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MODULE I: INFORMATION SYSTEM AND DATA RESOURCE MANAGEMENT.

CHAPTER 1: INFORMATION SYSTEM (IS_s)

Lesson 1: Introduction to information system (IS)

Competences:

- define an information system;
- describe functional components of an Information System ;
- identify basic functions of an organization;
- describe Management levels within an organisation.

1. Definition

An **information system** is a set of integrated elements or components that collect manipulate and disseminate information and provide a feedback mechanism to meet an objective. The minimal information system consists of *people, procedures and data*. People follow processes to manipulate data to produce information.

CBIS uses computer technology as the main component of the IS of the organization e.g. *computerized library management system, computerized hospital management, computerized school management system, computerized reservation systems for: flights, hotels, and football matches, Employee and pay roll processing system.*

2. Components of an information system

Its component includes:

- **Data and Information:** data is the set of raw facts and figures representing events, objects, images, numbers, sound, etc. Information is data that has been processed into a form that is useful or has meaning.
- **Hardware:** This is physical technology that works with the information. Hardware can be as small as a smartphone that can fits in a pocket or as large as supercomputer that fills a building.
- **Software:** The hardware needs to know what to do, and that is the role of Software.
- **Networks** allow diverse computers to distribute resources. Connection can be through wires or wireless.
- **Databases and data warehouses:** A database is any collection of data organized for storage, accessibility, and retrieval whereas Data warehouse is a collection of data single or multiple sources within an organization for reporting and analysis. (*Database is designed to record data whereas the data warehouse is designed to analyze data*).
- **Procedures** are the commands for combining the components above to process information and produce the preferred output.
- **People (users):** People operate the computer hardware, create and use the computer software.

❖ Advantages of CBISs:

- Many people can access information at the same time through a network.
- Large filing cabinet is replaced by the computer's large storage capacity.
- Save time, resources and money by processing information automatically,
- Facilitate communication and resource sharing to multiple users over a network.
- Provide fast and accurate information to support decision making.
- Improve productivity.
- Reduces duplication of information.

❖ Disadvantages of CBISs:

- Security is needed to protect data/information.
- To use the system, the user has to be trained.
- Computers hold personal information which may be misused.
- Expensive to develop.
- If system crashes, all data/information can be lost.

3. Information system in the organization

An IS is an organized combination of people, hardware, software, communication networks and the data resources in an organization.

An organization is a social unit of people that is structured and managed to meet a need or to pursue collective goals.

a. Characteristics of an Organization

- It has a well-defined authority.
- It has a co-operative relationship.
- It has specific objectives.
- Division of activities and functions.
- It has a distinct identity.
- It employs some form of leadership.

b. Functions of an Organization

A good organization has to fulfill some functions which are:

- It must enable the management to maximize the outputs through provision of an efficient man-machine system.
- It must ensure smooth and effective network of communication and information.
- It must offer interesting and meaningful jobs to all individuals working in the organizations.
- It must create, maintain and develop its own image or individuality.

A typical organization would have **six functional areas**;

1. Accounting
2. Marketing
3. Human resource
4. Production
5. Research
6. Information Technology (I.T).

c. Level of management in an organization

There exist three levels of management typically found in an organization (see figure 1):

- **Strategic Management (Top-level):** it provides the organization with overall direction and guidance, setting goals and developing long term plans for the organization.
- **Tactical Management (Middle-level):** responsible for developing the goals, objectives and strategies based on the orientations outlined by strategic management.
- **Operational Management (Lower-Level):** They manage the day to day operations and implementations of the plans and strategies. Developed by tactical management.

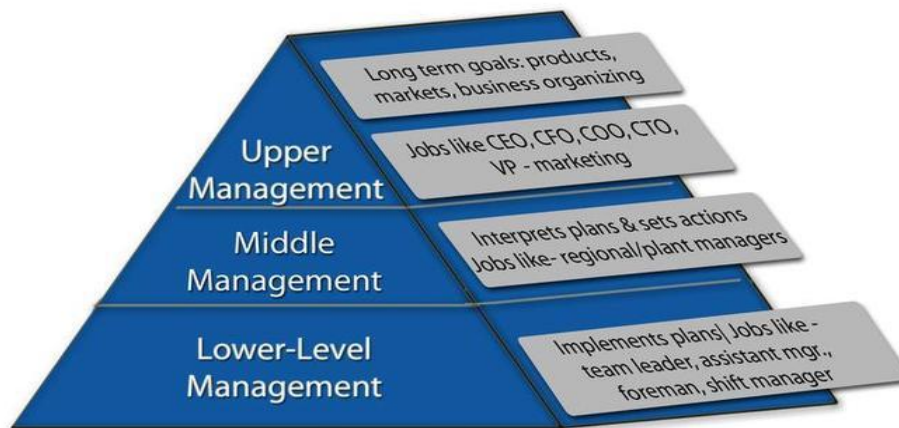


Figure 1: Management Levels in an organization

d. Information in an organization

It can be **internal, external, objective or subjective**. These are also called **attributes of information** in an organization.

- **Internal information:** it will describe specific operational aspects of the organization.
- **External information:** it describes the environment surrounding an organization.
- **Objective information:** it describes something that is known.
- **Subjective information:** it attempts to describe something that is currently not known.

e. Information's flow within management in an organization

Information flow with the different management levels of organization is typically; **vertical, upward, downward and horizontal**.

- *Downward flow* of information consists of strategies, goals and directives.
- *Upward flow* describes the current state of an organization based on its daily transaction.
- *Horizontal flow* refers to the information that passes among various dependents at a given managerial level.

In operational level, information flow is primarily vertical upward, from the supervisors to middle management or tactical management level.

In middle management, information flow is vertically upward to top management and downward to operational level, horizontal across different unit managers.

In top management, information flow is vertically downward as strategies tactical management, upward to reach external partners and horizontal amongst members of top management.

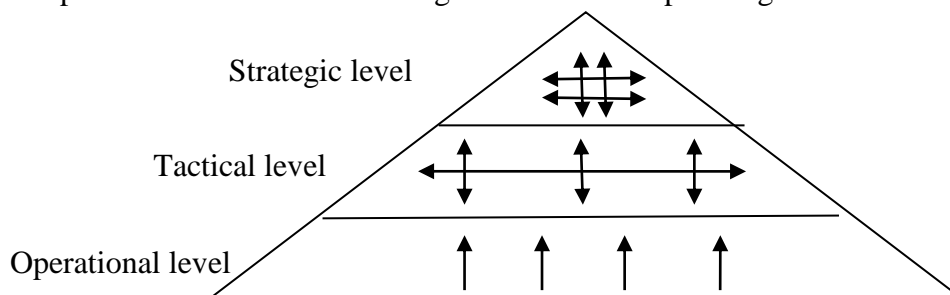


Figure 2: Information flow pyramid

Lesson 2: Types of Information System

Competences:

- Identify types of information Systems in an organization (TPS, EIS, DIS.....)
- Evaluate characteristics of different types of IS in an organization

Introduction

In any given organization, information system can be classified. The most common classification is the four level model based on the people who use the systems (see figure below).

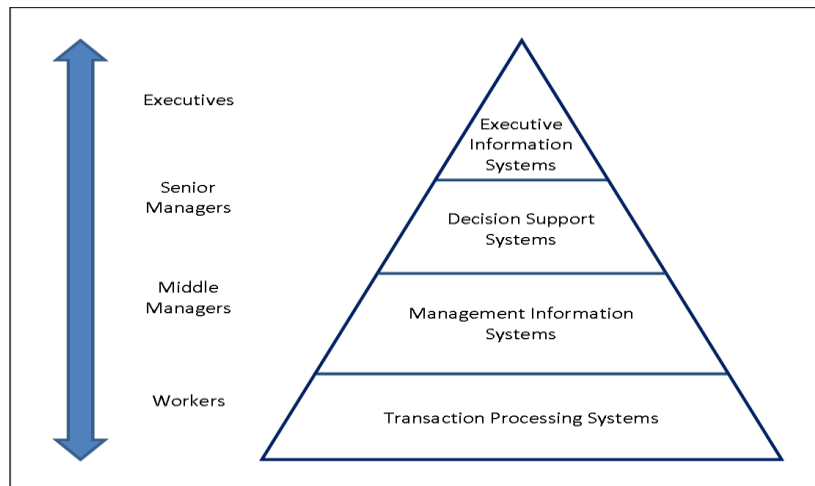


Figure 3: Four level pyramid type of IS

1. Transaction Processing System (TPS)

Transaction Processing Systems are usually operated directly by shop floor workers or front line staff, which provides the key data required to support the management of operations. This data is usually obtained through the automated or semi-automated tracking of low-level activities and basic transactions.

Some examples of TPS: *payroll systems, order processing systems, reservation systems, stock control systems, systems for payments and funds transfers.*

❖ Characteristics of TPS

- Produce information for other systems.
- Used by operational personnel + supervisory levels.
- Efficiency oriented.

2. Management Information Systems (MIS)

Management Information Systems are used by middle managers to help ensure the smooth running of the organization in the short to medium term. The highly structured information provided by these systems allows managers to evaluate an organization's performance by comparing current with previous outputs.

Some examples of MIS: *sales management systems, inventory control systems, Budgeting systems, Management Reporting Systems (MRS), Personnel (HRM) systems.*

❖ Characteristics of MIS

- Support relatively structured decisions.
- Used by lower and middle managerial levels.
- Deals with the past and present rather than the future.

3. Decision Support Systems (DSS)

A Decision Support System can be seen as knowledge based system used by senior managers which facilitates the creation of knowledge and allow its integration into the organization. These systems are often used to analyze existing structured information and allow managers to project the potential effects of their decisions into the future.

Some examples of DSS: *Logistics systems, Financial Planning systems*

❖ Characteristics of DSS

- Support all- structured or semi-structured decisions.
- Have analytical and/or modeling capacity.
- Used by more senior managerial levels.
- Are concerned with predicting the future.

4. Executive Information Systems

Executive Information Systems are strategic-level information systems that are found at the top of the Pyramid. They help executives and senior managers analyze the environment in which the organization operates, to identify long-term trends, and to plan appropriate courses of action. The information in such systems is often weakly STRUCTURED and comes from both internal and external sources.

❖ Characteristics of EIS:

- Are concerned with ease of use.
- Are concerned with predicting the future.
- Are effectiveness oriented.
- Are highly flexible.
- Support unstructured decisions.
- Use internal and external data sources.
- Used only at the most senior management levels.

CHAPTER 2: MODELLING AND SIMULATING SYSTEMS

Competences:

- Explain system modelling and simulation.
- Evaluate advantages of simulation and modeling.
- Perform what-if-analysis using spreadsheet.

Introduction

A system is a set of hardware and software operating in a computer. Generally, there is many types of systems among which we have modeling systems and simulation systems.

1. Modelling Systems

System modeling is the process of using models to conceptualize and construct systems in business and IT development. We analyze and simulate a model to answer questions.

A model is a precise representation of how a system works. It can also abstract representation of an object or set of objects having common characteristics.

2. Simulation systems

A simulation system is a system that imitates the real system in order to find out what happens under different situations and condition. It involves the creation of models of a situation (problem or possible

solution) and then tests to see how the models behave. Simulations are usually performed to avoid the expense or danger of making mistakes in the real system and have developed to represent systems such as traffic, training pilots, etc.

3. **Advantages of modelling and simulation**

- Can be saver and cheaper than the real world.
- Able to test a product or system works before building it.
- Can use it to find unexpected problems.
- Able to explore ‘what if ...’ questions.
- Can speed things up or slow them down to see the changes over long or short periods of time.

4. **Disadvantages of modelling and simulation**

- Mistakes may be made in the programming or rules of the simulation or model.
- The cost of the simulation model can be high.
- The cost of running several different simulations may be high.
- Time may be needed to make sense of the results.
- People’s reactions to the model or simulation might not be realistic or reliable.

5. **What-if-analysis using spread sheet (Case study of MS Excel)**

What-if-analysis is the process of changing the values in cells to see how those changes will affect the outcome of the formulas on the worksheet.

By using what if analysis tools in excel, you can use several different set of values in one or more formulas to explore all the various results. For example, you can do what-if-analysis to build two budgets that each assumes a certain level of revenue. Or you can specify a result that you want a formula to produce, and then determine what sets of values will produce that result.

Three kinds of What-if-analysis tools come with Excel: *Scenarios*, *Goal Seek*, and *Data Tables*. Scenarios and Data tables take sets of inputs values and determine possible results. A Data Table works with only one or two variables, but it can accept many different values for those variables. A scenario can have multiple variables, but it can only accommodate up to 32 values. Goal seek works differently from Scenarios and Data Tables in that it takes a result and determines possible input values that produce that result.

CHAPTER 3: IDENTIFYING MONITORING AND CONTROL SYSTEMS

Competences:

- Define monitoring systems.
- Identify areas where monitoring systems are used.
- Explain Control systems.
- Identify areas where control systems are used.

1. **Monitoring systems**

Monitoring systems seek to observe and record data about an environment through sensors. It checks new data against stored values and if new data is outside acceptable range, a new warning message is sent but the system does nothing further to effect the change, e. g. recording temperature of a greenhouse.

Some examples of monitoring systems include:

- Heart Rate monitoring systems

They are commonly used both in hospitals and by individuals who want to track their health. The system usually gives visual output on the display and often data is logged in persistent file storage for future analysis.

- Monitoring of intruders in a burglar alarm system.
- Checking the temperature levels in a car engine.
- Monitoring pollution levels in a river.

2. Control systems

A control system is a set of hardware and software that's used to regulate the operation of a system such that if new data is outside acceptable range the output from the system affects the next set of inputs. Control systems seek to actively maintain or change the state of a system through the use of actuators. There are two basic types of control systems:

- **Dedicated control systems:** They are basic systems that carry out a pre-programmed set of instructions. For example, *traffic light system* where the lights change at fixed time intervals.
- **Computer-controlled systems:** These systems use a computer to control the output device and this computer can be connected to a sensor making the system more flexible.

Some examples of control systems include:

- Turning street lights on at night and turning them off again during daylight.
- Regulating the temperature in a central heating/air conditioning system.
- Changing the traffic light at a road junction.
- Operating anti-lock brakes on a car when necessary.
- Regulating the environment in a greenhouse.

Other type of control system is the **Numeric Control System (NC)** which refers to the automation of machine tools that are operated by programmed commands encoded on a storage medium as opposed to manually controlled via hand wheels or levers or mechanically automated.

3. Difference between monitoring and control system

Monitoring system	Control system
seek to observe and record data about an environment through sensors	seek to actively maintain or change the state of a system through the use of actuators
Warning sent (screen, alarm) if new data is outside acceptable range	Signals sent to control valves, motor, if new data is outside acceptable range

CHAPTER 4: SYSTEM DEVELOPMENT LIFE CYCLE (SDLC)

Competences:

- Evaluate existing system: manual or computerized
- Analyse systems and evaluate options
- Explain SDLC phases
- Describe system implementation methods

Introduction

A system can be defined as an organized body of interrelated parts to achieve an objective. System development involves the use of various methodologies, models, tools and techniques to build and implement an IS.

1. System development methodologies, models, tools and techniques

System development methodologies: it provides guidelines to follow for completing every activity in the SDLC including specific models, tools, techniques and SDLC.

Models: A model is a representation of some important aspect of the real world. Examples of models used to develop a system include; *flow chart, data flow diagram (DFD), entity-relationship diagram (ERD) and case diagrams*. Models used to manage the development process include: *PERT chart, Gantt chart*.

Logical models: it shows what the system is required to do without committing to any one technology.

Physical models: it shows how the system will actually be implemented.

Tools are software that helps create models or other components required in a project. Examples of tools that help a system analyst and designers are: Project management application, Drawing/graphics application, Word processor/text editor, IDE, DBMS, Computer-Aided System Engineering (CASE tools).

Techniques: Techniques are a collection of guidelines that help the analyst to complete a system development activity or task. Examples are Project management techniques, User interviewing techniques, structured analysis and design techniques, Software testing techniques...

2. System development Life cycle

It is a structured step-by-step approach use to develop and implement a new system.

It can be represented in a number of phases typically six which are: **Planning, analysis, design, development, implementation, support and maintenance**.

a. Planning phase

It is the initial phase of the SDLC process that sets out to discover, identify and define the scope of the project to decide the course of action and specifically address the issues that are going to be solved by the new system. This phase *includes problem definition, feasibility studies, project plan...*

Some activities in this phase are:

- Define clearly in unambiguous terms the problem/opportunity.
- Carry out an assessment of initial feasibility of the project and.
- Prepare a system development project plan.

b. Analysis phase

During this phase, there is investigation on how the current system works (if it exists) and the identification of weaknesses and the opportunities to improve. Modeling techniques like data flow diagrams

can also be use and interviews, questionnaires, observation and inspection of documents currently in used can be used. Activities in this phase are:

- Creating a logical model of the new system and specifying the objectives for the new system;
- Specifying the input, processing and output of the new system;
- Preparing a plan for implementing the new system;
- Specifying the performance criteria of the new system.

c. Design phase

The system design phase involves generating several alternatives technical solutions for the new logical model. Activities in this phase are:

- selecting the best technical alternative;
- developing detailed software specifications and again reviewing the project plan;
- creating detailed physical model.

d. Development phase

The goal of the system development is to actually create the new system which involves a number of tasks including acquiring and installing new hardware, writing software, testing software and reviewing project plans. Most of the efforts deployed in SDLC are devoted to this phase.

- Writing software requires that programmers use the software specifications and a programming language or tool to actually create the working software.
- Testing software will employ testing techniques such as: *integration testing, acceptance testing and beta testing*.
 - **Integration testing** is to test to see if everyone in the organization is able to use the part of the software developed for the functioning of the IS.
 - **Acceptance testing** is a formal documented process in which users use the new system, verify that it works correctly under operational conditions and note any errors that needs to be fixed.
 - **Beta testing** is a form of testing involving a limited audience of external users.

e. Implementation

The system implementation phase involves training users, converting existing information to the new system, converting users, carrying out acceptance testing, and reviewing the project plan.

The project team installs the new software on the new hardware, trains all users on how to use the software, and goes through a process of acceptance testing.

Conversion: This is the act of moving from the old way of doing things to the new system. Four conversion methods in common include;

- **Parallel conversion:** Both the old and new systems are allowed to run until it's sure the new system works correctly. Though it delays final handover, it is the safest as it allows for gradual change over. It is expensive in terms of time, money and resources.
- **Plunge conversion (direct):** Here, the old system is unplugged and the new system is used exclusively. It carries relatively a high risk. However, it may be the option for a system commissioned from scratch or where resources are limited.
- **Pilot conversion:** Only a selected group of users are targeted to convert to the new system before converting everyone.

