allows for readability of a program. In one way, this can be represented as shown below:

Project

Class (es) / Module(s)

Function(s) / Sub-routine(s)

A project is made up of modules and/or classes that contain functions (sub-routines or methods) or other classes.

Modules versus Classes in VB.Net

It is important to understand how these types of containers differ in their use before we move on to the next discussion.

When we create a new Console Application Project in VB.Net, the project code is loaded by default onto a special form called a Module. The module names are suffixed with a number by default. That is, the first module you create will have the default name Module1, the second module will be Module2 by default, and so forth. However, you can rename the modules to any name of your choice as long as the name is valid. A valid module name follows the same rules as those of identifiers.

A module can contain one or more classes, and a class contains one or more functions or sub-routines. It is also possible to add another class or module onto a project. Making use of these containers allows separation of code (modularisation) so that it is more readable. When certain sections of the code are to run, they can then be called from a calling class, function or sub-routine.

Activity 8.2 In pairs

Nyabiko Private College wants to a computerised student management system. The system must allow users to be able to manage student (including capturing new students' details, editing or updating and deleting students' details), manage students' results (including capturing, printing and editing results), manage student fees (including billing students, receipting fees payments) and allocating hostel rooms to students.

Required: Derive modules from the scenario above; and then list the functions/ sub-procedures you could include in each of the derived modules.

```

diff = Subtract(val1, val2) 'Assign returned result to variable
prod = Multiply(val1, val2)
div = Divide(val1, val2)
Console.WriteLine("The sum of the 2 values is: " + sum.ToString) 'Displaying the values contained in the
variables
Console.WriteLine("The diff of the 2 values is: " + prod.ToString)
Console.WriteLine("The prod of the 2 values is: " + diff.ToString)
Console.WriteLine("The div of the 2 values is: " + div.ToString)
Console.ReadKey()
End Sub
Public Function Add(val1, val2) 'Function 1
Return val1 + val2
End Function

Public Function Subtract(val1, val2) 'Function 2
Return val1 - val2
End Function

Public Function Divide(val1, val2) 'Function 3
Return val1 / val2
End Function
Public Function Multiply(val1, val2) 'Function 4
Return val1 * val2
End Function
End Module

```

The code above includes comments that aim to explain the code that has been implemented.

Example 8.3

Now let us further separate the code by putting the functions for the operations in a separate class or module. We will then call these functions from the main method. We therefore, need to declare the class or module into which we are going to place our functions in the main method and make reference to the declared object when calling the functions. To add another class into our project, we do so from the solution explorer as shown in figure 8.1.

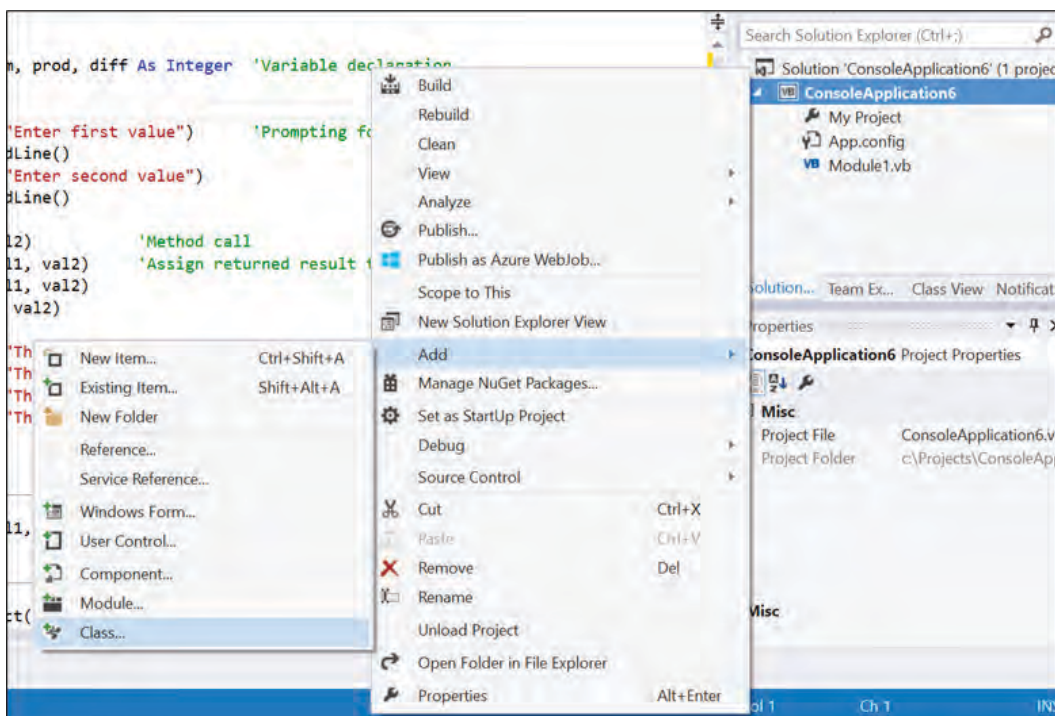


Figure 8.1

Forms

Given the Web Browser application above, suppose we want to add code for the exit button such that if the user clicks on this button, another window will open which is simply written "GOODBYE WORLD".