- **Piecemeal:** Here, only a porting of the new system is allowed to run and when it works correctly, the remaining system is then converted.

f. Support and maintenance

During system support:

- The organization provides a formal mechanism for the periodic review of the system.
- The users of the system may suggest changes that need to be made.
- The organization must evaluate the changes and determine which to undertake.

3. Some popular SDLC Models

There is no one single SDLC model. They are divided into main groups, each with its features and weaknesses.

- **Waterfall model:** It is a breakdown of activities into linear sequential phases, where each phase depends on the deliverables of the previous one and corresponds to a specialization of task.
- **Iterative model:** It is a particular implementation of SDLC that focuses on an initial simplified implementation and iteratively enhances the evolving versions until the complete system is implemented and ready to be deployed
- **V-shape model:** It represents a development process that may be considered as an extension of the waterfall model. Instead of moving down in a linear way, the process steps are bent upwards to form a typical V shape.
- **Prototyping:** It is a model in which a prototype is built, tested and then reworked as necessary until an acceptable outcome is achieved from which the complete system or product can be developed.

CHAPTER 5: OUTSOURCING AND DATA CAPTURE

Competences:

- Outline selection methods of data capture and data verification
- Describe data and sources of data
- Describe common methods of data validation: length checks, type checks, range checks, presence checks
- Explain the outsourcing

1. Outsourcing

Outsourcing is the process of by which an organization hands over parts of the system development steps or activities to another organization. These may include the design, development, implementation, and support steps of the SDLC. However, the source organization is still responsible for investigation, analysis, and some few steps.

The process of outsourcing:

- **Problem definition and feasibility:** This must be performed by the source organization no matter who will develop the proposed system. Possible reasons that can make a system to be outsourced include:
 - The IT specialists may not have enough time or resources to build a system.
 - The organization may not possess the expertise to develop a given system.
 - It may be cheaper to buy pre-written software than to develop from scratch.

- **System analysis:** The report generated during systems analysis is used as the foundation for the outsourcing document. Thus, the systems analysis step must be carried out for any proposed system and a request for proposal sent out to possible outsourcing organizations.
- **Evaluate Request for Proposal (RFP) returns and select a vendor:** Several potential outsourcing vendors are examined and a selection is made based on the RFP received.
- **Contract:** Once an outsourcing vendor is selected, a legal documentation that binds both organizations is prepared and signed by each party. This document states exactly what work is to be carried out, how and when payments will be made, the project time frame, and how the outsourcing organization can get out of the contract if the outsourcing vendor fails to deliver.
- **Test and accept the solution:** When the system is complete by the outsourcing vendor, a complete test of the system is carried out, users are train, old information is converted to the new system, and users are converted to the new system. If something fails to work as intended during the testing, the system is rejected and the outsourcing vendor is called upon to correct the problem(s).
- **System support:** Once the system is installed and in use, the IT specialist is expected to provide for the many support tasks such as performing a periodic review of the system, providing a formal mechanism through which users can request changes, and evaluating their worth.

The relationship with the outsourcing vendor may be reassessed since they also provide support and maintenance activities as part of the overall cost of the system.

2. Data capture

Data capture refers to the process of getting data into a format that can be processed by a computer. *Paper-based data capture and computerized data entry* are data techniques used to get data in the format for processing.

In paper-based data capture, people fill forms with information such as their personal details for example; name, address, telephone number, date of birth, etc.

In computerized data entry, answers from questions are typed directly into the computer and stored in the appropriate database.

While manual data capture techniques usually use forms, automated data capture method uses automated data capture devices such as: Barcode reader, Magnetic Ink Character Reader (MICR), Optical Mark Reader (OMR), Optical Character Recognition (OCR), Sensors, etc.

a. Types of data capture errors

- **Transcription errors:** Transcription errors occur due to misreading or mistyping data. This can be caused by bad hand writing or confusing characters for example, the number 5 with the letter S or the number 0 and the letter O.
- **Transposition errors:** This occurs when two digits or letters are swapped around. If you are to end up with say 'ot' instead of 'to' or 5124 instead of 5214. It is estimated that about 70% of all errors are transposition errors.

b. Data control

It refers to the mechanisms that are implemented to ensure an accurate and reliable data capture. Verification and validation are typical methods used to check for accuracy in data.

- **Verification:** This involves checking that what is on the source document or what is intended is exactly the same as what has been entered into the computer. Techniques used for verification are double entry and proof reading.

- **Double entry:** With manual data entry, two people enter the same data and the data is accepted for further processing only when the two entries are identical. This is cost ineffective since two people are to be paid for doing the same job.
- **Proof reading:** This involves carefully checking data that has been entered against what was in the original document.
- **Validation:** This has to do with detecting any data that is inaccurate, incomplete or unreasonable. Validation can be done by software and it can be set to reject any data that does not conform to set rules. Validation can be done using some or all of the following types of checks.

Check Types	Description
Character	Character checks make sure that the right types of characters have been entered.
Types check	Type checks are used to check that the correct type of data has been entered in a field. E.g. number instead of text and vice versa.
Check digits	A digit check is usually placed at the end of an original number. E.g. bank account number.
Range check	Checks if a number lies within a specific range. E.g. ≥ 60 .
Length check	Some item of information is always of a certain length containing a specified number of characters. E.g. the registration number of a public service worker in Cameroon always have eight characters like 955437-P.
Parity check	A parity check is used to make sure that data has not been corrupted during transmission. Even number, even parity. Odd number, odd parity.
Presence check	When entering data into a database the completion of some fields may be optional. E.g. certain fields like telephone number may be optional. There are certain fields which must contain data and the system may come to a halt if left blank.

CHAPTER 6: DATA RESOURCE MANAGEMENT

Competences:

- Identify the various data types.
- Describe components of a database.
- Explain data mining.

Introduction

Today's organizations cannot survive or succeed without quality data about their internal operations and external environment. Organizations typically make use of databases (both internal and external) to store data related to their operations.

Data resource management is an activity that applies information systems technologies to the task of managing an organization's data resources to meet the information needs of their business stakeholders.

1. What is data?

Data are pieces of information or fact related to the object being considered. For example, examples of data relating to an individual would be the person's name, age, height, weight, ethnicity, hair, colour, and birthday. Data is not limited to the facts themselves, as pictures, images, and files are also considered data.

Each data is associated with an attribute that tells a computer system how to interpret its value. This attribute is called a **data type**. Understanding data types ensures that data is collected in the preferred format and that the value of each property is as expected. The following are the common Data types:

Data type	Description	Example
Integer	It is used to store numbers without a fractional component.	-245; 0; 520
Floating point	It is used to store numbers that may have a fractional component.	-32.345; 234.002
Character	It is used to store a single letter, digit, punctuation mark, symbol or blank space	'A'; '7'; '?'; ' '
String	It used to store a sequence of characters or text	"Hello john"
Boolean	It is used to stored data with only two possible values.	True or false; 1 or 0; yes or no.
Date	It is used to store date generally a date in the YYYY-MM-DD format	2021-10-03
Time	To store a time generally in the hh:mm:ss format.	09:30:20
Date time	Stores values containing both date and time together in the YYYY-MM-DD hh:mm:ss format.	2021-10-23 11:20:55

2. What is a database?

A database refers to a collection of logically related information organized so that it can be easily accessible, managed, and updated. Databases are generally accessed electronically from a computer system and are usually controlled by a database management system. (DBMS). The database administrator (DBA) is the individual responsible for managing the databases, including database security, access control, backup, and disaster recovery.

a. Types of database in an organization

- **Operational:** store detailed data needed to support the business processes and operations of a company.
- **Distributed:** databases that are replicated and distributed in whole or in part to network servers at a variety of sites.
- **External:** refer to databases external to an organization and generally accessed over the internet and owned by other organizations.
- **Internal:** typically include operational databases and data warehouse

Data warehouses contain data collected from several sources, and the data contained within are generally not used for routine activities. Instead, data warehouse are usually used for business intelligence purposes.

b. Components of a Database

The five major components of a database are:

- **Hardware:** refers to physical, electronic devices such as computers and hard disks
- **Software:** refer to set programs used to manage and control the database and includes the database software, operating system, network software.
- **Data:** refer to raw facts and information that need to be organized and processed to make it more meaningful.
- **Procedures:** refer to instruction used in the DBMS and encompass everything from instructions to setup and install, login and logout.
- **Database Access Language:** It is a language used to write commands to access, update and delete data stored in a database.

3. Data Organization Terms and Concepts

Some few key terms that are useful to help one understand data more, particularly the relation between data and databases are:

- **Bit:** Smallest unit of data; binary digit (0, 1).
- **Byte:** Group of 8 bits that represents a single character.
- **Character:** single alphabetic, numeric or other symbol.
- **Field:** group of words or related characters and numbers.
- **Record:** collection of related fields
- **Table:** collection of related records with a unique table name
- **File:** group of related records.
- **Database:** integrated collection of logically related data elements. (file, tables)

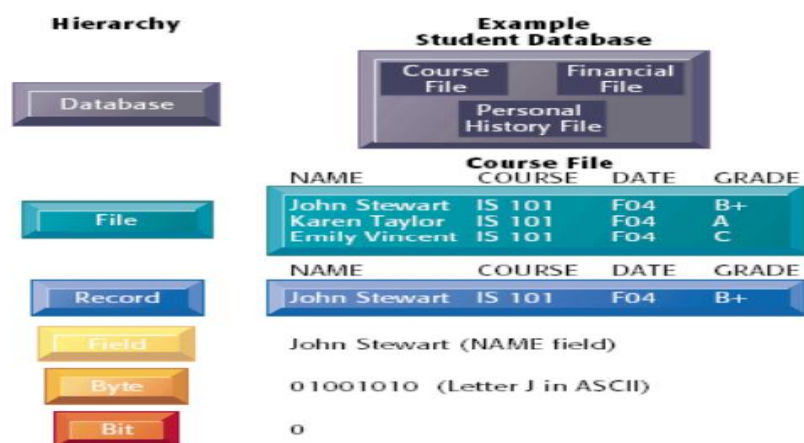


Figure 4: Data hierarchy

Remark:

In Traditional file processing, data were organized, stored, and processed in independent files of data records. Some problems of traditional file processing are:

- **Data Redundancy:** duplicate data requires an update to be made to all files storing that data.
- **Lack of Data Integration:** data stored in separate files require special programs for output making ad hoc reporting difficult.

- **Data Dependence:** programs must include information about how the data is stored so a change in storage format requires a change in programs.

***Note:** Data mining refers to the process of analyzing massive volumes of data from different angles in order to identify relationships between data and transforms them into actionable information.*

MODULE II: TECHNOLOGY AND SOCIETY, PEOPLE AND COMPUTER SYSTEM

CHAPTER 7: CAREER IN INFORMATION TECHNOLOGY, IMPACT OF COMPUTERS ON PEOPLE AND THE WORKPLACE HEALTH AND SAFETY WHEN USING TECHNOLOGY

Lesson 1: Careers in information technology

Competences:

- Describe the roles and responsibilities of computer systems specialists

Introduction

The invention and evolution of the computer resulted in millions of new types of computer related jobs. From those who enter data into the computer to those who maintain the largest computer systems, there continue to be a worldwide demand for workers who are trained to play a role in the development and use of Information Technology. A wide variety of career opportunities are available in computing and mainly being categorized under two heads: Hardware and Software.

1. Careers related to computer hardware

- **Computer Engineers:** These are professionals who apply the theories and principles of science and mathematics to design hardware, software, networks, and processes which can be used to solve technical problems.
- **Network Engineer:** The main responsibility of a network engineer is to design and implement computer network. They focus on the design and planning rather than on the day-to-day support.
- **Computer repair technician:** This is a professional who is skilled in assembling, repairing, and maintaining computers, printers, and other peripheral equipment's. Otherwise called *computer repairers* they also help in the installation of software.
- **Hardware Engineer:** Engineers that configure hardware of computers, improve layout and design of devices for increase efficiency.

2. Careers related to computer software

- **Software Engineers:** also called *software developers*, they analyze users' needs and design, create, and modify general computer applications software or specialized utility programmers. Those involved with the systems software may research, design, and test operating system software, compilers, network distribution software.
- **Computer Scientist:** These are professionals who typically work on the theoretical side of computer systems. The primary goal of computer scientists is to develop or validate models, often mathematical, to describe the property of computer-based systems with an overall objective of discovering designs that yield useful benefits (faster, smaller. Cheaper, more precise, etc.).
- **Computer Programmers:** They create code for software applications and operating systems. After a software developer designs a computer program, the programmer writes code that converts that design into a set of instructions a computer can follow. They test the program to look for errors and then rewrite it until it is error-free.
- **Database Administrator:** These are scientist responsible for the development of an organizations database making sure all the data is accurate, available and secure. They design, install, update, modify, maintain, and repair computer databases.

- **IT Consultant:** These are those who undertake strategic or operational missions, they help a client in implementation; they help develop or roll out a prototype or software to respond to a specific need.
- **Web developer:** A web developer is a programmer who is specialized in the development of web applications and network applications that are run over **HTTP** (Hypertext Transfer Protocol) from a web server to a web browser. They are found working in large corporations and government agencies, small and medium size companies or alone as freelancers.
- **Mobile Application Developer:** Their main responsibility is to develop and create apps for iOS and Android systems, etc.
- **System Analyst:** Design IT solutions and existing systems to improve business efficiency and productivity.
- **Cloud Architect:** It is an IT specialist who develops a company's computing strategy. This strategy incorporates cloud application plans, cloud application design as well as cloud management and monitoring.
- **Information specialist:** They are responsible for analyzing and managing a company's information databases, such as filing, record-keeping, or stocktaking. They specialize in streamlining company processes, disseminating information to personnel, clients, and shareholders, as well as preparing annual data summary reports for management review.

Lesson 2: Areas of application of computers

Competences:

- Identify and explain some areas of application of computers.

Introduction

It is a binding fact that computers are very productive, efficient and make our personal and professional lives more rewarding. These 'magical' machines can do just about anything imaginable; moreover they really excel in certain areas

1. Areas of application of computer

a. Education

Computer is a very effective tool which is used for teaching and learning, result processing, student data processing, question preparation, handouts and note preparation, etc. and also online education. Many universities provide online education through internet. The learning materials are packed in CD-ROM with interactive multimedia. The CAL (Computer aided Learning), CAI (Computer Aided instruction), multiple choice paper, result processing are done through internet.

b. Communication industry.

The integration of computers & telecommunication facilities has made the transmission and reception of messages very fast and efficient.

- They are used in telephone exchanges to switch incoming & outgoing calls.
- For sending & receiving electronic messages, e.g. fax and e-mails, if connected to a computer network.

c. Transport industry.

Computers are used in:

- Automobile traffic control, e.g., to monitor vehicle traffic in a busy town.
- Railway corporations to co-ordinate the movement of their goods & wagons.

- Airports (Airline industry). The computers are used;
- To control the movement of aircrafts, take off & landing through the use of radar equipment.
- Making reservations (booking purposes).
- Storing flight information.

d. Library services

Computers can be used in a library:

- To enable the library personnel to easily access & keep updated records of books and other library materials.
- To search for book titles instead of using the manual card catalogue.
- Employment: The emergence of computers has provided employment opportunities to very many people.

e. Domestic and Entertainment systems.

Computers are used at homes:

- For watching movies, playing music and computer games.
- For storing personal information.
- For calculating and keeping home budgets.
- In household items, such as, Microwave ovens, Televisions, etc

f. Multimedia applications.

- Computers are used to prepare business presentations for advertisement purposes.
- The presentations are done using overhead projectors attached to computers running slide shows & digital video clips.
- Computers are used in music related equipment such as **Synthesizers**.
- In entertainment (i.e., games & movies), computers are used to add stereo sound & digital video clips, which make games more realistic

g. Defense

Computers are largely used in defense. Modern tanks, missiles, weapons etc. Military also employs computerized control systems.

Some military areas where a computer has been used are:

- Missile Control
- Military Communication
- Military Operation and Planning
- Smart Weapons.

h. Government Institutions.

Computers play an important role in government. Some major fields in this category are:

- Budgets;
- Sales tax department;
- Income tax department;
- Male/Female ratio;
- Computerization of voters lists;
- Computerization of driving licensing system;
- E-citizen online services;
- Weather forecasting.

i. Health Care

Computers have become important part in hospitals, labs, and dispensaries. The computers are being used in hospitals to:

- Keep the record of patients and medicines.
- Scanning and diagnosing different diseases.
- To control life-supporting machines in the **Intensive Care Units (ICU)**.
- To enable medical experts in different countries to share their expertise or labor, thus reducing the transportation of patients & professionals.
- Diagnostic System: Computers are used to collect data and identify cause of illness.
- Lab-diagnostic System: All tests can be done and reports are prepared by computer.
- Surgery: Nowadays, computers are also used in performing surgery.

j. Banks/Insurance industries

Computers are used by Banks & Insurance industries:

- To manage financial transactions. They use special cash dispensing machines called **Automated Teller Machines (ATMs)** to enable them provide cash deposit & withdrawal services.
- For processing of Cheques.
- For preparation of Payrolls.
- For better record keeping and processing of documents.
- To provide electronic money transfer facilities.

k. Research.

Computers can be used for research in various fields. They are used by:

- Scientists to analyze their experimental data, e.g., in weather forecasting.
- Engineers & Architects to design & test their work.

Lesson 3: Ergonomics

Competences:

- Define Ergonomics
- Explain some computer health hazards(RSI, CTS, CVS, etc) and methods of prevention
- Describe a computer work environment

Introduction

Ergonomics is the science that studies how workers interact with their work environment. Proper ergonomics means designing objects in the workplace that provides a correct match between the human body, work-related tasks, and work tools such as chairs to provide safety and comfort for the worker. Ergonomics is alternatively called **Human Engineering**. Ergonomic principles helps reduce stress and eliminate many potential injuries and disorders associated with the overuse of muscles, bad posture, and repeated tasks.

1. Computer health hazards

Once on the computer, the user should be able to identify certain signs and know what to do immediately to avoid a health problem.

The signs of these problems can occur in the hands, wrists, arms, shoulders, neck or back and can include the following:

- Numbness, burning or tingling of the fingers
- Soreness, aching or tenderness
- Pain or swelling
- Tightness or stiffness
- Weakness or coldness

Symptoms may be felt during typing, when using a mouse, or at other times when no work with the hands is being performed especially at night when these symptoms might awaken you.

The main risks associated with using the computer include the following;

- **Musculoskeletal Problems:** These are general problems that range from general aches and pain to more serious problems like upper limb disorders, back and neck pain and discomfort, tension, stress and headaches.
- **Repetitive stress injury (RSI)**, which occurs when muscle groups are forced through repetitive actions often with high-impact loads or tens of thousands of repetitions under low-impact loads (working at a computer keyboard)
- **Computer vision syndrome (CVS)** refers to any eyestrain condition related to display screen use in desktop computers, laptops, e-readers, smartphones, and handheld video games. Symptoms include headaches, blurred vision, and dry and irritated eyes.
- **Carpal tunnel syndrome (CTS)**, in which pressure on the median nerve through the wrist's bony structure, called a carpal tunnel, produces pain. Symptoms include numbness, shooting pain, inability to grasp objects, and tingling.

❖ Problems and Possible Remedies for Visual Display Unit (VDU) Users

The VDU or the screen is known to be the main equipment that creates a lot of health problems to its users. Below are some problems and their possible remedies.

Problems	Possible Remedies
1. Eyestrain caused by glare and reflection from the screen.	- Avoid setting up your VDU in a brightly lit area where light reflects on the screen. - Do not look directly at windows or bright lights. - Use an anti-glare screen filter.
2. Stress caused by boredom and slow computer response time.	- Vary your activity.
3. Posture Fatigue.	- Use adjustable chairs. - Adopt a comfortable and relaxed keying position.
4. Screen Flicker.	- Do regular servicing to correct errors.
5. Unsatisfactory working environment - Space. - Ventilation, Light and Heat. - Noise.	- Ensure that there is adequate space. - Make provision for the circulation of fresh air because the electric equipment may dry air. - Use a sound proof.

2. Safety Precautions

The following are guides to be respected when using your computer:

- Set up or connect your equipment according to the instructions provided by the supplier or manufacturer. For example, always be sure that the computer is switched off and disconnected from the main electrical supply once you have stopped working on.
- Make sure that your working room has sufficient light.
- Fit in your devices and CD-ROMs correctly because that which is wrongly fitted may vibrate and get destroyed.
- It is important to look away from the screen from time to time and focus your eyes on a distant object to avoid eye strain.
- Before you start working, do the following;
 - Adjust the position of the screen, the keyboard, the mouse and the documents you are working with so as to sit comfortably.
 - Keep your upper body as relaxed as possible and don't over stretch your wrists and fingers. As a general guide, your forearm should be roughly horizontal and your elbows level with the keyboard or the mouse.
 - If your feet don't reach the floor when you are sitting in a good position, try to use a foot rest.
 - Use a document holder when typing from a manuscript.
- Make alternating work tasks. That means that after a short while on the computer leave it and do other things.
- Regularly stretch up to relax your body.
- Avoid gripping your mouse too tightly (hold your mouse lightly and click gently).
- Be familiar with keyboard short cuts for applications you regularly use to avoid over using the mouse.
- Your chair should:
 - Support the back,
 - Allow chair height to be adjusted from a sitting position,
 - Be 18 to 30 inches away from the screen when you are seated.
- Your table or desk should:
 - Provide sufficient leg room and preferably be height adjustable,
 - Have enough room to support the computer equipment and space for documents,
 - Be at least 900mm deep,
 - Have rounded corners and edges.
- To avoid eyestrain take the following precautions;
 - Exercise your eyes periodically focusing on objects at different distances,
 - Blink regularly,
 - Position the monitor to avoid glare,
 - Keep your monitor clean,
 - Service, repair or replace monitor that flicker.

Note: To ensure about electrical safety, do not be tempted to add too many extension cables to your existing electrical sockets.

CHAPTER 8: DATABASES

Competences:

- Identify Models of databases.
- Use a database application to create a simple relational database.
- Populate a simple database.
- Create simple queries to demonstrate data integrity and consistency.

Introduction

Organizations work on vast amount of data and information on daily bases thus, there is need for data and information to be organized logically. These data may not make meaning if not organized into an appropriate structure. A database is application software for such a task and is one of the core/main parts of most/all applications/software in use today.

A *database* is a structured collection of data in a computer system which allows for arranging, modifying, and extracting information easily in different logical orders. It is a tool that stores data, and lets you create, read, update, and delete the data in some manner. The management of these data can be computerized or not.

A **computerized database** is a database that stores and manages its data by the use of application software called *database management system (DBMS)* in the computer.

A **non-computerized computer** is a database that files are grouped in folders or envelops and stored in drawers or filing cabinets. Both types of database have advantages and disadvantages. An advantage for one is probably a disadvantage to the others.

Note: Data are raw facts that have no meaning. It needs treatment (processing) to become useful (information).



Figure 5: Data, Information, and Knowledge

1. The structure of a Database

Within the database, the data are organized into storage containers called **tables**. Tables are made up of columns and rows. In a table, columns represent individual fields and rows represent records of data. The following are the basic database terms.

Table 1: structure of database

Serial No	Registration No	Surname	FirstName	Sex	Class
1	123	Shey	Ndim	Female	Form 4
2	456	Eliza	Joy	Female	Form 4
3	789	Didier	MC	Male	Form 5
4	012	Cecil	Pride	Female	Form 5

This table is made up of **six fields (columns)** i.e. serial number, registration number, surname, first name, sex and class and **four records (rows)**.

- **A table** is the database object that contains the basic data or information to be stored about an entity of the database. For example, the registration of students in a school form a database called student table which is a database entity.
- **A field or (attribute)** represents one related **column** of a table and is the smallest logical structure of storage in a database. It holds one piece of information about an entity or a subject represented by the table. For example, in the above table we have the following fields; registration no, surname, firstname, sex, and class.
- **A record or tuple** is a collection of multiple related fields that can be treated as a unit or a record is a row of the table for a database which contains a collection of attributes related to an entity (such as student or a person) of the database. For example, information from the field's registration no, surname, firstname, sex, and class for a particular student form a record.
- **A query** is the database tool that allows to *retrieve information* from one or more tables based on a set of *search conditions* you define using the table fields. Queries are covered in more details later.
- **Forms** are Access tools that users can create to make *data entry* in database tables **easier**. Entering data directly into a table can be difficult if there is a lot of information to enter. Like an Excel spreadsheet, an Access table is essentially a screen filled with blank rows where a user enters records. **Forms**, however, provide users with an easy-to-read interface where they can **enter table data**.
- **Reports:** It is an effective tool that gives you way to *analyse and present data* using a specific layout. The text can be formatted in an Access report, just like it can be in Word documents.
- **Key field or Primary Key:** it is a field or a collection of fields in a database whose value can be used to distinguish one record from another. E.g. in the table above, registration n^o. can be used as the key field.
- **Foreign Key:** a foreign key is a column or group of columns in a relational database table that provides link between data in two tables. It acts as a cross-reference between tables because it references the primary key of another table thereby establishing a link between them.
NOTE: a primary key is always distinguish from the other key by a () on it or is underlined.*
- **Entity:** it is a single data item; persons, things, places or events (a table's name).

NB: Typical data is logically organized as follows; *characters, fields, records, files and database.*

- *Characters are the most basic logical data elements.*
- *File is a collection of related records. E.g. a table can be referred to as a file.*

2. Advantages and disadvantages of database

❖ Advantages of database:

- There is less data inconsistency since each data item is stored in fewer locations.
- It enables querying and faster searches.
- Data is independent of application.
- It is easier to maintain the confidentiality of the information.

❖ Disadvantages of database:

- It requires trained personnel to design, implement, maintain and work on.
- A total system failure can have a severe negative impact on the establishment.

3. Database Applications

Databases are widely use because it forms an essential part of almost all organizations/software's/enterprises today. Here are some representative applications: *Banking, Universities/schools, Business, Manufacturing, organizations, enterprises, government, hospitals, Facebook, Google, Twitter, etc.*

4. Data Type for database

A **data type** determines the type of data that can be stored in a column of field of a table in the database. Although many data types are available, the followings are the most commonly used data types:

Table 2: Available Data type for database in MS Access

<i>Data type</i>	<i>Description</i>	<i>Size</i>
Text	Alphanumeric data, letters, numbers, symbols and specials characters	Up to 255 characters
Memo	Alphanumeric data, support rich-text formatting (bold, italic, bullets lists...)	Store up to 2G, display up to 65 535 characters
Number	Positive or negative values that can be used in arithmetic calculations	Up to 16 bytes of data
Data/Time	Date and time information	8 bytes
Currency	Monetary values, not rounding during calculation.	8 bytes
Auto number	Automatically generate by the computer when a new record is added	Up to 16 bytes
Yes/No	Boolean values (true or false) data 1=true 0=false	1 bit

Remark:

A database file that consists of a single data table is called a **flat-file database**. Flat-file databases are useful for certain single user or small group situations, especially for maintaining lists such as address list or inventories. Data that is stored, managed, and manipulated in a spreadsheet is similar to a flat-file database.

❖ **Disadvantages of flat file database**

- **Redundant data:** that is repeated information in the table.
- **Errors on input:** typographical errors occur each time is entered.
- **Problems with updating data**
- **Problems with modifying data**

5. Database models

A database model is a type of data model that determines the logical structure of a database. It fundamentally determines in which manner data can be stored, organized and manipulate. The most popular example of database model is the **relational model** which uses a *table-based format*. Other examples of database models include: *flat file model, hierarchical model, object-oriented model, network model, Entity-relation model and multi-dimensional model*.

A. Entity Relationship Model (ER):

An entity relationship model is a diagrammatic representation of the relationship that exists between entities.

An **entity** is a “thing” or “object” in the real world that is distinguishable from all other objects. For example, each person in an enterprise is an entity. An entity has a set of properties or attributes, and the value(s) for some set of properties may uniquely identify an entity.

A **relationship** is an association among several entities. For example, we can define a relationship between the entity students to the entity teacher in a secondary school. Each student has one teacher but each teacher has many students.

The ER diagram is used to represent database schema. The following are use in ER diagram:

- A rectangle represents an entity set.
- An ellipse represents an attribute.
- A diamond represents a relationship.
- Lines represent linking of attributes to entity sets and of entity sets to relationship sets.



i. Example of ER model:

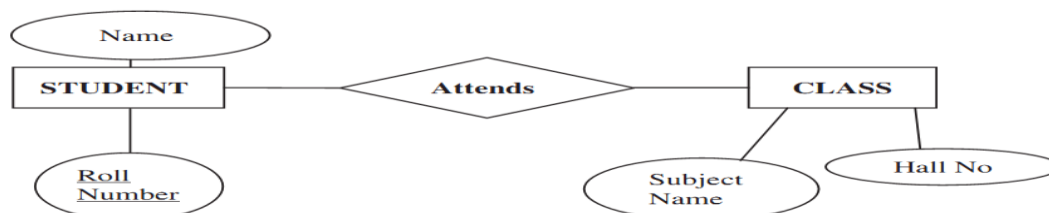
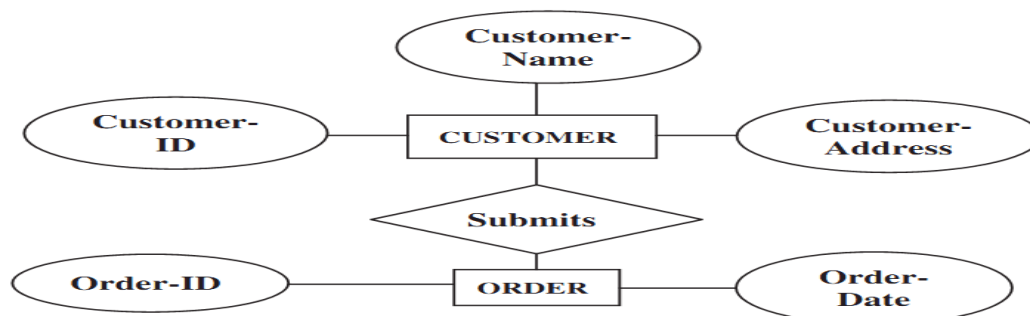


Figure 6: ER diagram for entities student and class

In the ER diagram shown above the two entities are *STUDENT* and *CLASS*. Two simple attributes which are associated with the *STUDENT* are *Roll number* and *the name*. The attributes associated with the entity *CLASS* are *Subject Name* and *Hall Number*. The relationship between the two entities *STUDENT* and *CLASS* is *Attends*.

Exercise:



Observe the above ER diagram and answer the following questions.

1. How many entities are on the diagram?
2. What are the attributes of each entity?
3. What is the relationship between them?

ii. Types of Relationship between entity

You share many relationships with members of your family. For instance, you and your mother are related. You have only one mother, but she may have several children. You and your siblings are related. You may have many brothers and sisters and, of course, they'll have many brothers and sisters as well. If you're married, both you and your spouse have a spouse each other but only one at a time. Database relationships are very similar in that they're associations between tables (entities of the DB).

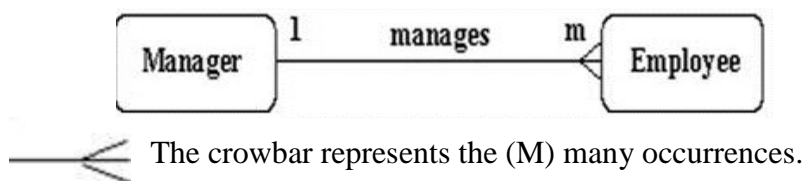
Even though a relationship may involve more than two entities, the most commonly encountered relationships are binary, involving exactly two entities. Generally, such binary relationships are of three types and called **cardinality**: *one-to-one*, *one-to-many* and *many-to-many*.

a. One-to-one Relationship (1:1)

One-to-one is where one occurrence of an entity relates to only one occurrence in another entity, e.g. if a man only marries one woman and a woman only marries one man, it is a one-to-one (1:1) relationship.

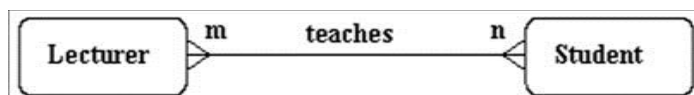
b. One-to-many Relationship (1:M)

A one-to-many relationship is where one occurrence in an entity relates to many occurrences in another entity. For instance one manager manages many employees, but each -employee only has one manager, so it is a one-to many (1: M) relationship.



c. Many-to-many Relationship (M:M)

In many-to-many relationship, one record in a table can be related to one or more records in a second table, and one or more records in the second table can be related to one or more records in the first table. For example, one teacher teaches many students and a student is taught by many teachers.



B. Relational Model

The relational model is a lower-level model. It uses a collection of tables to represent both data and the relationships among the data. Its conceptual simplicity has led to its widespread adoption; today a vast majority of database products are based on the relational model. Designers often formulate database schema design by first modeling data at a high level, using the E-R model, and then translating it into the relational model.

The software used in a relational database is called a **relational database management system (RDBMS)**. The relational model is based on the mathematical concept of a relation, which is physically represented as a table.

Note: Referential integrity: *It a property of a relational database that enforces valid relationships between tables such that no foreign key can contain a value that does match a primary key in the corresponding linked table.*

i. Terminology

There are different set of terms used to designate the tables, the columns and rows of the relational model. The following table summarized it.

Relational terms	<i>relation</i>	<i>tuple</i>	<i>Attribute</i>
Alternative 1	<i>Table</i>	<i>row</i>	<i>Column</i>
Alternative 2	<i>File</i>	<i>Record</i>	<i>Field</i>

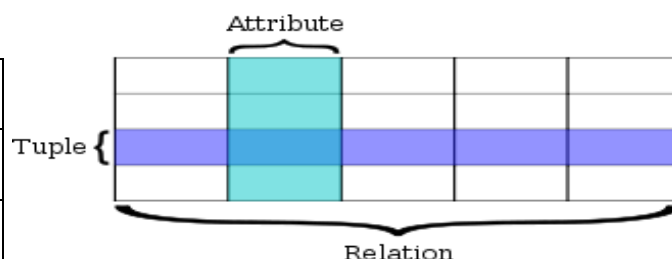


Figure 7: relational model

- A relation is a table with columns and rows
- An attribute is a named column of a relation
- A tuple is a row of a relation.

ii. Transforming the ER model to Relational model

To implement the database, it is necessary to use the relational model. There is a simple way of mapping from ER model to the relational model. There is almost one-to-one correspondence between ER constructs and the relational ones. Here,

- *Entity name = Name of the relation or table.*
- *Attributes of ER diagram = Column name of the table.*

Example: The E-R model in section A (i) is converted to a Relational model

Here we have two entities **CUSTOMER** and **ORDER**. The relationship between CUSTOMER and ORDER is one-to-many and the relationship is **Submit**.

The tables can then be represented in the relational model as:

Customer (Customer-ID, Customer-name, Customer-Address)

Order (Order-ID, Order-Date)

And can read in a relational way as:

CUSTOMERSubmitsORDER (Order-ID, Order-Date, Customer ID, Customer-name, Customer-Address)

In the relation above, **the primary key** CUSTOMER ID in the CUSTOMER relation becomes **a foreign key** in the ORDER relation.

Normalization of a database: It is a process in a relational design that breaks down data in to record groups in accordance with a series of so-called normal forms for efficient processing by eliminating redundancy and improving data integrity.

C. Other type of database models

- **Hierarchical database model:** Uses nodes to link and structure fields and records. Entries may have one node with several child nodes in a one-to-many relationship.
- **Object-Oriented Database (OOD):** Data is organized using objects classes, entities, attributes and methods.
- **Network Database:** This is similar to hierarchical except that a child node may have more than one parent in a many-to- many relationship.
- **Multidimensional Database:** Extend two dimensional relational tables to three or more dimensions (hyper cube)

Remark: The description of the database includes the table structures and the rules that will be followed. The description is called a scheme. The schemas are stored in a data structure called the **data dictionary**.

Data dictionary is a collection of descriptive information about data and objects in a database i.e. a computerized-base catalogue or directory containing metadata that is data about data. It contains a list of all tables in the database, the number of records in each table, and the names and types of each field.

6. Database Management Systems (DBMS)

A DBMS is software that is used to create, modify, and extract information from a database. The main idea with a DBMS is that all the data is kept centrally and only authorized users can have access to data through the DBMS.

A DBMS is a general-purpose software i.e. not application specific. A DBMS consists of:

- A part for collection of interrelated and persistent data. This part of DBMS is referred to as database (DB).
- A set of application programs used to access, update, and managing data. This part constitutes the management system (MS).