First let us add the form and design it.

Adding the form:

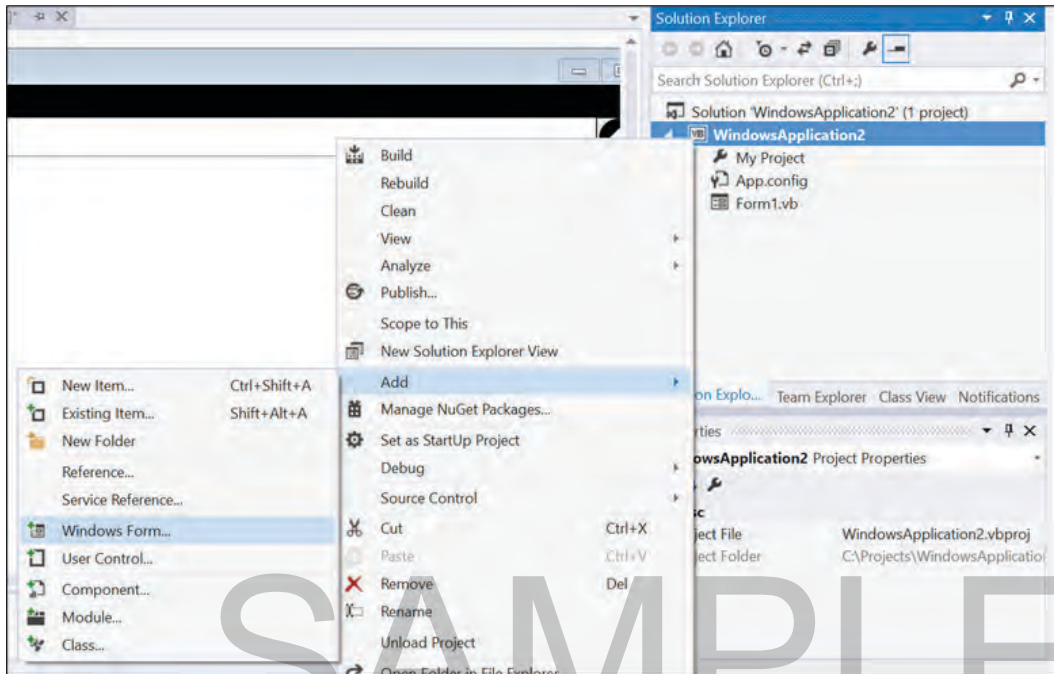
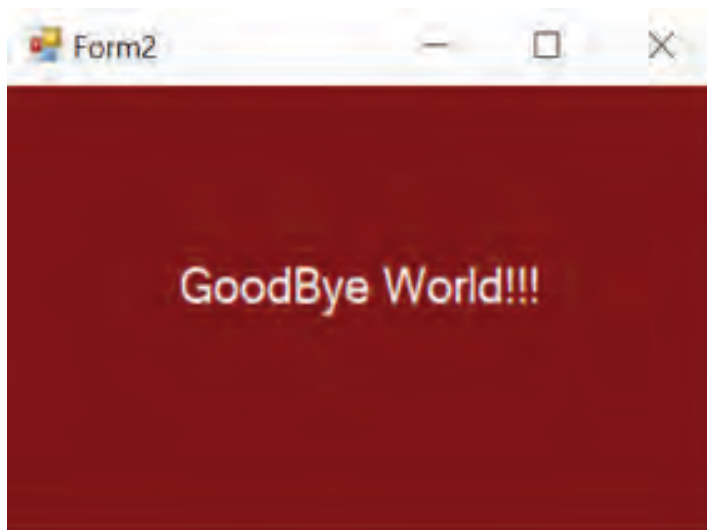


Figure 8.5

When you click on "Windows Form", the form is added onto our project. Now let us design the form.



We also need to add an event handler for the button click event of the button we just added. The code for this button should be as shown:

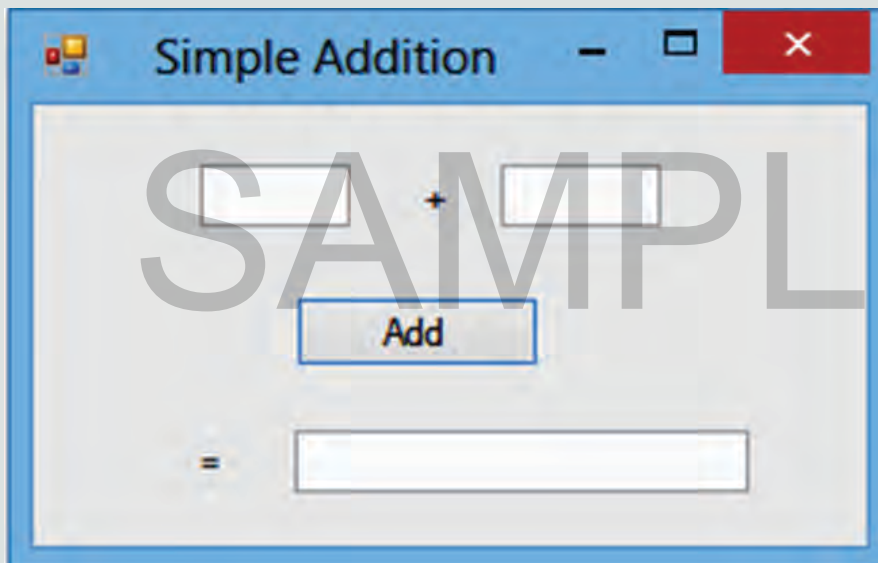
```
Private Sub btnExit_Click(sender As Object, e As EventArgs) Handles btnExit.Click
    Form2.Show()
End Sub
```



Use the following code snippet to answer questions 19 and 20.

```
Sub Main()  
Dim a As Integer = 5  
    Console.WriteLine("A is " a)  
    Console.ReadKey()  
End Sub
```

19. Which of the following is the best description of the error above:
- A. 5 is not an Integer
 - B. The spelling of WriteLine is wrong
 - C. The brackets after the ReadKey should be removed
 - D. A comma (,) is missing before a in the Console.WriteLine() statement.
20. What type of error is shown in part (19) above?
- A. Design-time
 - B. Run-time
 - C. Logic
 - D. Syntax
21. What type of project can be used to create the interface shown below:



- A. Windows application
 - B. Console application
 - C. Class library
 - D. Portable class library
22. What is the name of the IDE environment window which contains all the tools used to create your interface?
- A. Error list
 - B. ToolBox
 - C. Solution Explorer
 - D. Properties
23. What is the name of the window used to specify properties of your controls?
- A. Error list
 - B. ToolBox
 - C. Solution Explorer
 - D. Properties
24. Which of the following windows are useful for debugging your program?
(Choose all that apply)
- A. Command window
 - B. Quick Info
 - C. Error list
 - D. Code definition

A system to be developed has the following costs and benefits.

Costs	(\$)	Benefits	(\$)
Hardware hire	20000	Goodwill	2400
Labour (20% of hardware hire)		licensing	30000
Software purchase	10000	Maintenance	40000
Rent	3000		
Electricity (3% of rent)			

3. a) Define the following terms:

Flowchart [2]

Pseudo code [2]

List any two algorithm design tools that you know. [2]

Explain the purpose of algorithms in computer programming and problem solving. [5]

Explain, giving examples any 2 selection constructs that you learnt in this chapter. [10]

4. Which HTML tag would you use for each of the following?

a) Creating an ordered list [2]

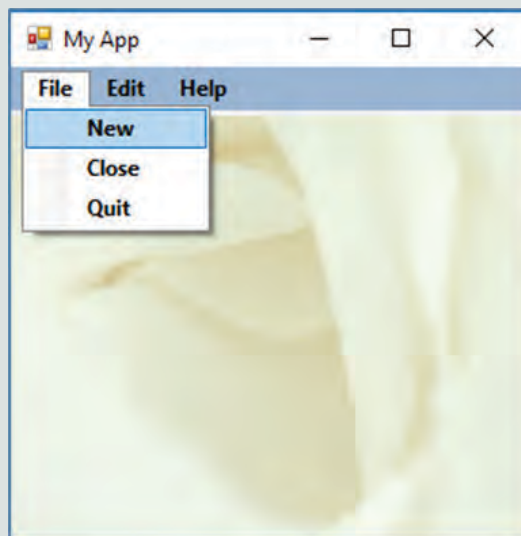
b) Creating a table [2]

5. Write pseudocode for a program that solves the following situation:

a) Accepts two integers from a user and determine which of them is bigger.

b) Accepts a person's height and weight and calculates their BMI (Body-Mass-Index). If the BMI is less than 18.5, display the message "You are underweight", else if it is between 18.5 and 25, display the message "Your weight is normal", else if it is more than 25 but less than or equal to 30, display the message "You are overweight" and else if it is above 30, display the message "You are obese". BMI is calculated as w/h^2 where h=height in metres and w=weight in kilograms. [10]