A. Features of a DBMS

The features of a DBMS are as follows:

- **Queries:** to extract data in the database using language like the Structured Query Language (SQL);
- **forms, reports;** (*see section 1 for definition*)
- **Models** define rules and standards for all data in the database
- **Data mining** has to do with using software to search through data from many sources looking for connections.

B. The main objectives of DBMS:

- **Control of data redundancy:** the database approach attempts to eliminate the redundancy by integrating the files so that multiple copies of the same data are not stored.
- **Data consistency:** If a data item is stored only once in the database, any update to its value has to be performed only once and the new value is available immediately to all users.
- **Improved data integrity:** Database integrity refers to the validity and consistency of stored data. Integrity is usually expressed in terms of constraints, which are consistency rules that the database is not permitted to violate.
- **Improved security:** Database security is the protection of the database from unauthorized users. The access that an authorized user is allowed on the data may be restricted by the operation type (retrieval, insert, update, delete).
- **Increased concurrency:** In some file-based systems, if two or more users are allowed to access the same file simultaneously, it is possible that the accesses will interfere with each other, resulting in loss of information or even loss of integrity. Many DBMSs manage concurrent database access and ensure such problems cannot occur.
- **Improved backup and recovery services:** modern DBMSs provide facilities to minimize the amount of processing that is lost following a failure.\

Examples of DBMS are: Oracle, Postgres SQL, Sybase, MySQL, **Microsoft Access**, SQL, DB2, Open Office Base, etc.

7. Database languages

A particular language that has emerged from the development of the relational model is the Structured Query Language (SQL). Over the last few years, SQL has become the standard relational database language.

❖ Objectives of SQL

Ideally, a database language should allow a user to:

- Create the database and relation structures,
- Perform basic data management tasks, such as the insertion, modification, and deletion of data from the relations,
- Perform both simple and complex queries.

❖ Data-Definition Language:

We specify a database schema by a set of definitions expressed by a special language called a Data-Definition Language (DDL). DDL defines the database structure and controls access to the data.

❖ **Data-Manipulation Language:**

A data-manipulation language (DML) is a language that enables users to access or manipulate data as organized by the appropriate data model. Its functions are:

- The selection or retrieval of information stored in or from a table;
- The insertion of new information into a table;
- The deletion of information from a table;
- The updating or modification of information stored in a table;

EXERCISES

A database of students is to be set up with the following fields:

FamilyName, OtherName, StudentID, DateOfBirth, DateOfEntry, CurrentClass, CurrentSchoolYear, EmailAddress.

- Select a data type for each field.
 - Which fields should be validated and which fields should be verified?
 - Decide the validation rules for those fields which should be validated.
 - Which field is best for the primary key?
 - Choose a suitable format for the StudentID.
 - Build a database with at least 10 records. Include all your validation checks.
 - Run a query to print OtherNames, FamilyName, and EmailAddress in alphabetical order of family name.
 - Run a query to select all the students of class four with their StudentID.
-

CHAPTER 9: PROJECT MANAGEMENT

Competences:

- Explain the concept of a project.
- Explain project management terms: earliest start time, earliest finish time, slack time, lag time, float time, milestone, event, task, critical task, etc.
- Outline project management tools, techniques and models
- Use project management tools to facilitate the execution of projects: Gantt and PERT charts

Introduction

A typical project starts with someone having an idea and documenting the idea on paper. Projects usually go through a number of phase's i.e. well-defined beginning, intermediaries and an end. There are classified according to size and duration whereby:

- Medium projects have a small size and small time frame.
- Small projects have duration of more than one month.
- Large projects have duration of more than one year.

The duration of a project is determined by its complexity. A project starts when at least one of its activities is ready to start. A project is completed when all of its activities have been completed. A project should have some 'deliverables' for ease of monitoring.

Often program and project are used interchangeably, but nominally, a program is a larger concept than a project. A **Program** is a set of related **Projects**. Example the space shuttle program consists of many flights which are each separately managed projects. This chapter is focused on **PROJECTS**.

1. Definitions

A **project** is a planned process to achieve a specific objective through a well-defined set of activities, budget and time frame.

Project Management (PM) is a combination of techniques, procedures, people, and systems focused on the successful completion of a project. It is also a discipline that will support the planning, implementation, tracking, and control of projects.

Project management program permits the user to identify tasks, task relationships, resources, and time requirements of a project. The constraints of a PM are: **Scope, Time and Budget**. The forth constraint is **Quality** which is the core of each and every project.

2. Characteristics and resources needed for a project

Characteristics of a project include:

- Well defined and achievable objectives or goals.
- A time frame for which to achieve its goals.
- Resources (types: budget, people, and material & facilities) are efficiently allocated for activities in the various project phases.
- Project is aimed at satisfying the customers.
- Created once and must be sustainable.

Types of resources needed for a project include:

- People
- Facilities
- Equipment
- Money
- Materials

Examples of projects are:

- Programming computer software or an App or web site.
- Setting a computer network.
- Creating an IS.
- Constructing a bridge, house, and road.
- Setting up a business, etc.

3. Concept and/or Notion of Project Planning

Project Planning involves understanding the fundamentals of a project:

- What business situation is being addressed?
- What do you need to do?
- What will you do?
- How will you do it?
- How will you know you did it?
- How well did you do?

4. Duties and Qualities of a Project Manager

A **project manager** is a qualified individual (or a firm) that directs, supervises, and co-ordinates a project from beginning to end.

Some duties/activities of a project manager are the following:

- Define the project, set manageable tasks, obtain resources, and build a team and motivate the team to carry out the work on time.
- Inform all stakeholders of progress on regular basis.
- Assess and monitor risks to the project and mitigate/reduce/diminish/lighten them.
- Be able to adapt to and manage changing conditions.

Qualities of project manager are:

- Strong leadership ability.
- Ability to develop people.
- Excellent communication skills.
- Contract management skills.
- Problem solving and time management skills.
- Creative and critical thinking.

A **project team** is a group of professionals committed to achieving common objectives, who work well together and who relate directly and openly with one another to get things done i.e. action performed by a team towards a common goal. A team consists of more than one person each of whom typically has different responsibilities and they success is the responsibility of all the members.

Team working is the fuel that allows common people to attain uncommon results. Recent development in management jargon outlines TEAM as **TOGETHER EVERYONE ACHIVES MORE.**

Characteristics of effective teams consist of members who have:

- A common purpose and clear goals;
- The necessary skills and resources;
- A common approach to work;
- The willingness to share information;
- Trust and support in each other;
- The willingness to take responsibility for team actions.

❖ Benefits of teamwork

- Maximize strength of each member;
- Increase in productivity and product quality and also decrease in the cost of production;
- A balance work load as each member can help each other;
- Can blame your teammate if the project goes bad;
- Encouragement of skills, knowledge sharing and fast learning;
- Education of group members on tolerance and understanding.

❖ Disadvantages of teamwork

- Never gets enough credit when the project goes well;
- Not all members will have the same strengths and weaknesses;
- Tasks/work not undertaken on time by some members can let the team down;
- Conflicts in ideas can cause tensions and personality clashes can cause issues too;
- Opposing views can cause arguments.

5. Project Management Life Cycle (PMLC)

These are the sequence of steps or phases to be completed when implementing a project and are not a linear process. In each phase are the project activities that are carried out.

a. Project conception and Initiation:

At this phase the idea is carefully examined to determine whether or not it benefits the organization and a decision making then decides if the project is feasible. The project manager works with the business sponsor or the manager who wants the project implemented and other stakeholders. The following are examined in this phase:

- Analyzing the business needs/requirements in measurable goals.
- Stakeholder analysis including users and support from personnel for the project.
- Financial analysis of the cost and benefits including a budget.
- Project charter (contract) including cost, tasks, deliverable, and schedules.

b. Planning and design:

At this stage all project activities and plan charter may be put in writing outlining the work to be performed. It consists of the following sub-stages:

- Determining how to plan.
- Estimate the resource requirements for the activities.
- Identifying deliverables and creating the work breakdown structure
- Select the planning team
- Risk planning.

c. Execution and construction:

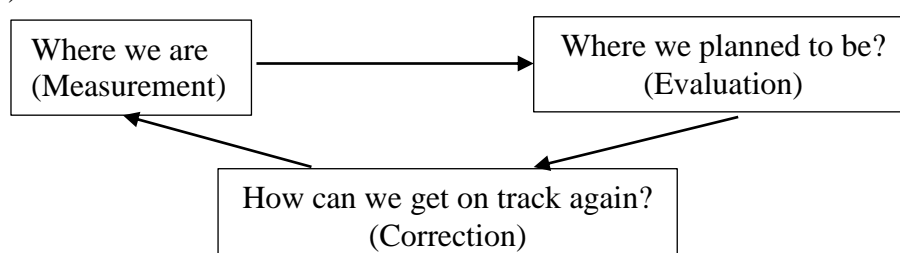
In this phase, the project manager knows how many resources and how much budget is needed to work the project. The project manager then assigns those resources and allocates budget to various tasks and all the teams are informed of responsibilities. It involves the following process:

- Coordinating people and resources.
- Integrating project activities.
- Performing the project activities in accordance with the project management plan.

d. Monitoring and Controlling:

Project managers compare project status and progress to the actual plan and other necessary actions are taken to keep the project on track. If the client disapproves or request a specific change, the team must then revert to the project planning phase and adjust the scope to match the new required deliverables. Its activities include:

- Measuring the ongoing project activities.
- Monitoring the project variables (e.g. cost, effort, scope) against the project management plan and the project performance baseline (where we should be).
- Identifying corrective actions to address issues and risks properly (that is how can we get on track again).

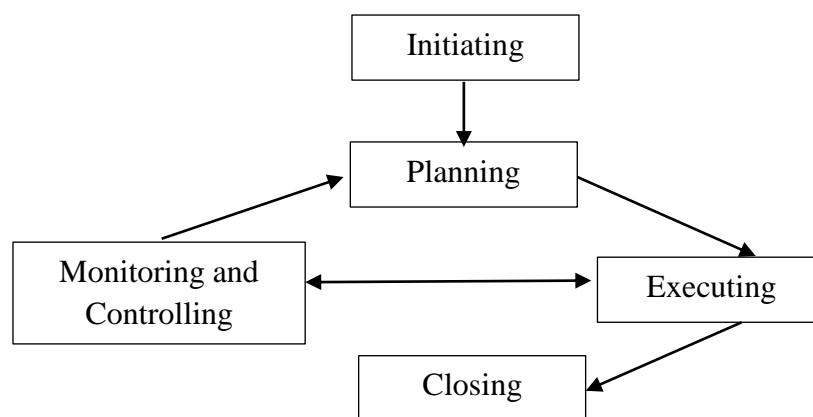


Project maintenance is an ongoing process and it includes continuing support of end-users, correction of errors, and updates of the software.

e. **Completion and finish point:**

Here the project manager and project sponsor pull together the project team and those who have an interest in the outcome of the project (stakeholders) to analyze the final outcome of the project. An evaluation is done to highlight project success and/or learn from the project. The finish point (closure) is the formal acceptance of the project. This phase consists of the following sub-stages:

- Finalizing all activities across all of the process groups to formally close the project or a project phase.
- Completing and settling each contract and closing each contract applicable to the project or project phase.
- Formal acceptance of deliverables by customer



❖ **Major challenges in Project Management**

- Unrealistic deadlines.
- Communication deficit.
- Scope change.
- Misunderstanding and/or Disagreement.
- Bad weather.
- Personality conflict.
- Resource competition.
- Failure to manage risk.
- Insufficient team skills.

6. **Project Management Tools**

PM tool is a piece of technology that is used for visually communicating information (e.g. phases, tasks, resources) about a project. This visualization tool enables project managers to direct and supervise the various tasks and schedules that are required for completing the project. PERT chart and Gantt chart are the most popular project management tools today. They are both used to schedule tasks, keep the project on schedule and ensure that the timeline is met in accordance with the original project plan.

a. **PERT chart**

The term PERT stands for **Program Evaluation and Review Technique**.

A PERT chart is a project management tool used to schedule, organize, and coordinate tasks within a project. A PERT chart represents a graphic illustration of a project as a network diagram or flow chart consisting of numbered nodes (either circles or rectangles) representing events or milestones in the project linked by labeled vectors (directional lines) representing tasks in the project.

Project managers can use PERT charts to:

- Set a realistic timetable for project completion.

- Make sure focus is maintained on the most critical tasks for the critical path – since the path leads to the minimum time the project requires, any delays to these tasks will result in a delay to the overall project.
- Identify tasks that need to be shortened if the overall project time needs to be reduced.
- Identify tasks that can be carried out simultaneously.
- Identify slack time where certain tasks are not as time-critical to the overall deadline.

i. **PERT Node**

A PERT node is as follows and is use in drawing the PERT network diagram.

Early Start	Duration	Early Finish
Task Name		
Late Start	Slack	Late Finish

ii. **PERT Terminologies**

- **PERT event:** a point that marks the start or completion of one or more activities. Consumes no time and uses no resources.
- **Predecessor event:** an event that immediately precedes some other event without any events intervening. An event can have multiple predecessors' events and can be the predecessor of multiple events.
- **Successor event:** an event that immediately follows some other event without ant other intervening events. An event can have multiple successor events and can be the successor of multiple events.

Example: consider that you want to paint your room, the first thing you need to do is to remove the layer of old paint and after that you can start painting. So we have activities as follows:

- ✓ Activity #1 is removing the old paint.
- ✓ Activity #2 is painting.

Since activity #2 can only start after activity #1 is done, we call activity #2 a successor and activity #1 a predecessor.

- **PERT activity:** the actual performance of a task which consumes time and requires resources such as labor, materials, space, machinery. A PERT activity cannot be performed until the predecessor event has occurred.
- **Task:** this is any activity that consumes resources such as time and manpower.
- **Super task:** one or more activities that no subtask can begin until the super task has begun and the super task cannot end until all the subtasks have ended.

Examples:

- An OS is a super task because for a computer to work, it must be loaded in the RAM first before subtasks like Applications software's can be able to start.
- In the construction industry, foundation and especially walls are the super tasks for it most start before other subtasks like piping, wiring, plastering, and painting can be done.
- **Critical task:** a task that must be completed on schedule for the project to finish on time.
- **Path:** a set of sequentially connected activities in a project.
- **Critical path:** a critical path is a series of tasks that must be completed on time for a project to finish on schedule. Each task on a critical path is a critical task.

- **Lag:** describes a delay in the link between a predecessor and a successor task. It tells the logical relationship between the start and or finish of one activity and the start and or finish of a following activity.
- **Lag time:** it is the amount of time delay between the completion of one task and the start of its successor task. A negative value against a lag is known as a lead.
- **Slack time:** it is the amount of time an activity can be delayed from its early start without delaying the project finish date. Also known as float time.
- **Floating task:** a task that can be performed earlier or later in the schedule without affecting the project duration.
- **Lead:** a lead is observed when a task that should theoretically wait for its predecessor to finish starts a little earlier.
- **Lead time:** it the time that a successor is allowed to start before its predecessor goes to completion.
- **Duration (D):** it is the number of days (or hours) it will take to complete a task.
- **Early Finish date (EF):** this is the earliest date that a task can be completed. The EF duration of the last task(s) is the total duration of the project.
For any one task, **EF = ES + Duration.**
- **Early Start date (ES):** is the earliest date on which a given task can start.
- **Effort:** it is the number of labor units required to complete an activity or other project element.
- **Free Float or Slack Time (FF) or (ST):** the amount of time an activity can be delayed without delaying the ES date of any immediate successor activity. It can be calculated as follows:
FF = LS – ES or FF = LF - EF
- **Late Finish date (LF):** is the last date a task can be completed without delaying the project. Equals the EF of the last task(s).
- **Late Start date (LS):** is the last date a task can be start without delaying the project. Calculated as follows: **LS = LF – Duration.**
- **Dependency:** a dependency between two tasks says that these two tasks are linked. The most common kind of dependency is finish-to-start. This means that task A must be finished before task B can start.
- **Fast tracking:** it is performing more critical activities in parallel.
- **Risk:** it is an event which has a probability of happening and whose effect may adversely impact the project.
- **Forward pass:** is a calculation performed on each task determining its early start date and early finish date.
- **Backward pass:** is a second calculation for each task on the project starting on the project finish date and working backwards to the first task. It calculates the late finish date and late start date of each task.
- **Total project duration:** it is the length of time the whole project will take, all tasks start to finish as calculated by the forward pass. It equals the length of the critical path.
- **Project finish date:** is the number of days a project will finish.
- **Milestone:** a significant event in the project usually the completion of a major component.

Example 1:

The following table shows the expected duration of each task. The task dependencies are shown.

Task	Description	Order	Duration
A	Produce software specification	To be completed first	1 week
B	Write test plans	Start when A is complete	3 weeks
C	Software design	Start when A is complete	2 weeks
D	Software Code	Start when B is complete	3 weeks
E	Developer test	Start when C is complete	3 weeks
F	Software test	Start when D and E are complete	4 weeks

- Construct a PERT chart for the project.
- Identify the critical path and hence the minimum time to completion.
- Describe where there is slack time in the system.
- Construct a Gantt chart for the software development project. Assume that the first task starts on 17th October 2015.

Example 2:

The following table shows the tasks, dependencies, and estimated times a project manager might input to a PERT chart for a software development project (estimates are used for illustrative purposes only), and the calculated Expected Times:

Task Identifier	Task description	Predecessor Task(s)	Optimistic Time(O)	Most Likely Time (M)	Pessimistic Time (P)	Expected Time (T _E)
A	Establish project		4	5	12	6
B	Establish customer requirements	A	2	3	4	3
C	Produce software specification documents	B	6	8	22	10
D	Write test plans	C	4	6	8	6
E	Write code	C	3	4	5	4
F	Developer testing	E	2	4	6	4
G	System testing	D, F	2	3	4	3
H	Write manuals	C	5	7	15	8

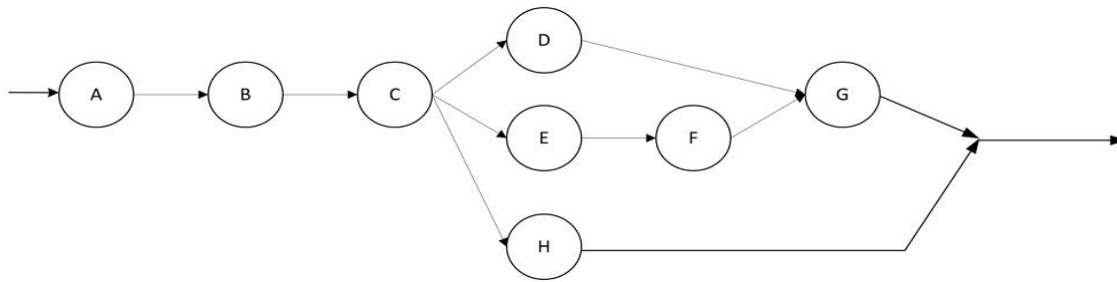


Figure 8: Network diagram

The network diagram is based on the tasks and their dependencies (predecessor tasks). Task A has no predecessor, and therefore starts the project on the left. Task B has only task A as a predecessor, and is therefore the next task. The diagram shows that tasks D, E and H (writing test plans, code and manuals) all have task C (specification) as a predecessor, and can therefore be carried out simultaneously.

Identify the critical path: The critical path is determined by using the estimated times to work out the earliest start (ES) and finish (EF) times (forward pass), and latest start (LS) and finish (LF) times (backward pass), and identifying the tasks where ES and LS are equal.

Step1: Forward pass.

This is done by working from left to right across the chart. The ES of task A is week 0, and the EF is 6 since this is the ES plus the duration (estimated time). The earliest that task B can begin is week 6 (since task A must be complete) so its ES is 6, and EF is $6 + 3 = 9$. Note that task G has an ES of 27 because it is dependent on both task D and task F being complete first, and the earliest that both tasks will be completed is week 27.

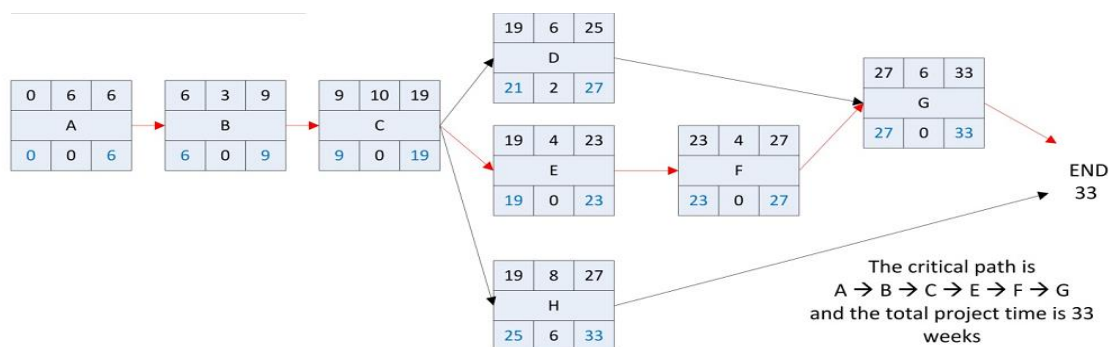


Figure 9: PERT chart representation

Step 2: Backward pass.

Working from right to left, the Latest Finish Time (LF) and Latest Start Time (LS) can be filled in. The final time is 33 weeks, so the LF of task H must be 33. Because this task (H) has a duration of eight (8) weeks, it means it has a LS of $LF - D \Rightarrow 33 - 8 = \text{week } 25$.

Note that for some tasks, such as Task C, there are different possibilities. To calculate the LF of Task C we need to look at the latest start times for Tasks D, E and H which are dependent on it. The latest time task C can finish (LF) must be 19 weeks because Task E has to start at this point.

Step 3: Critical path and slack.

The critical path is identified by finding the nodes where $ES = LS$. These are nodes for which there is no 'slack' or spare time for a task in the project. The slack is calculated as $LF - EF$ or $LS - ES$, e.g. Task H has 6 weeks' slack, and could be scheduled to start sometime between week 19 and week 25 depending on factors such as the resources available to a task on the critical path.

b. Gantt chart

A Gantt chart is a graphic display of a schedule that helps to plan, coordinate, and track specific tasks in a project. It was developed in 1918 by H.L. Gantt. In a Gantt chart, activities are listed down the left side of the chart, dates are shown across the top, and planned activity durations are shown on horizontal bars.

It is a tool which enables project managers organize time, people, equipment, and money. Allows managers to monitor the progress of a project and ensures the right people and equipment are in the right place and the right time. It can be created using Spreadsheet.

The time relation of all tasks to each other (for example, tasks carried out simultaneously) is therefore clearly apparent in a Gantt chart. Unlike PERT charts, GANTT charts do not show the critical path, however, dependencies between tasks can be indicated by lines linking tasks.

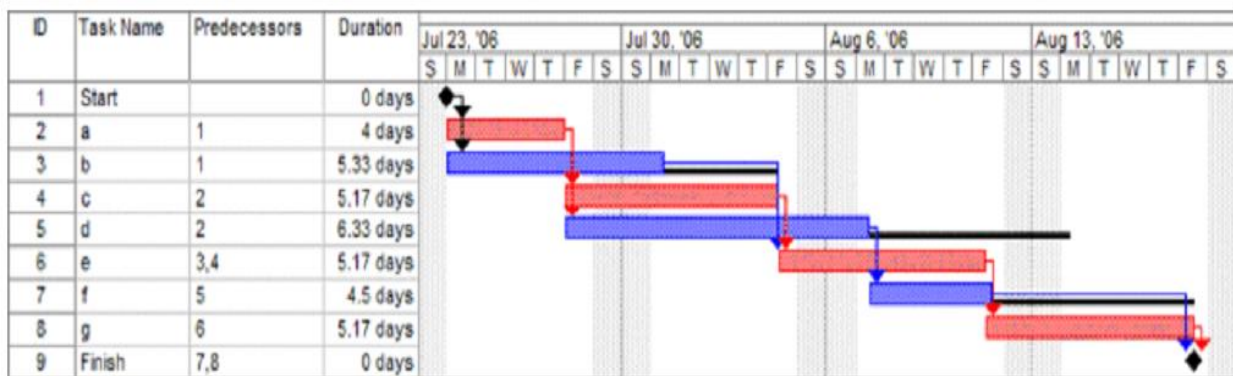


Figure 10: Example of Gantt chart

❖ Limitations of a Gantt chart

- Does not clearly indicate details regarding the progress of activities.
- Does not give a clear indication of interrelation between the activities.

Example 3: The following table shows the tasks, dependencies, and estimated times a project manager might input to a basic GANTT chart for a software development project.

Project start date : 12 June 2015			
Task Identifier	Task description	Predecessor Task(s)	Time (days)
1	Establish project	-	2
2	Establish customer requirements	1	3
3	Produce software specification documents	2	4
4	Write test plans	3	1
5	Write code	3	2

6	Developer testing	5	2
7	System testing	4, 6	4
8	Write Customer documentation	3	3

Task 1 has no predecessors, and can thus start on 12 June. The Gantt chart shows the task as a box starting on 12 June and finishing on 13 June on the horizontal axis. Task 2 requires Task 1 to be completed, and the duration is three days, so the box covers the dates 14 to 16 June. The line from the finish of Task 1 to the start of Task 2 indicates the dependency. Note that Tasks 4, 5 and 8 all require Task 3 to be completed, and have no other dependencies, so these all start on the same date. The chart below show all seven days of the week, but often, weekend days are excluded.

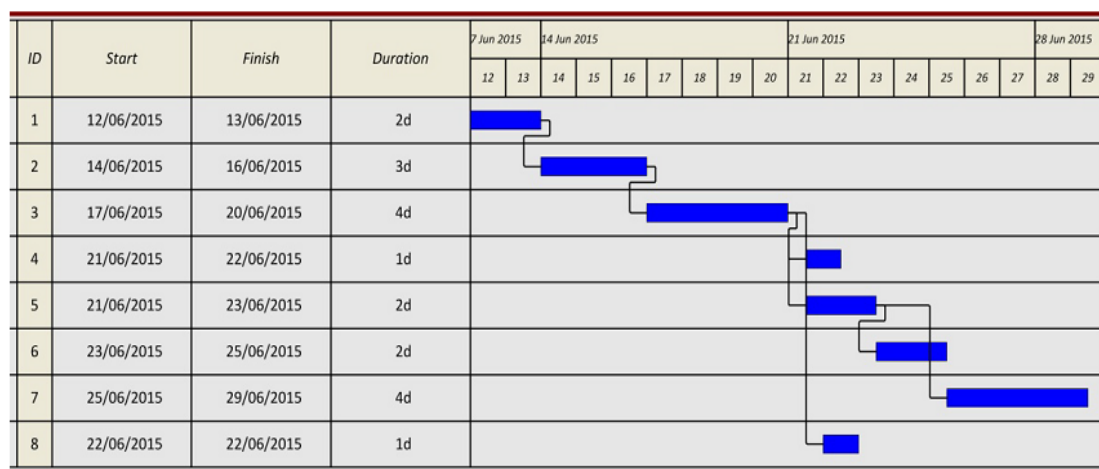


Figure 11: Gantt chart representation

7. Difference between PERT chart and Gantt chart

PERT charts focus on the sequence of tasks and their dependencies between one another while Gantt charts focus on the time required for each task. Other differences include the following:

- PERT chart display critical and non-critical tasks whereas Gantt charts fail to show the critical and non-critical tasks.
- PERT chart produces more accurate expected time T_E . This is because tasks in PERT charts will have three representative time structures; optimistic time, most likely, and pessimistic. By averaging these times, a manager can predict the time a task will take to complete more realistically than the single time that Gantt charts provide.
- Gantt charts are straightforward and are not made for projects which will experience change; while PERT charts are complex and tolerate great deals of unknown.
- Gantt charts focus on the time required to complete a task whereas a PERT chart focuses on relationships between the tasks, the sequence of tasks, their dependencies between one another and time.
- Gantt charts handle sequence and duration while PERT charts manage large and complex projects with variable duration tasks.
- A PERT chart presents information in the form of a flow chart or network diagram while the Gantt chart presents information in the form of a bar chart.

8. Report writing

Reports are documents which both **give readers information** and ask the reader to **do something** with that information. Reports can be used:

- To suggest new ideas and options;
- To ask people to accept a point of view;
- To influence decisions;
- To ask people to make choices between alternative recommendations.

Therefore a well-structured and well written report can be a very influential document.

❖ **The Format of a Report**

- 1- Problem analysis/specification/introduction.
- 2- Design (technical specification).
- 3- Implementation (how the project was carried out).
- 4- Testing (how did you verify to ensure that the project is working as specified).
- 5- Evaluation (what problems did you encounter? How did you solve them?)

MODULE III: SOFTWARE DEVELOPMENT, PROJECTS

CHAPTER 9: ALGORITHMS AND PROGRAMMING LANGUAGES

Lesson 1: Algorithms

Competences

- Write out simple algorithms using: pseudo code, flow chart
- Explain characteristics of algorithms.
- Identify control structures in an algorithm
- Select a suitable control structure in a given problem

Problem situation:

Divine wants to make a tea, but he doesn't know how to do it. You are used to do it and he is asking for a hand.

- 1) What does he need to make a tea?
- 2) What are the necessary steps to follow to make a tea?

I. Algorithmic concepts

1. Definition of terms

An Algorithm is a finite sequence of well-defined and precise instructions that can be used to solve a specific problem.

Algorithmic thinking is a way of getting to a solution through the clear definition of the steps needed.

Computational thinking is a set of problem-solving method that involves expressing problems and their solutions in ways that a computer could also execute.

Logical thinking is the act of analyzing a problem using reasoning skills and coming up with a meaningful conclusion.

Computational complexity: is the amount of resources required to run an algorithm. (Focus is given to time and memory requirements). The time complexity of an algorithm indicates how fast the algorithm runs. The space complexity indicates how much memory the algorithm needs.

2. Steps to resolve a problem (Computer problem solving approach)

Problem solving is done through a rigorous analytical methodical approach; it can be summed up essentially in 5 points namely:

- Define the problem identified by specifying the expected results (outputs)
- Identify the data input required for obtaining the output.
- determine how to process the inputs to obtain the desired output. That is to determine what formula, method, way or steps that can be used to obtain the output.
- Implement the chosen processes to solve the problem while respecting the conditions, if there is any
- Test the algorithm, that is try the algorithm with the exact or some randomly values to ensure the correctness and the effectiveness of the algorithm.

Example: A car travels 150km in 2h. How fast is the car moving?

Input: distance, time.

Processes: Ask for the distance and time, set the speed to: distance/time, display the speed.

Output: speed.

Methods usually employed when solving problems in Computer Science are *Stepwise Refinement* and *Top-Down Design*.

- **Stepwise Refinement:** this means replacing existing algorithmic steps/instructions with a new version that fills in more details. When carrying out stepwise refinement, the complex problem is broken down into a number of simpler steps which are simpler than the one required solving the overall problem. Refinement of the steps continues in this manner until each step is sufficiently detailed.
- **Top-Down Design:** the goal of the top-down design is to divide a given problem into sub-problems. A sub-problem in turn can be thought of as simply another problem and so it can be divided into sub-problems which would be easier to solve than the original problem. The division of the problem starts at the top level down that is why the process is called top-down design.

3. Characteristics of Algorithms

A good algorithm should have the following characteristics:

- It must be **explicit**: i.e.be clear and obvious.
- It must be **precise** or unambiguous: it must be specified exactly and accurately and there should be no doubt about what to do next
- It must be **effective or executable**: it must produce a result and there should be no impossible or unknown steps in the algorithm
- It must be **finite or terminate**: it must have a beginning and an end though there are some that do not end.
- **Efficient**: some algorithms may work correctly but be inefficient by taking more time and using more resources (space) than required to solve the problem.
- Must have an **input and output**

To satisfy these quality standards, one can put the following question at the time of the resolution of the algorithm problem:

- Which are the data on which the algorithm will work?
- Which are the processes which it must execute to offer these services?

- Which are the services which it most produce (this include respond to users request or another algorithm)?

3. Effectiveness of a solution

There are many different solutions to the same problem so in order to consider the effectiveness of a given solution, the following questions may be asked:

- Does the solution work for all sets of data?
- Does the solution have any unnecessary processes that are never used?
- Are any actions repeated more often than necessary?
- Can the solution be simplified and still work as well?

II. Representing algorithms

There are many ways in which algorithms can be represented. We shall consider just 3 ways. They are: **Structured English (Natural language), Flow charts, and Pseudo code.**

1. Structured English



To represent algorithms in Structured English, we simply write down the steps to follow in solving a problem in chronological order.

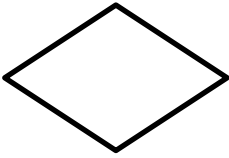


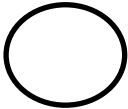
Examples:

An algorithm to add 2 numbers and to find the difference	An algorithm to make tea will be given as
1. Get two numbers a and b; 2. Add a and b; 3. Subtract b in a; 4. Display the sum; 5. Display the difference;	1. Put water into the coffee machine 2. Add tea to it 3. Plug the machine to the current 4. Wait for ten minutes 5. Stop machine 6. Unplug it from current 7. Serve tea in a tea cup 8. Add sugar 9. Drink

2. Flow charts

A flow chart is a graphical representation of an algorithm. It uses graphic symbols to describe the nature and flow of steps in an algorithm. Each step in a flowchart contains information about what must be done, and the arrows show the order in which the instructions must be executed.

Symbol	Name	Meaning
	Terminator	Indicate the beginning (begin/start) or end (end/stop) of an algorithm
	Rectangle	Indicates a process i.e. instructions, procedures, or actions to be carried by an algorithm.

	Rhombus or Diamond	Indicates a decision or choice that must be made and only one flow line enters the diamond. However, two or more flow lines may leave a diamond
	Parallelogram	Indicates data input and output
	Arrow	indicates the direction of flow
	Circle	Joins two or more lines.

❖ Advantages of flow chart

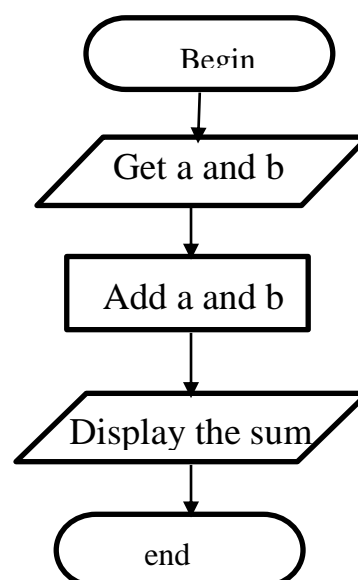
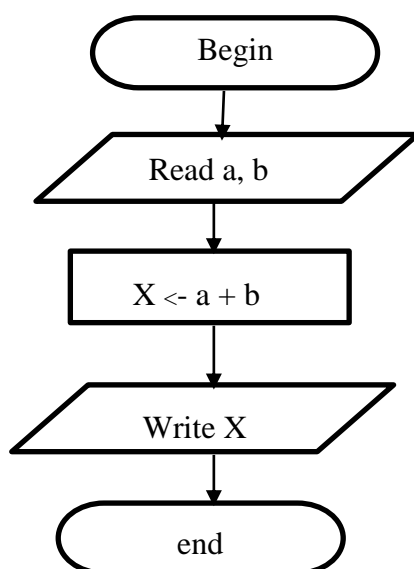
- Communicate the details of a task or procedure to others.
- Excellent way of communicating each stage in a procedure.
- Acts like a guide or blueprint for the designer.
- Helps in analyzing problems or bottlenecks in a given task.

❖ Disadvantages of a flow chart

- It is often difficult to present complex processes or tasks clearly using flow charts.
- Flowchart symbols cannot be typed
- Alterations can become a hassle when using flowcharts.

Examples:

Flow Char to add two numbers

**3. Pseudo code**

A pseudo code is an outline of a computer program written in a mixture of a programming-like language and English. Pseudo-codes help programmers write out the program in a simple clear language before

attempting to put it in a suitable programming language of their choice. Writing pseudo code is one of the best ways to plan a computer program.

The three standards for writing good pseudo-code are:

- Number each instruction or use indentation: this is to enforce the notion of an ordered sequence in which instructions are carried out.
- Each instruction should not be ambiguous but effectively computable.
- Nothing should be left out.

The advantage of pseudo-code is that it allows the programmer to concentrate on how the program works while ignoring the details of the language.

For example, here is a pseudo code outline of a program that reads two numbers and says which is greater:

Begin

```
Read (a, b);
If a is greater than b then;
    Write ("a is greater than b");
If b is greater than a then;
    Write ("b is greater than a");
```

End

The **advantages of pseudo-code** are:

- It allows the programmer to concentrate on how the program works while ignoring the details of the language.
- It describes how an algorithm should work
- It explains the computing process to less technical users.

a. Basic Structure of an algorithm

An algorithm essentially consists of 3 parts: the header, the declarative part and the body.