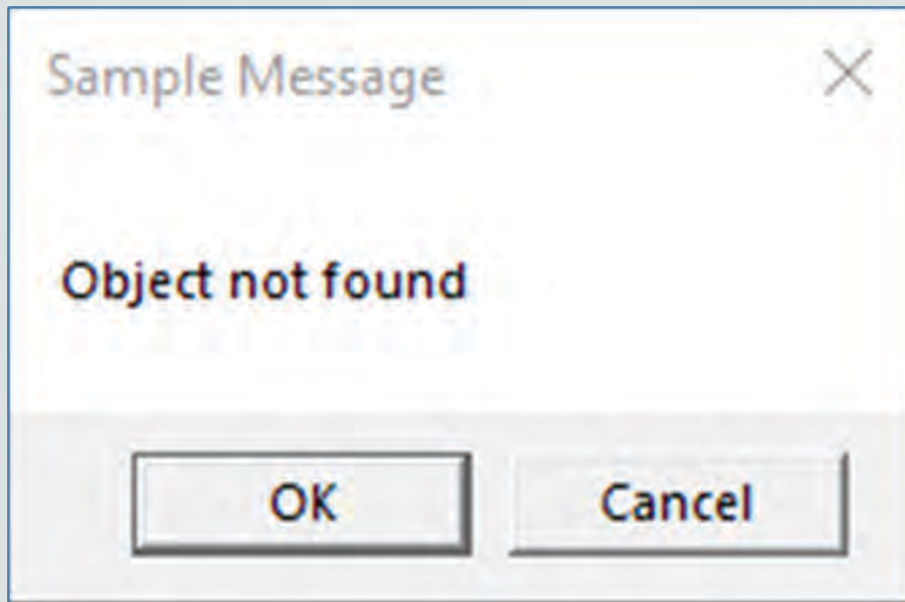
6. Design the interface shown below: [8]



Question 13

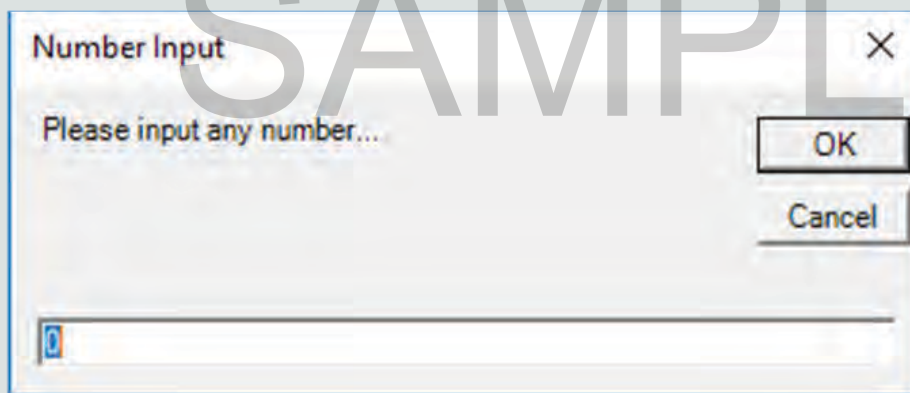
Write a single statement to do the following:

a) Display the message box shown below: [4]



b) Round the value 3.5 to the nearest whole number. [3]

c) Display the input box shown below: [3]



Paper 3 2 Hours 30 minutes

Answer all questions

Question 1

Design a flowchart for a program that:

a) Accepts two integers from a user and determine which of them is bigger.

b) Accepts a person's height and weight and calculates their BMI (Body-Mass-Index).

If the BMI is less than 18.5, display the message "You are underweight", else if it is between 18.5 and 25, display the message "Your weight is normal", else if it is more than 25 but less than or equal to 30, display the message "You are overweight" and else if it is above 30, display the message "You are obese". BMI is calculated as w/h^2 where h =height in metres and w =weight in kilograms.

[12]

Primary Key Entry

Data type of short text consists of alphabetic and numeric characters. You will notice that EC-Number starts with a letter followed by three numbers, hence we select short text as the data type of size 4 characters.

5. Type the next field name Teacher-Name and data type being short text.
6. Save table, and right click to open table. Enter information in Table 9.1 and save. See Figure 9.4.

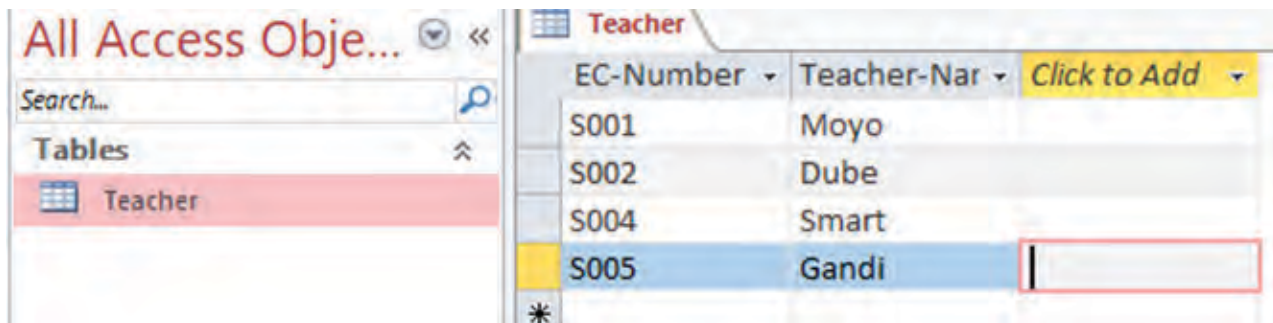


Figure 9.4

Teacher Table

7. Create Subject table see Table 9.2. Use Table 9.4 to select data types for field names. Note Subject-Code is the Primary Key. See Figure 9.5 for Table design.