Algorithm name_of_the_algorithm

CONST name_of_constant = value

VAR name_of_variable: type

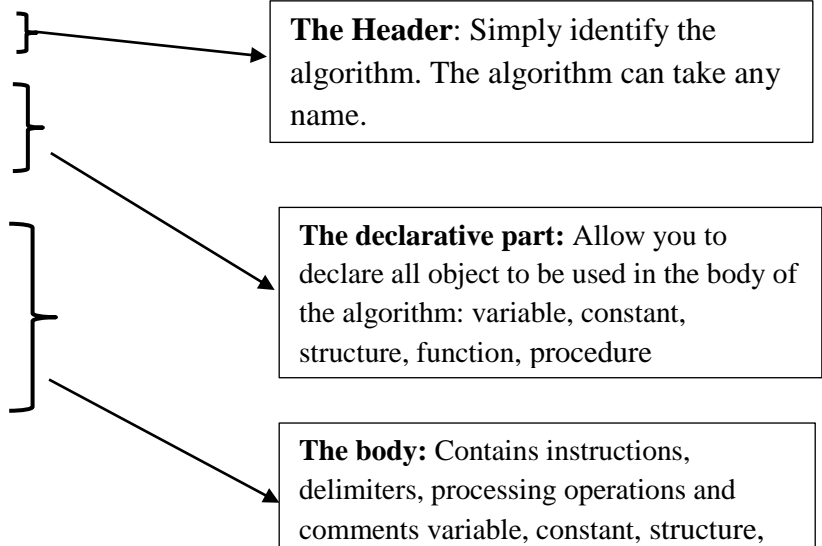
Begin

Instruction 1;

....

Instruction n;

End



b. Variables, Constants and Literals

- ❖ **Variable:** it is an object in a program whose value can be modified during the execution of the program.

To declare a variable, we use the keyword **VAR** followed by the name and the type of the variable. The syntax is as follows: **VAR** *name_of_the_variable*: *type*

Example: declaration of variable A of type Integer

VAR A: Integer

A **data type** defines the domain in which an object gets its value and the kind of operations that can be performed on the object. The basic data types are

Name of type	Description	Example of values
Integer	used to store positive, negative whole number and zero	1; 50; 234; 16578; -89
Real	used to store real numbers with decimal points both positive and negative.	12; 15.57; -64.234
Boolean	used to store logic values	true/false; yes/no.
Character	used to store a single character, digit or special character	'd'; '6'; '#'; '='
Strings	used to store a word or phrase	"nested55"; "34\$5"

- ❖ **Constant:** it is an object whose value cannot be modified in the course of the algorithm or program. A constant is given a value that remains the same all through the program.

To declare a constant, we use the keyword **CONST** followed by the name and the value. The syntax is as follows: **CONST** *name_of_constant* = *value*

Example declaration of π equal to 3.14 as a constant.

CONST PI = 3.14

Variables and constants are characterized by:

- **An identifier:** This is the name of the object.
- **A value:** This is the content of the object.
- **A type:** This defines the domain in which the object gets its value

- ❖ **A Literal:** is anything (numbers or text) that is fixed (set) by a programmer during the creation of the program's code. It is usually written within double quotes. Examples "Enter a number", "The result is" are literals.

c. Basic Instructions

An **instruction** is a processing order to perform an action. The three basic instructions used in an algorithm are **input, output and assignment instructions**.

- ❖ **An input instruction** allows to read a value from the keyboard using the keyword **"read ()"**, **"readln ()"** or **Get**. The value read is saved in a variable of the same.

The syntax is: **read**(name_of_variable);

Example: read(a);

- ❖ **An output instruction** allows to display an information on an output device such as monitor or printer. We use the keyword: **“write ()”, “writeln ()” or print.**

The syntax is **write (“What we want to display”);**

Example **write(“bonjour”);**

- ❖ **The assignment or affectation instruction** allows a value to be assigned to a variable. the content of a variable can be assigned as the content of another variable. The symbols used for affectation statement are: **“←” or “:=”**

The syntax is **name_of_variable ← value;**

Example: **a ← 2; message ← “bonjour Peter”; sum ← a + b;**

- ❖ **Incrementation/ decrementation instruction**

- **Incrementation** is the operation of adding 1 (and by extension any fixed integer value) to a variable called a counter.

The syntax is: **i ← i + 1; i++;**

- **Decrementation** is the operation of subtracting 1 (and by extension any fixed integer value) to a variable called a counter.

The syntax is: **j ← j + 1; j - -;**

Activity: Complete the table below

Instruction	x	y	z
$x \leftarrow 2$		/	/
$x \leftarrow x + 1$		/	/
$y \leftarrow 1 + x$			
$z \leftarrow x + y$			
$y \leftarrow z + x$			

d. Basic Algorithmic Control Structures

i. Sequence Structure

A sequence control structure executes a set of instructions (Actions) one after the other from the first to the last in the order they are given.

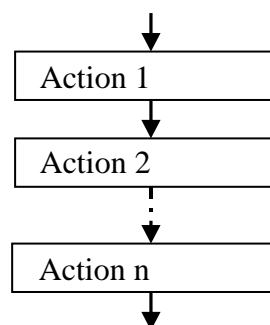
Syntax: Instruction 1

Instruction 2

...

Instruction n

```
Get a ;
Get b ;
c ← a + b ;
print (“Sum =”, c) ;
```



ii. Selection Control Structure (alternative structure)

A selection control structure (condition control structure) chooses the instruction or set of instructions to be executed based on the validity of a certain condition. Examples: If ...then ...else and case ...of

❖ **If... then ... else**Syntax: **if** condition **then**

```

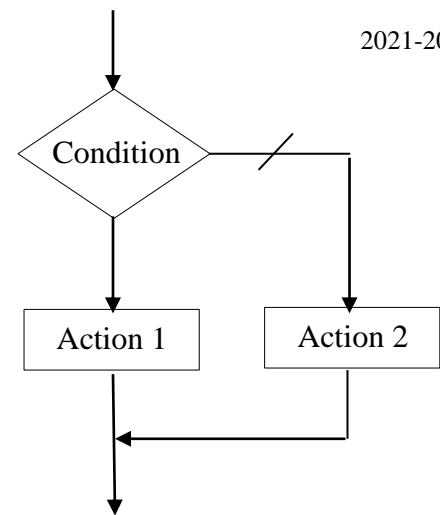
    instruction 1;
else
    instruction 2;
end

```

```

Get a, b;
if a = 0 then
    print ("error: division by
zero");
else
    print (b/a);
end

```



It is possible to nest many selection structures.

Syntax:

```

if condition1 then
    if condition2 then
        instruction 1;
    else
        instruction 2;
else
    instruction 3;

```

```

Get a, b;
if a <> 0 then
    if b <> 0 then
        write (b/a);
    else
        print ("the answer is 0");
    else
        print("error: division by 0");
    end
end

```

Explanation: If condition1 is true, we move to condition2. If condition2 is true, then instruction 1 is executed otherwise, instruction 2 is executed. If condition 1 is false, instruction 3 is executed. Instruction1 or instruction 2 will be executed if and only if condition 1 is true.

❖ **Case ... of**

Syntax: Case variable of

Case 1: Instruction 1

Case 2: Instruction 2

...

Case n: Instruction n

end

```

Get day
Case day of
    1: print "today is Monday";
    2: print "today is Tuesday";
    ....
    7: print "Today is Sunday";
end

```

Explanation: the value of variable is evaluated, if it matches with case 1, instruction 1 is executed. If it matches with case 2, instruction 2 is executed and so on. Case...of is a multiple selection structure. It is used when an important number of choices are to be considered depending on the value of a variable.

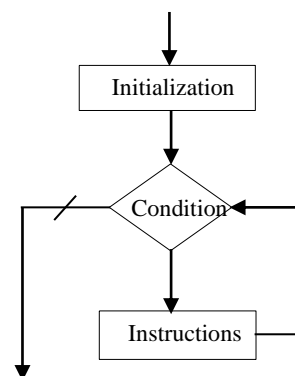
iii. Repetition (iteration) Structure

The repetition (iteration) control structure executes an instruction or set of instructions many times until a certain condition is reached or while a condition is true. Repetition structures define the order of operations and the number of repetitions. They are also known as loops. Examples are: **while...do**, **repeat...until**, **for...to...do**.

❖ **While Loop Syntax:**

While condition **do**
 Instruction(s)
End while

```
Get n
I ← 1
While i <= n do
    Print ← "his is a loop";
    i ← i + 1;
end while
```

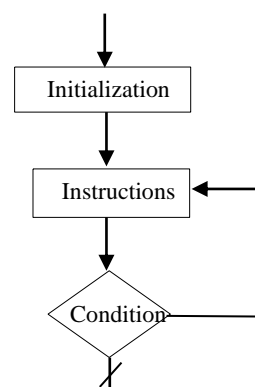


Explanation: The condition is evaluated, if it is true instruction(s) is/are executed. Instruction(s) is/are executed as long as condition remains true. When the condition becomes false, the loop stops.

❖ **Repeat Loop Syntax:**

Repeat
 Instruction(s)
Until condition

```
Get n
i ← 1;
repeat
    print "this is a repeat
loop";
    i ← i + 1;
until i <= n
```

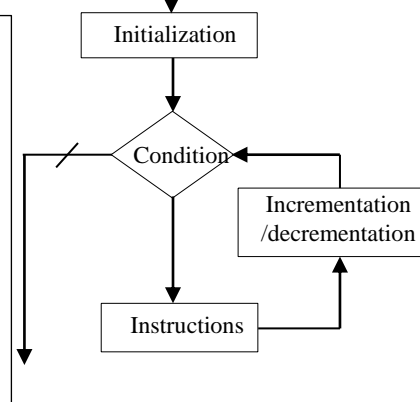


Explanation: The instruction or set of instructions is executed and the condition is evaluated. If it evaluates to false, the instruction or set of instructions is executed again. If condition evaluates to true, the program exits the loop.

❖ **For Loop Syntax:**

For var ← low_limit **to** hi_limit **do**
 Instruction(s);
End for
 Or
For var: ← hi_limit **downto** low limit **do**
 Instruction(s)
End for

```
Get n
For i: = 1 to n do
    Print "this is a for loop"
End For
Or
Get n
For i: = n down to 1 do
    Print "this is a for loop"
End For
```



Explanation: var (variable) is given a value low limit or hi limit depending on the loop, which is automatically incremented or decremented (by 1) after any execution of the loop. The loop stops when low limit becomes greater than hi_limit. In both cases, if hi_limit is less than low limit, the loop body is not executed at all.

Remark: Some problems are recursive in nature. The solution to such problems involves the repeated application of the solution to its own values until a certain condition is reached. Algorithms for such problems are known as recursive algorithms.

A recursive algorithm is one that calls (invokes) itself during an execution. **Examples** are the Factorial function, the sum function, and the Fibonacci function.

Recursion can be defined as the calling of a procedure by itself thereby creating a new copy of the procedure.

Exercises

- 1) Write an algorithm to calculate the area of a circle.
- 2) Write an algorithm to solve a linear equation.
- 3) Write an algorithm that reads a person's sex and writes good morning sir if it's male and good morning madam if it's female.
- 4) Write an algorithm that solves a quadratic equation

Lesson 2: Programming

Competences:

- Explain programming paradigms
- Evaluate importance development tools: compilers, interpreters and assemblers.

Introduction

Programming or program development is the act of writing computer programs.

A **computer program** is a set of instructions written in a programming language that tells the computer what to do in order to solve a problem. In other words, it is an algorithm expressed in a programming language.

1. Characteristics of a good Computer Program and software

- **Efficiency:** it is the degree with which the program fulfills its purpose without waste of resources.
- **Reusability:** it is the ease with which a program can be reuse to design other programs.
- **Maintainability:** it is the ease with which modifications can be made to satisfy new requirements or to correct deficiencies.
- **Reliability:** this is the extent to which a program fails to perform its functions under normal operating circumstances.
- **Correctness:** degree with which a program meets its specified requirements.
- **Robustness:** degree with which a program resist to users manipulations errors.
- **Documentation:** enough comment should be included in a program to facilitate its understanding by any computer user.
- **Portability:** it refers to the ability of software to run on different platforms (system software's) with or without minimal changes.
- **Flexibility:** a program should be flexible enough to handle most of the changes without having to rewrite the entire program.
- **Readability:** it should be written in such a way that it makes other programmers or users to follow the logic of the program without much effort.

2. Programming Languages

A programming language is a set of words, symbols and rules for writing computer programs.

A programming language is determined by its **syntax** (rules guiding the formulations of the program statement) and **semantics** (it describes the meaning of the program statement i.e. it is the vocabulary of the language).

Two categories of programming languages exist: *low-level languages and high-level languages*.

a. Low Level Languages

Low level languages are those that allow low-level access to hardware features. There are two categories of low-level languages: *machine language and assembly language*.

- **Machine Language:** it is the computer's language. It is the language the computer understands. A Machine language instructions are written in binary (a series of 0s and 1s), and are directly executable by the computer (processor). Each machine language statement corresponds to one machine action. Machine language is the first generation of programming languages.
- **Assembly Language:** it is a low-level language that uses words or symbolic codes called mnemonic codes to represent machine language instructions. Assembly language is the second generation of programming languages. *ADD, LOAD, and STORE* are known as mnemonics. For example:

LOAD	R0	Number1	Loads number1 in register 0
ADD	R2	R0 R1	Adds registers 0 and register 1 and store result in register 2.

❖ **Advantages of low level languages**

- Programs are easier to write and understand when compared to machine language.
- It can produce small size program.
- It can produce very fast code as it allows low-level access to hardware features.

❖ **Disadvantages of high level languages**

- Programs are not as easy to write and understand when compared to high level languages.
- Programs are tied to specific computer hardware and can't be reused on another kind of computer.

b. High Level Languages

A high-level language is a language that is closer to human language.

It allows a programmer to write programs without having to understand the inner workings of the computer. High-level languages are the third generation of programming languages. Examples of high-level languages are *C, BASIC (Beginners All-purpose Symbolic Instruction Code), Pascal, Java, FORTRAN (FORmular TRANslation), C++, COBOL (COmmon Business Oriental Language), etc.*

❖ **Advantages of high level languages**

- Programs are easy to write and understand
- Built-in libraries to perform routine tasks
- Can be ported to multiple hardware setups from same.

❖ **Disadvantages of high level languages**

- Slower than second generation languages
- Produce larger program files for same functionality than second generation languages.
- May not allow for low level hardware access.

3. Language Translators

To run a program on a computer, the program needs to be translated into the machine language of the computer on which it will run.

A **language translator** is a computer program that translates program instructions from one language into another without loss of original meaning. There are three types of language translators: ***assembler, compiler, and interpreter.***

a. Assembler

An assembler translates instructions from assembly language into machine language. This process is called assembling.

b. Compiler

A compiler is a computer program that translates an entire block (i.e. at once) of instructions written in a high-level language into machine language instructions before executing it.

The high-level language program is called **source code** and the generated machine language program is called **object code**. Types of compiled languages are *Pascal, C, C++, FORTRAN, JAVA, and Python*.

❖ Advantages of a Compiler

- Fast in execution
- The object/executable code produced by a compiler can be distributed or executed without having the compiler present.
- The object program can be used whenever required without the need of recompilation.

❖ Disadvantages of a Compiler

- Debugging a program is much harder. Therefore not so good at finding errors.
- When an error is found, the whole program has to be re-compiled though compilation process is so fast.

c. Interpreter

An interpreter is a computer program that translates and executes instructions written in a high-level language into machine language instructions one line at a time. If a program performs a section code 1000 times, then the section is translated into machine code 1000 times since each line is interpreted and then executed. Types of interpreters: *BASIC, Lisp, Logo*, etc.

❖ Advantages of an Interpreter

- Good at locating errors in programs since interpretation is done line by line.
- Debugging is easier since the interpreter stops when it encounters an error.
- If an error is corrected, there is no need to retranslate the whole program.

❖ Disadvantages of an Interpreter

- It is slow as interpretation is done line by line.
- Translation has to be done every time the program is to be executed since no object code is produced.
- For the program to run, the interpreter must be present.

4. Program Errors and Correction**➤ Syntax Error**

Syntax is the set of rules that specify how the symbols of a language can be put together to form meaningful statements. A **syntax error** is a place in a program where the syntax rules of the programming language were not followed. A syntax error will stop a program compilation or interpretation.

➤ Semantic Error

Semantics specify the meaning of an orderly well-formed program. A **semantic error** is a situation where the programmer misunderstood the meaning of something in the programming language. Compilation and interpretation do not detect semantic errors. Semantic errors are detected from wrong results. They are also called logical errors.

Something may be syntactically correct but semantically incorrect.

➤ Run-time Error

Run-time error is an error that occurs when a program is being executed. For example, a run-time error may occur if division by 0 is attempted. A run-time error may cause the program to stop execution.

➤ **Debugging**

An error in a computer program is known as a bug and debugging is the process of finding and removing bugs. Syntax errors and semantic errors are bugs. A debugger is the software tool (or person) used for this purpose.

6. **Key Words and Operators**

a. **Key Words**

Any high-level language has its own set of predefined words which are used to write programs. Each of these words has a specific meaning, and cannot be used for any other purpose within the programming language IDE. These words are known as **key words or reserved words**.

A reserved word is a key word in a programming language that has a specific meaning and cannot be used for any other purpose. E.g. *If, Else, For, To and goto*.

b. **Operators**

Operators are used to perform various operations on data. They may be arithmetic, relational or logical. Arithmetic operators are +, -, *, %, ++ and -- and /. Relational operators include <, >, ==, <=, >= and !=. Logic operators are NOT (!), AND (&&) and OR (||).

7. **Programming paradigms**

It is a fundamental style and methodology of computer programming. There are: *imperative (procedural), declarative, and object oriented Paradigms*.

- **Imperative Paradigm:** It is also known as procedural programming paradigm. It uses sequences of instructions that are executed by the processor in the order the programmer designed. Imperative programming manipulates variables and data structures/types stating how to obtain the results. Examples: *C, Pascal, FORTRAN, Ada, etc.*
- **Declarative Paradigm:** Made up of logic Paradigm and Functional Paradigm. Its control flow is implicit i.e. the programmer states only what the result should look like not how to obtain it.
- **Logic paradigm** is a programming process that consists of a set of facts and rules (axioms) describing properties of a certain objects and theorems to be proved. E.g. *Prolog, Mercury*. *Prolog and Mercury* are fifth generation language also called Natural Languages.
- **Functional programming paradigm:** Here a program development is the construction of mathematical functions. E.g. *Lisp, Mathematical, etc.*
- **Object Oriented Paradigm (OOP):** Here software is viewed as a collection of units called objects which receive messages each of which is capable of performing the actions that are immediately related to it as well as requesting actions of other objects. Objects respond to messages by performing operations called methods. Together, these objects interact to solve the problem. E.g. *design of graphical user interface using C++, Python, Perl, Java.*

8. **Software development tools**

These are software that are used to develop applications and system software.

- **Source code editor:** A source code editor is a text editor program designed specifically for editing source code of computer programs. It could be a standalone application or it may be built into an IDE.
- **Integrated Development Environment (IDE):** An IDE is single software that provides comprehensive facilities to computer programmers in which all software development is done.

Also known as Integrated Design Environment or Integrated Debugging Environment. An IDE normally consist of: *a source code editor, a compiler or interpreter, automation tools, a debugger.*

- **Linker:** This is software that is used to combine object code modules (sub-programs) together to make a complete program.

9. Stages in the program development cycle

- Problem Analysis.
- Task Analysis.
- Algorithm Development.
- Coding
- Testing and Debugging.
- Documentation and Maintenance.

Lesson 3: Introduction to C Programming Language

Competences

- Develop simple code fragments from algorithms using a standard C programming language
- Compile and run the programs
- Assess the program developed for correctness of solution using language tools: debug, run,

Introduction

C is a very powerful all-purpose programming language mostly used in creating OSs and more sophisticated programs.

C is one of the oldest programming languages and the most widely used, it was developed in the 70s, but it is still very powerful. Learning C is a great way to introduce yourself to more complex languages as well, and the knowledge you gain will be useful in almost every programming language and can help you get into application development.

1. Why to use C?

C was initially used for system development work in particular the programs that make-up the operating system. C was adopted as a system development language because it produces code that runs nearly as fast as code written in assembly language. The modern version of C is Objective C & C++.

Some examples of the use of C might be: *Operating Systems, Language Compilers, Assemblers, Text Editors, Print Spoolers, Network Drivers, Modern Programs, Databases, Language Interpreters, and Utilities.*

2. Software needed for a C program

C code needs to be compiled by a program that interprets the code into signals that the machine can understand. Also known as Integrated Development Environment IDE made up of Text Editor and Compiler. Depending on the platform we can use the following software

- For Windows; Dev C++ or tuo C or CodeBlocks.
- For Mac; XCode is one of the best C compilers.
- For Linux; gcc is one of the most popular options.

3. Reserved/Key words in C

These are words that should not be used as an identifier to define variables or functions in a program.

void	Used to indicate that a function takes no arguments or returns no value
Data structures-related	
typedef	Used to associate a type with an identifier
const	Used to declare constants
char, int, float, double	Simple data types
struct	Used to create a record data structure
Selection	
if	test a condition and perform a set of instructions based on the result
else	used in if statement to provide an execution path when the if test fails
switch, case and default	The switch statement tests the value of a expression and test with the different "case" values. We can use "default" value, if it doesn't matches any of "case" values.
break	Used to jump out of the innermost enclosing loop or switch statement
continue	Used to skip the statements that follow <i>continue</i> inside the loop
Operators	
sizeof	Determines the number of bytes of an object
return	Used to terminate the execution of a function
return val	Used to terminate the execution of a function and returns the value <i>val</i> to the calling function
Loops-related	
for	Used in a <i>for</i> loop
do	Used in a do... while loop (equivalent to repeat..until loop in Pascal)
while	Used in a <i>while</i> loop
Constant values	
null	pointer value indicating the pointer does not contain a value

NOTE: C is a case-sensitive language i.e. all keywords must be in lowercase.

4. Basic C code

Take a look at the very basic program below to get a good idea about how some of the various aspects of the language work together, and to get an idea of how programs function.

```
#include <stdio.h>
int main()
{
    /*my first program in C */
    printf("Hello, World! \n");
    system("PAUSE");
    return 0;
}
```

- The **#include<stdio.h>** It is a preprocessor command which tells a C compiler to include `stdio.h` file before going to actual compilation and also loads libraries that contain the functions you need. In this example, `stdio.h` lets us use the `printf()` and `system()` functions.
- The **int main()** command tells the compiler that the program is running the function called "main" and that it will return an integer when it is finished. All C programs run a "main" function.
- The braces { } indicate that everything inside them is part of the function. In this case, they denote that everything inside is a part of the "main" function.
- **/* */** : is comment and is ignored by the C compiler , to comment in C place **/*** at the start of the comment and ***/** at the end.

- The **printf()** function displays the contents of the parentheses on the user's screen. The quotes ensure that the string inside is printed literally. The `\n` sequence tells the compiler to move the cursor to the next line.
- The “**;**” denotes the end of a line. Most lines of C code need to end with a semicolon.
- The **system (“pause”)** or **getchar()** command tells the compiler to wait for a keystroke input before moving on. This is useful because many compilers will run the program and immediately close the window. This keeps the program from finishing until a key is pressed.
- The **return ()** command indicates the end of the function.

Remark: Comments are part of the code that is not compiled but allows you to explain what is happening. This is useful for reminding yourself what your code is for and for helping other developers who might be looking at your code.

5. Using Variables

Variables allow you to store data either from computations in the program or from user input. Variables need to be defined before you can use them and there are several types to choose from.

Some of the more common variables types in C programming include *int*, *char*, and *float*. Each one stores a different type of data.

How variables are declared?

Variables need to be established, or "declared", before they can be used by the program. You declare a variable by entering the data type followed by the variable's name. For example, the following are all valid variable declarations:

```
float x;
char name;
int a, b, c, d;
```

Note: you can declare multiple variables on the same line as long as they are of the same type. Simply separate the variable names with commas.

Like many lines in C, each variable declaration line, instruction line needs to end with a semicolon.

Variables must be declared at the beginning of each code block (The parts of your code that are enclosed in {} brackets). If you try to declare a variable later in the block, the program will not function correctly.

6. C input and output

As in Pascal, many C programs make use of user-supplied inputs and produce outputs that are intended for consumption by the user. The inbuilt functions **scanf** and **printf** are commonly used for input and output, as explained in Table below.

Function	Description
scanf	<p>This function can be used to read keyboard input. Usage of this function generally takes the form <code>scanf("format", argument_list);</code>, where format is a string of characters that controls the input process. Some examples:</p> <ul style="list-style-type: none"> • <code>scanf("%d", &x);</code> /*read data into int variable x*/ • <code>scanf("%f", &y);</code> /*read data into float variable y*/ • <code>scanf("%d%f", &x,&y);</code> /*read data into integer variable x*/ /*and float variable y*/ • <code>scanf("%c", &z);</code> /*read data into character variable z*/

	<ul style="list-style-type: none"> • <code>scanf("%s", &w); /*read data into character array w */</code>
printf	<p>This function can be used to display things on screen. Usage of the function generally takes the form <code>printf("print_specifier", argument_list);</code>, where <code>print_specifier</code> is a string that will be printed, and contains zero or more <code>%character</code>; <code>%character</code> is replaced by arguments that follow the print specifier. Some examples</p> <ul style="list-style-type: none"> • <code>int x=10; float y=6.5; char z = 'D';</code> • <code>printf("%d", x); /*10*/</code> • <code>printf("Integer value %d", x); /*Integer value 10*/</code> • <code>printf("Float value %f", y); /*Float value 6.500000*/</code> • <code>printf("Character value %f", z); /*Character value D*/</code>

Example 1

```
#include <stdio.h>
int main()
{
    int x;
    printf("Enter a number: ");
    scanf("%d", &x);
    printf("You entered %d", x);
    system("PAUSE");
    return 0;
}
```

- The "**%d**" string tells `scanf` to look for integers in the user input.
- The **&** before the variable `x` tells `scanf` where to find the variable in order to change it, and stores the integer in the variable.
- The final **printf** command display the inputted integer to the user.

Example 2:

1. `/*this program computes the dimensional weight of a box*/`
2. `#include<stdio.h>`
3. `Int main (void)`
4. `{`
5. `Int height, length, width, volume;`
6. `Float weight;`
7. `Printf ("enter the length of box: ");`
8. `Scanf ("%d", &length);`
9. `Printf ("enter the width of box: ");`
10. `Scanf ("%d", &width);`
11. `Printf ("enter the height of box: ");`
12. `Scanf ("%d", &height);`
13. `Volume = length*width*height;`
14. `Weight = (volume+165)/166;`
15. `Printf ("volume (cubic inches) : %d\n", volume);`
16. `Printf ("dimensionalweight (pounds) : 2f\n", weight);`
17. `Return 0;`
18. `}`

Details of the program

Line	Explanation
1	A comment describing what the program does and is ignored by the compiler.
2	Commands beginning with the # are known as pre-processor directives.
3	The main function starts the execution of the program. The keyword 'int' indicates the return type is an integer. Also the keyword 'void' indicates that the function takes no arguments.
4, 18	The braces each indicate where the body of the program begins and ends respectively. They can also be use to group statements.
5, 6	Define the type of data that each variable i.e. height, length, width, volume and weight will hold. Here we have integers and float (decimal numbers)
7, 9, 11	Printf statement: it causes the message 'enter length, width, and height of box'' to be displayed on the console screen.
8, 10, 12	Scanf statement: it reads input and stores it in the specified variable. %d indicate s that the input is a decimal integer, %f; input is a floating point number, %s input is a string. The '&' specifies the location where the variable is stored.
13, 14	Computations
15, 16	Printf displays the values of the numeric expressions volume and weight as integers and floating point numbers respectively. For the weight, '2f' specifies that the value printed will have just 2 digits after the decimal point. The '\n' character tells printf to move the cursor to the beginning of a new line.
17	Indicates that the main function terminates and the program returns the value '0' to the O.S. when it terminates or returns a value to the user.

7. Learn the basic operators in C

❖ **Arithmetic operators** : these operators perform arithmetic manipulations on their operands

Operators	Description
+	Adds both operands
-	Subtracts second operand from the first
*	Multiplies both operands
/	Divides numerator by denominator Note: In C, if both operands are ints, integer division is performed and the result will be an integer. The fractional part of the result is discarded. If however, any of the operands is float or double, the result is a floating point number and the fractional part is not discarded
/	Integer division. Same comment above with C.
%	Modulus operator. Result is the remainder when numerator is divided by the denominator

++	Increment operator. Increments its operand by 1
--	Decrement operator. Decrements its operand by 1

❖ Conditional operators (Relational operators)

These operators perform a comparison on their operands and result in a true or false result.

Operators	Description
==	Equality. The result is true if both operands are equal, and false otherwise
!=	Not equal. The result is true if operands are not equal, and false if they are equal
>	Greater than. The result is true if the left operand is greater than the right operand and false otherwise.
<	Less than. The result is true if the left operand is less than the right operand, and false otherwise.
>=	Greater than or equal to. The result is true if the left operand is greater than or equal to the right operand, and false otherwise.
<=	Less than or equal to. The result is true if the left operand is less than or equal to the right operand, and false otherwise.

❖ Logical operators:

These operators perform logical operations on their operands; the result is a true or false

Operators	Descriptions
&&	The AND operator. In C, the result is true if both operands are non-zero, otherwise the result is false. In Pascal, the result is true if both operands are true, otherwise the result is false.
	The OR operator. In C, the result is true if any of the two operands is non-zero, otherwise the result is false. In Pascal, the result is true if any of the two operands is true, otherwise the result is false.
!	The NOT operator. Used to reverse the logical state of its operand. If a condition is true then the NOT operator will make false

❖ Assignment Operators: Change the value in a memory location, i.e. in a variable

Operators	Descriptions
=	Simple assignment operator. Assigns the value of the right hand side expression to the left hand side operand. Statements involving the assignment operator may look mathematically incorrect. Examples: $c = c + 5$; (in C) or $c := c + 5$; (in Pascal) should be interpreted as follows: Assign to variable c a value which is the same as the old value of c, plus 5.
+=, -=, *=, /=, %=	These C operators perform an arithmetic operation, then assign the result to the left operator. Example, += (add AND assignment operator) adds right operand to the left operand and assign the result to left operand. Hence, $c += 5$ is equivalent to $c = c + 5$;

❖ Manipulate your variables.

You can use mathematical expressions to manipulate the data that you have stored in your variables. The most important distinction to remember for mathematical expressions is that a single “=” sets the value of the variable, while “==” compares the values on either side to see if they are equal.

```
x = 3 * 4; /* sets "x" to 3 * 4, or 12 */
x = x + 3; /* adds 3 to the original value of "x", and sets the new value as the variable */
x == 15; /* checks to see if "x" equals 15 */
x < 10; /* checks if the value of "x" is less than 10 */
```

8. Using Conditional Statements

Conditional statements are what drive most programs. They are statements that are determined to be either TRUE or FALSE, and then acted upon based on the result. The most basic of the statements is the if statement.

TRUE and FALSE work differently in C than what you might be used to. TRUE statements always end up equaling a nonzero number. When you perform comparisons, if the result is TRUE then a "1" is returned. If the result is FALSE, then a "0" is returned. Understanding this will help you see how IF statements are processed.

❖ Write a basic IF statement.

You can use IF statements to determine what the program should do next after the statement is evaluated. You can combine it with other conditional statements later to create powerful multiple options, but for now write a simple one to get used to them.

```
#include <stdio.h>
int main()
{
    if (3 < 5 )
        printf("3 is less than 5");
    getchar();
}
```

❖ Use ELSE/ELSE IF statements to expand your conditions.

You can build upon IF statements by using ELSE and ELSE IF statements to handle different results. ELSE statements run if the IF statement is FALSE. ELSE IF statements allow you to include multiple IF statements into one code block to handle various cases. See the example program below to see how they interact.

```
#include <stdio.h>
int main()
{
    int age;
    printf("Please enter your current age: ");
    scanf("%d", &age);
    if ( age <= 12 ) {
        printf("You're just a kid!\n");
    }
    else if (age < 20) {
        printf("Being a teenager is pretty great!\n");
    }
    else if (age < 40) {
        printf("You're still young at heart!\n");
    }
    else {
```

```

        printf("With age comes wisdom.\n");
    }
    return 0;
}

```

The program takes the input from the user and takes it through the IF statements. If the number satisfies the first statement, then the first printf statement is returned. If it does not satisfy the first statement, it is taken through each ELSE IF statement until it finds one that works. If it doesn't match any of them, it goes through the ELSE statement at the end.

9. Loops

Loops are one of the most important aspects of programming, as they allow you to repeat blocks of code until specific conditions are met. This can make repeating actions very easy to implement, and keeps you from having to write new conditional statements each time you want something to happen.

Loops use what is known in C as Increment and Decrement. The unary operator ++, --, is used to increment and decrement which acts upon single operand. Increment operator increases the value of variable by one. Similarly, decrement operator decreases the value of the variable by one. These operators can only be used with the variable but can't be used with expression ++(x+y+z) or constants ++6.

There are three main types of loops: *FOR*, *WHILE*, and *DO...WHILE*.

❖ Use a **FOR** loop.

This is the most common and useful loop type. It will continue running the function until the conditions set in the FOR loop are met. FOR loops require three conditions: initializing the variable, the condition to be met, and the way the variable is updated. If you don't need all of these conditions, you will still need to leave a blank space with a semicolon, otherwise the loop will run forever.

```

#include <stdio.h>
int main()
{
    int y;
    for (y = 0; y < 15; y++;)
    {
        printf("%d\n", y);
    }
    getchar();
}

```

In the above program, y is set to 0, and the loop continues as long as the value of y is less than 15. Each time the value of y is printed, 1 is added to the value of y and the loop is repeated. Once y = 15, the loop will break.

❖ Use a **WHILE** loop.

WHILE loops are more simple than FOR loops. They only have one condition, and the loop acts as long as that condition is true. You do not need to initialize or update the variable, though you can do that in the main body of the loop.

```

#include <stdio.h>
int main()
{
    int y=0;
    while (y <= 15){

```

```

        printf( "%d\n", y );
        y++;
    }
    getchar();
}

```

The `y++` command adds 1 to the `y` variable each time the loop is executed. Once `y` hits 16 (remember, this loop goes as long as `y` is less than *or equal to* 15), the loop breaks.

❖ Use a DO...WHILE loop.

This loop is very useful for loops that you want to ensure run at least once. In FOR and WHILE loops, the condition is checked at the beginning of the loop, meaning it could not pass and fail immediately. DO...WHILE loops check conditions at the end of the loop, ensuring that the loop executes at least once.

```

#include <stdio.h>
int main()
{
    int y;
    y = 5;
    do {
        printf("This loop is running!\n");
    } while ( y != 5 );
    getchar();
}

```

This loop will display the message even though the condition is FALSE. The variable `y` is set to 5 and the WHILE loop is set to run when `y` does not equal 5, so the loop terminates. The message was already printed since the condition is not checked until the end.

More on Pascal and C programming in the HIGH SCHOOL!

CHAPTER: WEB AUTORING

Lesson 1: Hypertext Markup Language (HTML)

Competences:

- Identify and explain the purpose of the parts of an HTML page
- Work with lists, tables, hyperlinks and images
- Use form tags

1. HTML overview

HTML stands for **H**ypertext **M**arkup **L**anguage and it is the most widely used language to write **Web Pages**. It was created by Tim Berners-Lee a British scientist in late 1991. **Hypertext** refers to the way in which Web pages (HTML documents) are linked together. Thus, the link available on a webpage is called Hypertext. As its name suggests, HTML is a **Markup Language** which means *you use HTML to simply "mark-up" a text document with tags that tell a Web browser how to structure it to display*. Originally, HTML was developed with the intent of defining the structure of documents like headings, paragraphs, lists, and so forth to facilitate the sharing of scientific information between researchers. Now, HTML is being widely used to format web pages with the help of different tags available in HTML language.

To create a web page you need a text editor like **notepad**, **notepad++**, **blocknote**, **Adobe Dreamweaver**, **Brackets**, **CoffeeCup**, **Edit plus**, etc. Save the code with extension **.html** or **.htm** and then run (compile) the code using any of your favourite web browsers like **Internet Explorer** or **Google Chrome**, or **Firefox** etc.