Field Name	Data Type	Size
EC-Number	Short text	4
Lecturer-Name	Short text	
Subject-Code	Short text	
Subject-Name	Short text	
Mathematics 2	MTH2	

Table 9.4

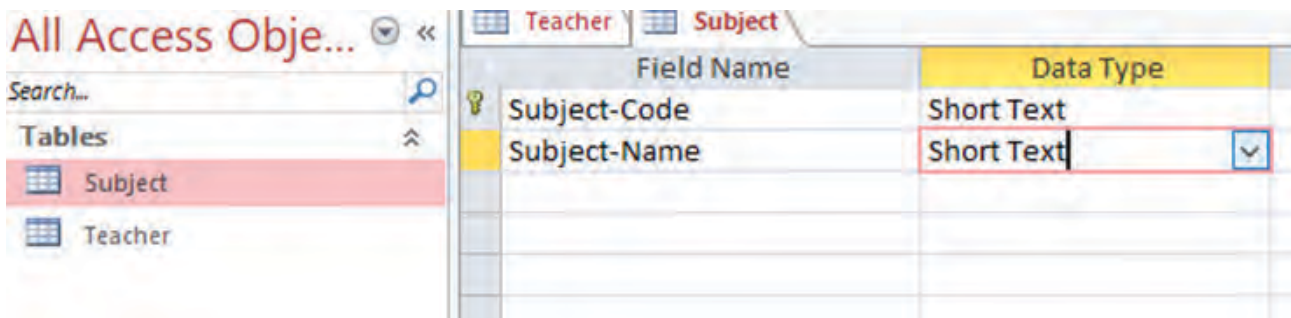


Figure 9.5

Subject Table Design

8. Save design and enter information in Table 9.2, see Figure 9.6.

10. Select table Subject where EC-Number field is housed, see Figure 9.8.

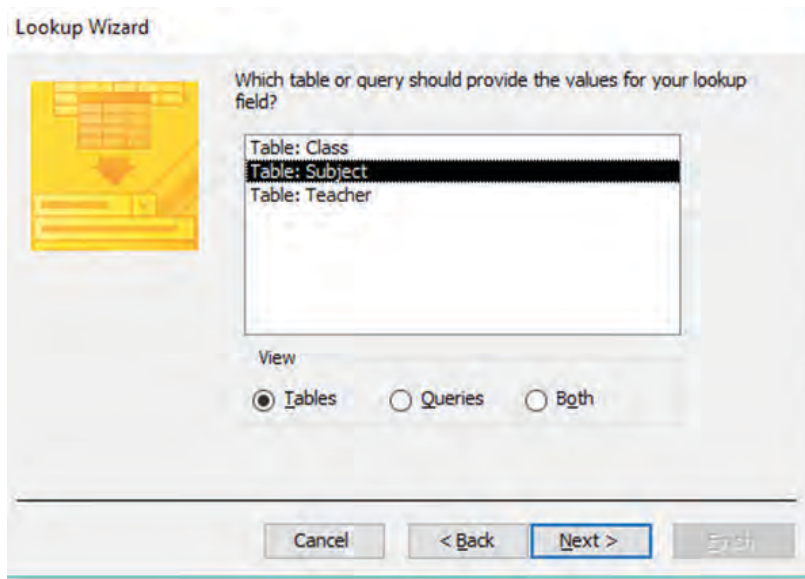


Figure 9.8

11. Select all the fields as shown in Figure 9.9

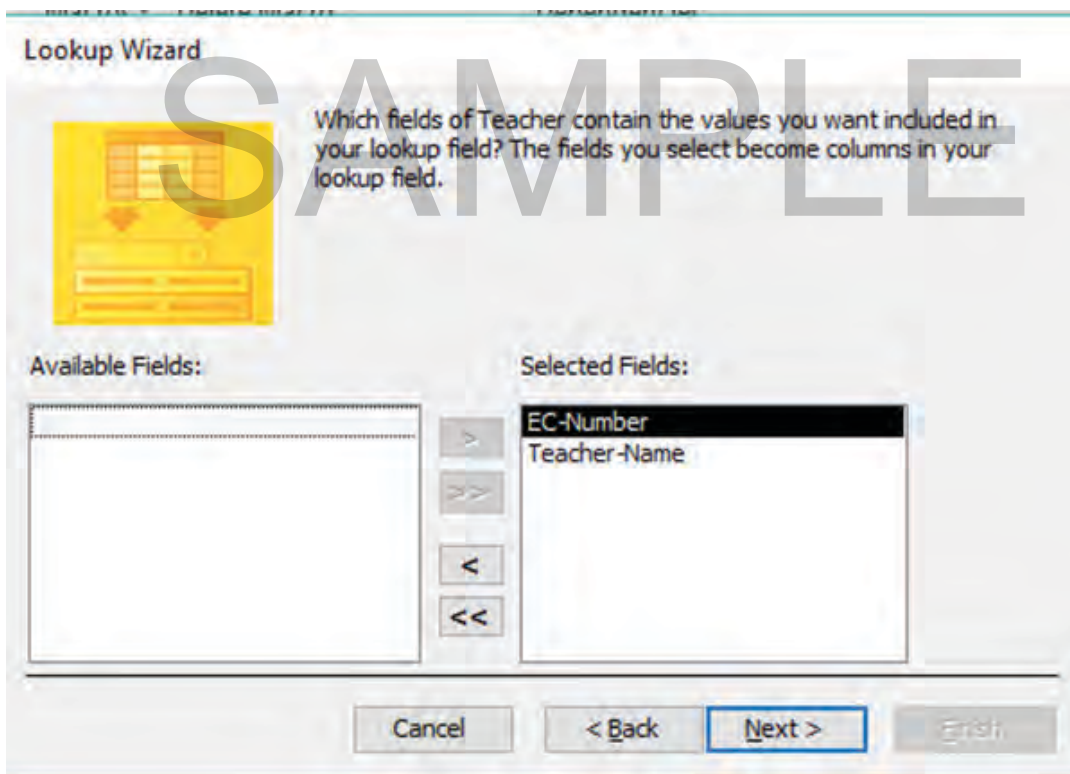
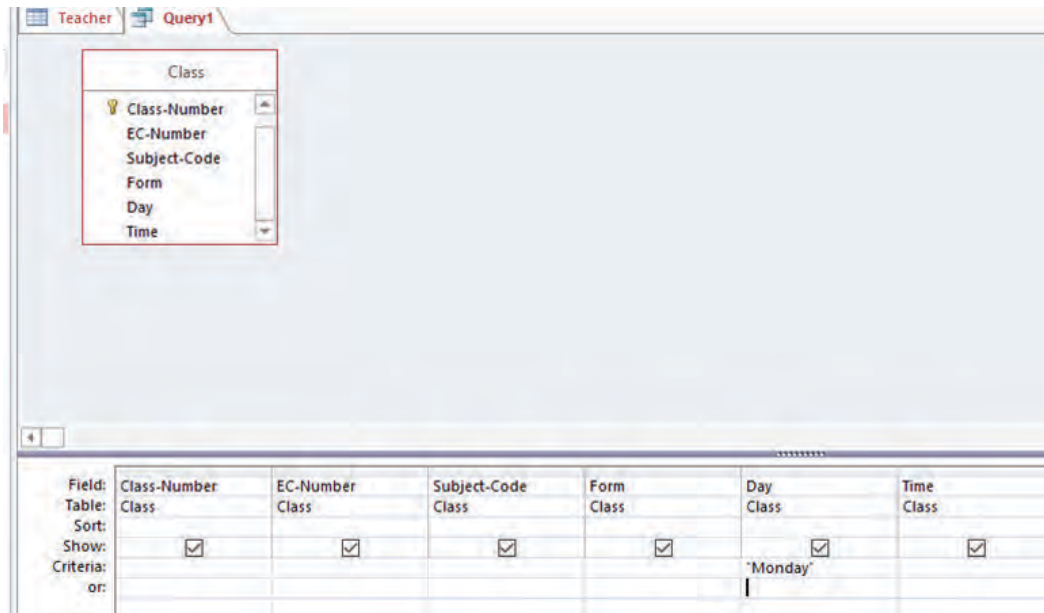


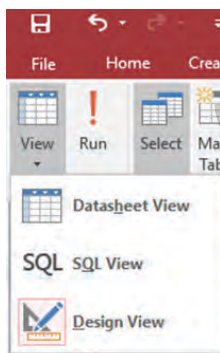
Figure 9.9

12. Select sort order as shown in Figure 9.10

- As indicated in Figure 9.21 Select all fields from the table Class. On field name Day type "Monday"



To preview your result, click the View icon and a drop down list appears that you can view your results as a table, view the SQL script and the design view as shown in Figure 9.22.



- Now Click the Datasheet view icon to view the results of the query in a table. The results are shown in Figure 9.23

Class-Numb	EC-Number	Subject-Cod	Form	Day	Time
C001	S001	MTH2	2A	Monday	08:00
C002	S002	MTH1	1A	Monday	08:00

Figure 9.23

- Click the SQL View Icon to view the commands. The commands are shown in Figure 9.24

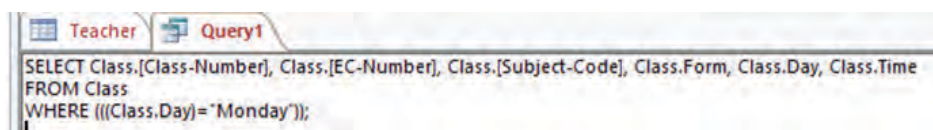


Figure 9.24

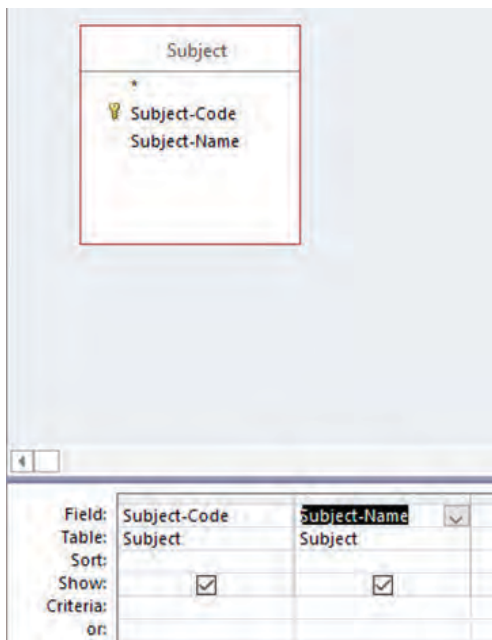


Figure 9.27

3. Select the Update Icon on the main menu as shown in Figure 9.28

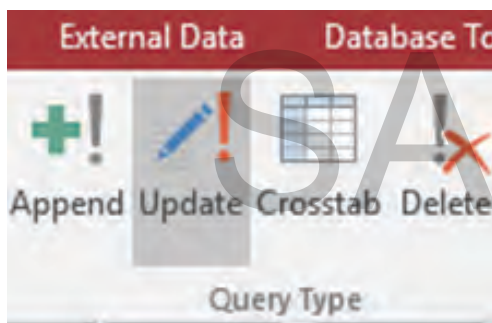


Figure 9.28

4. As shown in Figure 9.29 type "CT1" under Subject-Code on Criteria. Under Subject-Name type "Computing 1" on Update to.

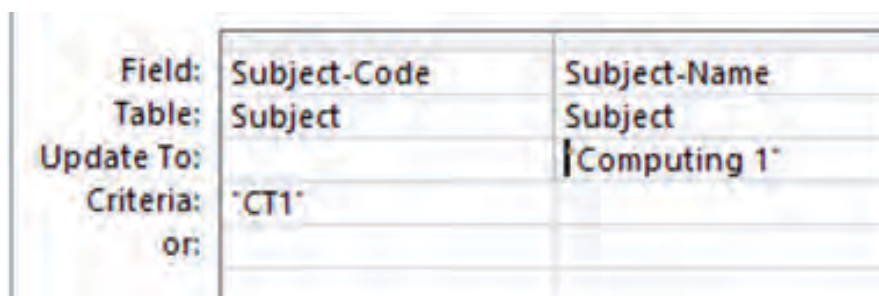


Figure 9.29

5. Click the SQL View icon to view the SQL command generated see Figure 9.30.

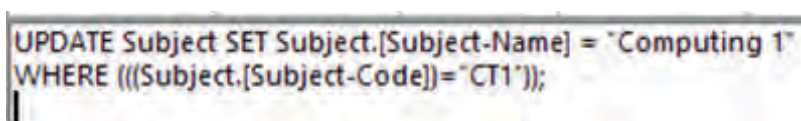


Figure 9.30

Query Builder Query Editor	
1 SELECT * FROM class WHERE Day = "Monday";	
Message	Result1 Profile Status
ClassNumber	SubjectCode ECNumber Form DAY Time
▶ C001	MTH2 S001 2A Monday 08:00:00
C002	MTH1 S002 1A Monday 08:00:00

Activity 9.10 In pairs

Write an SQL script to retrieve classes that are taught on Tuesdays only. Updating a Record Using MySQL

Updating is the same as modifying a record. To modify a record we use the format:
UPDATE table_name
SET column1 = value1, column2 = value2, ...
WHERE condition;

The subject name "Computer Science 1" is changed to "Computing 1". We want to modify all records in the subject table with such name.

1. To modify records, write the following script
UPDATE SUBJECT
SET SubjectName = "Computing 1"
WHERE SubjectCode = "CT1";
Note the condition references the primary key of the table.

2. The result of the script is shown in Figure 9.49

SubjectCode	SubjectName
▶ CT1	Computing 1
CT4	Computer Science 4
GPY4	Geography 4
HS3	Heritage Studies 3
MTH1	Mathematics 1
MTH2	Mathematics 2

Figure 9.49



Case Study

Database monitors are computer programs that observe changes in the contents of database objects, e.g. the current price of some commodity or the location of some ship. In addition to stored facts one often wants to monitor derived information, e.g. the highest paid employee in a department or the expenses of a department relative to its sales. Other monitoring applications include real time systems where a process is invoked or where a user is alerted upon pre-specified data changes.

Source: Risch, T. (1989). Monitoring Database Objects. Proceedings of the Fifteenth International Conference on Very Large Databases, (pp. 445-454). Amsterdam.

Questions

1. Define computer program
2. Define the term database
3. Define database object
 - a) State any four examples of database objects
 - b) Describe the function of each object
4. State and give an example of
 - a) Stored information
 - b) Derived information in a database
5. State application areas where real time systems can be used.

Activity 9.16 In pairs

Do this activity with your friend. Describe the advantages of using a Schools Database for enrolment described in the case study.

Fascinating fact

Did you know that Oracle was launched in 1980? This was the first most popular relational DBMS which gradually edged out earlier mainframe products such as IMS.

Source: Aequor Technologies (2015) 10 Interesting Facts About Database Management

ICT Link

<https://www.encyclopedia.com/science-and-technology/computers-and-electrical-engineering/computers-and-computing/databases>

<https://www.bbc.com/bitesize/guides/z37tb9q/revision>

http://ijarcse.com/Before_August_2017/docs/papers/Volume_5/5_May2015/V5I4-0780.pdf

HTML, CSS, sql and Javascript. Examples of content management systems include WordPress, JOOMLA and Drupal. In this section, we want to learn how to create and publish a website using WordPress.

The CMS can be used for numerous types of projects, including personal websites, small business sites, blogs, graphic design portfolio, advertisement sites, photography portfolio and online store.

Creating a website using WordPress

For us to start using WordPress on our local machine, there are certain requirements that we need before we can get started, namely:

A web server: A program that is able to serve the files that form Web pages to users, in response to their requests, which are forwarded by their computers' browsers.

A MYSQL Database: A database system which makes use of human-readable statements called (Structured Query Language) SQL as commands which enable manipulation of the database system and its content.

The web server and MYSQL database are all part of XAMPP software package, and so we will just install XAMPP for that purpose. This tutorial provides set-up instructions for installing WordPress on a local machine through 4 stages, namely:

- Installing and launching XAMPP.
- Creating a database.
- Installing the WordPress package
- Creating the website.

Publishing the website - Making the website available online

- Installing and launching XAMPP
- Download XAMPP from the following website: <https://www.apachefriends.org/index.html>
- Go to the Downloads folder or the default folder where your downloads are kept, and run the file by double-clicking on the file. When you double-click on the file, the following program will show on screen:



Figure 10.2

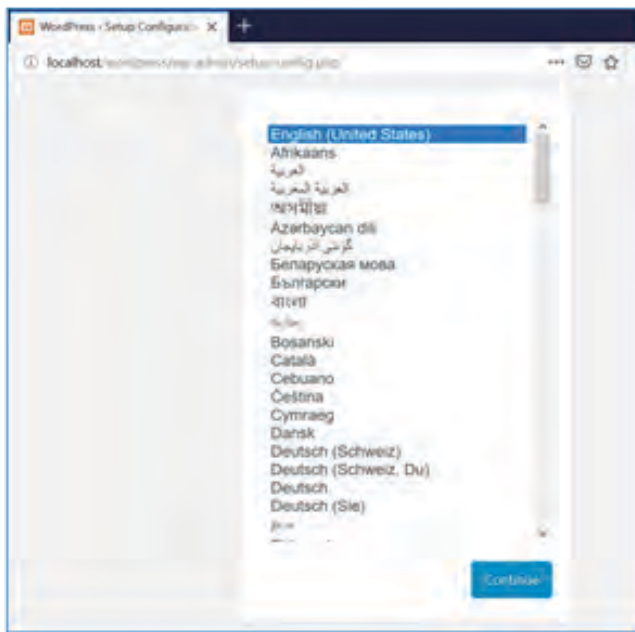


Figure 10.7

- From the screen, you would want to choose the language you are most comfortable with, then you click “Continue” towards the bottom of the page. The following screen will show (Figure 10.8):



Figure 10.8

- Here, just click on “Let’s go”.
- Fill in the next form as shown in figure 10.9:



26. Physical infrastructure of an organisation refers to _____.
A. all the human resources B. all the technologies
C. all structures such as buildings and space D. all computer software and hardware
27. Networking in an incubation centre is provided between the upcoming business people and _____.
A. buildings e.g. offices B. everyone
C. mentors, consultants and advisors D. people who want to make more profits.
28. In general, academic institutions promote technopreneurship by _____.
A. creating a culture of innovative thinking. B. inspiring a culture of innovative thinking.
C. nurturing a culture of innovative thinking. D. all the above.
29. Collaboration with the private sector means that an academic institution _____.
A. decides for the private sector.
B. works hand in hand with the private sector.
C. works for the private sector
D. is directed by the private sector.
30. Which one of the following is not an academic institution:
A. A school B. A church C. A university D. A private college
31. Which statement is true of an academic institution?
A. It must be registered
B. It must have at least one academic programme
C. It must have at most ten classes
D. It must own its premises.
32. Salami slicing means _____.
A. skimming small amounts of money from bank accounts.
B. stealing time slices from the employer time
C. agreeing with your workmates to steal from the company.
D. none of the above.
33. Who commits computer crime?
A. Hackers B. Crackers C. All sorts of people D. Competitors
34. Which of the following is not a computer crime?
A. Data diddling
B. Training your child on how to use a computer in your office at work.
C. Denial of service
D. Learning how to clean computer viruses.
35. In relation to computer crime, cost of counter measures is _____.
A. Money spent developing solutions to computer related crime losses.
B. Money used to buy computer software
C. Money invested in ICT equipment
D. Cost benefit analysis