2. Basic HTML document

In its simplest form, following is an example of an HTML document:

```
<!DOCTYPE html>
<html>
  <head>
    <title>This is document title</title>
  </head>
  <body>
    <h1>This is a heading</h1>
    <p>Document content goes here.....</p>
  </body>
</html>
```

After running this code with Mozilla Firefox or any other browser, the output will look like this:



3. HTML Tags

It is a set of characters constituting a formatted command for a web page. As told earlier, HTML is a markup language and makes use of various tags to format the content. These tags are enclosed within angle braces **<Tag Name>**. Except few tags like **<hr />** tag is an example of the **empty** element where you do not need opening and closing tags, as there is nothing to go in between them. The **<hr />** element has a space between the characters **hr** and the forward slash. Most of the tags have their corresponding closing tags. For example, **<html>** has its closing tag **</html>** and **<body>** tag has its closing tag **</body>** tag etc.

Above example of HTML document uses the following tags:

Tag	Description
<!DOCTYPE...>	This tag defines the document type and HTML version.
<html>	This tag encloses the complete HTML document and mainly comprises of document header which is represented by <head>...</head> and document body which is represented by <body>...</body> tags.
<head>	This tag represents the document's header which can keep other HTML tags like <title>, <link> etc.
<title>	The <title> tag is used inside the <head> tag to mention the document title.
<body>	This tag represents the document's body which keeps other HTML tags

	like <h1>, <div>, <p> etc.
<h1>	This tag represents the heading.
<p>	This tag represents a paragraph.

To learn HTML, you will need to study various tags and understand how they behave while formatting a textual document. Learning HTML is simple as users have to learn the usage of different tags in order to format the text or images to make a beautiful webpage. World Wide Web Consortium (W3C) recommends using lowercase tags starting from HTML4.

4. General HTML Document Structure

A typical HTML document will have the following structure:

Document declaration tag

```
<html>
```

```
<head> ... </head>
```

```
<body>
```

```
...
```

```
</body>
```

```
</html>
```

Remark: The <!DOCTYPE> declaration tag is used by the web browser to understand the version of the HTML used in the document. Current version of HTML is 5 and it makes use of the following declaration: <!DOCTYPE html>

5. HTML Elements

An **HTML element** is defined by a starting tag. If the element contains other content, it ends with a closing tag, where the element name is preceded by a forward slash as shown below with few tags:

Start Tag	Content	End Tag
<p>	This is paragraph content.	</p>
<h1>	This is heading content.	</h1>
<div>	This is division content.	</div>
 	This is line break	
Hr	Headings	
<!--	This is a comment	-->
	This is a link	
<body>	Content of your page	</body>
<head>	Special information about your page	</head>

So here <p>....</p> is an HTML element, <h1>...</h1> is another HTML element.

There are some HTML elements which don't need to be closed, such as <img.../>, <hr/> and
 elements. These are known as **void elements**.

HTML documents consists of a tree of these elements and they specify how HTML documents should be built, and what kind of content should be placed in what part of an HTML document.

6. HTML Tag vs. Element

An HTML element is defined by a *starting tag*. If the element contains other content, it ends with a *closing tag*. For example, <p> is starting tag of a paragraph and </p> is closing tag of the same paragraph

but **<p> This is paragraph</p>** is a paragraph element. There are also **Nested HTML Elements** where it is very much allowed to keep one HTML element inside another HTML element:

```
<!DOCTYPE html>
<html>
  <head>
    <title>Nested Elements Example</title>
  </head>
  <body>
    <h1>This is <i>italic</i> heading</h1>
    <p>This is <u>underlined</u> paragraph</p>
  </body>
</html>
```

Which when run will produce the following output:

This is *italic* heading
This is underlined paragraph

7. HTML Attributes

We used them so far in their simplest form, but most of the HTML tags can also have attributes, which are extra bits of information.

An attribute is used to define the characteristics of an HTML element and is placed inside the element's opening tag. All attributes are made up of two parts: a **name** and a **value**:

- The **name** is the property you want to set. For example, the paragraph **<p>** element in the example carries an attribute whose name is **align**, which you can use to indicate the alignment of paragraph on the page.
- The **value** is what you want the value of the property to be set and always put within quotations. The below example shows three possible values of align attribute: **left**, **center** and **right**. Attribute names and attribute values are case-insensitive. However, the World Wide Web Consortium (W3C) recommends lowercase attributes/attribute values in their HTML 4 recommendation.

Example:

```
<!DOCTYPE html>
<html>
  <head>
    <title>Align Attribute Example</title>
  </head>
  <body>
    <p align="left">This is left aligned</p>
    <p align="center">This is center aligned</p>
    <p align="right">This is right aligned</p>
  </body>
</html>
```

This will display the following result:

This is left aligned

This is center aligned

This is right aligned

8. Core Attributes

The four core attributes that can be used on the majority of HTML elements (although not all) are: *Id*, *Title*, *Class*, and *Style*

These attribute which provide additional information about an element. Attributes are always assigned in the opening tag and always contain a name and value pair. The value must be contained in double quotes.

`<tag name="value"> Content </tag>`

Attribute Descriptions

Class	Specifies one or more class names for an element (CSS)
Id	Specified a unique id for an element
Style	Specifies an inline CSS style for an element
Title	Specifies extra information about an element (displays as tooltip)

9. HTML Lines

The HTML horizontal rule can be used to divide content areas and uses the `<hr>` tag. Inserting the `<hr>` tag will draw a horizontal line across your content area.

10. HTML Comments

Comments can be inserted into HTML code to make it more readable and to explain to the reader of your code what it is you plan to do or what you have changed. It's always good practice to comment your HTML code. Comment elements are written as follows and do not show on your rendered page.

`<!-- This is a comment -->`

The `<!--` is the beginning of the comment and the `-->` is the end. Everything typed within these tags will be invisible to the viewer unless the source code is viewed.

11. HTML "White Space"

Browsers will ignore all "white space" in your HTML document. White space can be added to make your code more human readable, but it will be completely ignored when the browser renders the document. **Keep this in mind when you write your code. Everything is controlled by a tag. Tags tell the browser what to do, if you instruct nothing, nothing will result.**

12. HTML Headings

HTML headings are defined with `<h1>` through `<h6>` tags. `<h1>` defines the most important heading while `<h6>` defines the least important heading.

13. HTML Paragraphs

HTML Documents are divided into paragraphs. Paragraphs are defined with the `<p>` tag. Browsers will automatically add white space above and below a paragraph tag. Make sure to include the closing `</p>` tag to complete the paragraph and start the next.

14. HTML Formatting

HTML also uses tags for formatting text, much like you would with a word processing program. Text formatting means simply things like **bold**, *italic*, and underline. You should note, however, that underlining text in an HTML document is terribly poor form as it can be misconstrued as a link. All formatting tags must be closed.

Tag Description

	Defines bold text
	Also defines bold text
<i>	Defines italic text
	Also defines italic text
<sub>	Defines subscript text
<sup>	Defines superscript text
<blockquote>	Defines a section of text that will be indented

Example:

<p>Text formatting means simply things like bold,<i> italic,</i> and <u> underline. </u>

15. HTML Links

The HTML <a> tag defines an anchor or hyperlink.

A **hyperlink (or link)** is a word, group of words, or image that you can click on to jump to another document. When you move the cursor over a link in a Web page, the arrow will turn into a little hand. The most important attribute of the <a> element is the href attribute, which indicates the link's destination.

By default, links will appear as follows in all browsers:

- An unvisited link is underlined and blue.
- A visited link is underlined and purple.
- An active link is underlined and red.

16. HTML Link Syntax

An HTML link is required to have an attribute in order to have a function. The <a> tag will surround the content you wish to effect, whether it be an image, text or any other HTML element. The value of the attribute **must** be contained in quotes.

Attribute Value

href	Specifies the destination of the link
target	Specifies the browser window to display the link
id	Specifies a bookmark inside a document
title	Displays a tooltip (not required)

Example

```
<a href=http://www.andar360.com> Andar360.com</a>
<a id="top">Top of the page</a>
<a href="#top">Go to the top of the page</a>
<a href="home.html" target="_parent">Go to Home Page</a>
```

❖ Target Attribute

There are five values for the target attribute. The target attribute specifies where to open the linked document and is supported in all major browsers. As with all attributes the value must be contained in quotes.

Value Description

Value	Description
_Blank	Opens the linked document in a new window or tab
_Self	Opens the linked document in the same frame as it was clicked
_Parent	Opens the linked document in the parent frame
_Top	Opens the linked document in the full body of the window
Framename	Opens the linked document in a named frame

17. HTML Head

The HTML <head> element is a special container element to contain all of the head specific elements. Elements inside the head can include scripts, tell the browser where to find external information such as style sheets or JavaScript and provide search engines with descriptive information about the content of the page.

Tag Description

<head>	Defines information about the document
<title>	Defines the title of a document
<base>	Defines the default address of the page
<link>	Links to the document to an external resource
<meta>	Defines metadata about an HTML document
<script>	Defines a client-side script
<style>	Defines style information for a document

18. HTML Images

Images are displayed in HTML by use of the tag. The tag does not need to be closed. The tag has multiple attributes to define what to display and how it should be displayed. As with other attributes, values must be contained in quotes.

Attribute Value Description

alt	Plain text	Alternate text to describe the image
border	Pixels #	Width of border around an image "0" for none
height	Pixels #	Height in pixels
src	URL	The location of the image file
width	Pixels #	Width in pixels

19. HTML Tables

A table is comprised of rows and columns, similar to a spreadsheet, and can be quite complex. Tables consist of a number of tags and will always start with the <table> tag. Like many other tags the table tag can have attributes assigned to it such as width and follow the same rules as other attributes. The <table> tag signifies the start of a table but will need other tags to assign rows and columns inside it.

❖ Table Rows and Columns

Table Rows are defined using the <tr> tag and columns are defined using the <td> tag. The <td> tag stands for 'Table Data' and can contain text, images, links, lists or any other HTML element. Below is an example of a simple table in HTML.

```
<table>
  <tr>
    <td>Row One – Column One</td>
    <td>Row One – Column Two</td>
  </tr>
  <tr>
    <td>Row Two – Column One</td>
    <td>Row Two – Column Two</td>
  </tr>
</table>
```

The output is the following :

Row One –Column One	Row One – Column Two
Row Two – Column One	Row Two – Column Two

20. HTML Lists

There are two types of lists in HTML, Ordered and Unordered. Quite simply, the two are best described as Numbered and Bulleted, respectively. Lists contain two types of tags: The type of list: Ordered and Unordered and the List items .

Unordered List

```
<ul>
  <li>List Item</li>
  <li>List Item</li>
</ul>
```

Ordered List

```
<ol>
  <li>List Item</li>
  <li>List Item</li>
</ol>
```

CHAPTER: DATA COMMUNICATION

Competences:

- Explain communication channels
- Describe data transmission mode
- Identify communication media and devices.

Introduction

Communication is a process whereby information is enclosed in a package and is channelled and imparted by a sender to a receiver via some medium. The receiver then decodes the message and gives the sender a feedback. All forms of communication require a sender, a message, and an intended recipient. Communication requires that all parties have an area of communicative commonality. There are **auditory** means, such as **speech, song, and tone of voice**, and there are nonverbal means, such as **body language, sign language, paralanguage, touch, eye contact**, through media, i.e., pictures, graphics and sound, and writing. It should be noted here that communication is only said to have taken place when the recipient understands the message or information sent.

In data communication the following basic terms are frequently used:

- **Data:** a collection of facts in raw form that becomes information after processing.
- **Signal:** an electric or electromagnetic encoding of data.
- **Signaling:** propagation of signals across a communication channel.
- **Transmission:** sending of data from one place to another by means of signals.

Five basic components in a communication system.

- **Data Source:** creates data for transmission,
- **Transmitter:** encodes data for transmission,
- **Communication channel:** connecting medium between communicating devices,
- **Receiver:** decodes transmitted data back to original,
- **Destination:** the final destination of the transmission.

Example: John calls Peter on phone.

The data source is John, the transmitter is John's phone, the communication channel is the telephone cable or microwave, the receiver is Peter's phone and the destination is Peter.

1. Communication Channels

A communication channel is a pathway over which information can be conveyed. It may be defined by a wire that connects communicating devices, or by a radio, laser, or other radiated energy source that has no obvious physical presence. Information sent through a communication channel has a source from which the information originates, and a destination to which the information is delivered. Although information originates from a single source, there may be more than one destination, depending upon how many receive stations are linked to the channel and how much energy the transmitted signal possesses. Any communication channel has a direction associated with it:

a. Simplex Mode

In simplex mode, signals are transmitted in only one direction. The flow of information is unidirectional from transmitter to receiver always. Examples are radio broadcasting, television broadcasting, computer to the printer connection and CPU to monitor communication.

b. Half duplex Mode

In half duplex mode, signals can be transmitted in both directions but only one way at a time. The flow of information is bidirectional but information can only be sent if it is not being received. It is suitable for data transmission between a computer and dumb terminals. An example is the police radio (walkie-talkie).

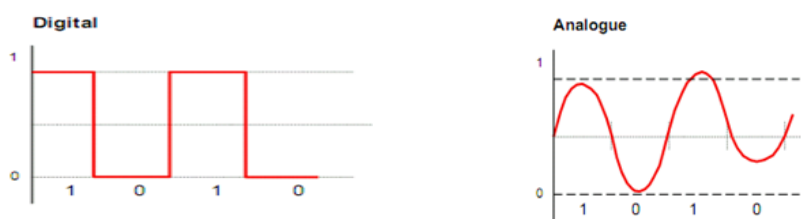
c. Full duplex Mode

In full duplex mode, signals can be transmitted in both directions simultaneously. The communicating devices can transmit at the same time. The flow of information is bidirectional. It is suitable for interactive systems. An example is the telephone.

2. Data transmission modes

a. Digital vs. Analogue transmission

Digital transmission or digital communications is the physical transfer of data (a digital bit stream) over a point-to-point or point-to-multipoint communication channel. Examples of such channels are copper wires, optical fibres, wireless communication channels, and storage media.

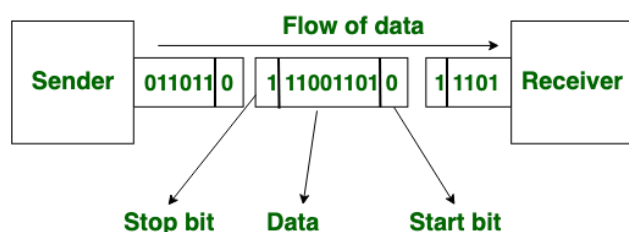


While **Analogue communications** is the transfer of continuously varying information signal, analogue communications is the transfer of discrete messages. The messages are either represented by a sequence of pulses by means of a line code (*baseband transmission*), or by a limited set of continuously varying wave forms (*pass band transmission*), using a digital modulation method.

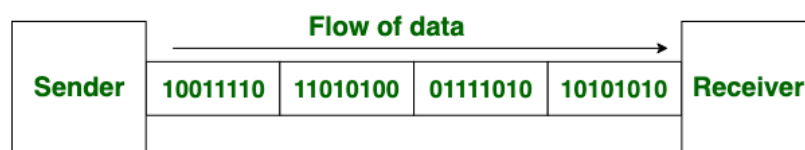
b. Asynchronous vs. Synchronous Transmission

Asynchronous transmission refers to the exchange of data between two or more parties without the requirement for all the recipients to respond immediately. There is gap present between the data and consist of start bit (1) and end bit (0) in middle of which actual data is present. It is much better and flexible than synchronous communication though it's slow and cheaper.

In **synchronous transmission**, data is sent in form of blocks or frames. Here, there is no gap present between data. Synchronous transmission means that two or more people exchange information in real-time. Mostly used to confirm an important operation immediately and it's fast and costlier.



Asynchronous Transmission

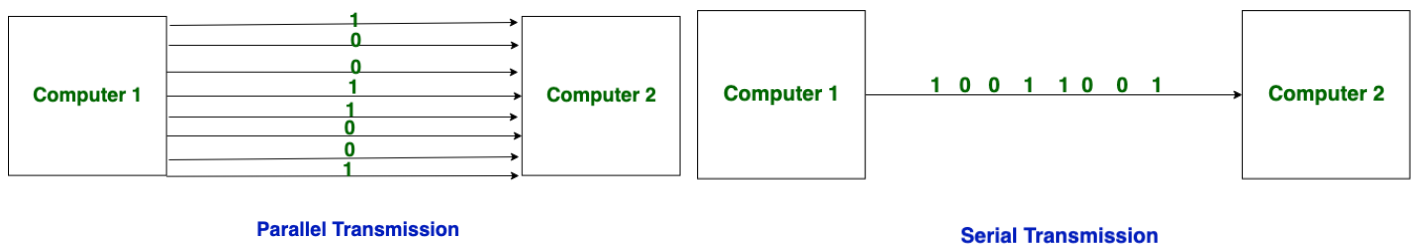


Synchronous Transmission

c. Serial vs. Parallel transmission

In **serial transmission** there is only a single line (or few more) between the source and destination and the complete data is transferred through it. Since the data bits are transferred one by one, in series, hence serial transmission is quite slow in comparison to parallel transmission but in spite of its slow speed it is quite practical. This is the reason why it is used in abundance. For example, transmission between computer and terminal takes place in serial form. All USB devices such as pen drive, web camera etc. are serial devices.

In **parallel transmission**, there are multiple lines (usually 8 or multiples of eight) so that more than one bit can be transmitted at a time. Since multiple bits are transferred in parallel hence the transmission is very fast. But in spite of being fast, it is not practically used for longer distance because multiple lines are costlier to lie and due to the parallel wires running beside each other, the problem of cross talk starts and the signal gets corrupted. But for the shorter distances such as connecting printer to the computer for printing, it works very well.



3. Communication media and devices

In communication, **media** (singular **medium**) are the storage and transmission channels or tools used to store and deliver information or data. It is often referred to as synonymous with mass media or news media, but may refer to a single medium used to communicate any data for any purpose.

a. Wired communication media and devices

This refers to the transmission or delivery of information or data with the use of wires. There are many types of wires: twisted pair, coaxial, fibre optic, etc. In addition to the hardware components needed for networking wired communication makes use of:

❖ **Modems (Modulation DEModulation)**

This is a device that during communication converts digital carrier signals to analogue information (analogue to digital conversion) in order to produce a signal that can easily be transmitted and decoded to produce the original digital information or data (digital to analogue conversion) by another modem the other side. It therefore carries out modulation at one end and demodulation at the other.

❖ **Multiplexers and Demultiplexers**

A multiplexer is a device that accepts many signals (both analogue and digital) from different sources and transmits them in a single line while, a demultiplexer does the reverse i.e. accepts a single signal send to it by the multiplexer and breaks it into the multiple signals expected.

b. Wireless communication media

Wireless communication technology which is not new at all in our lives has been gaining much fame now our days. This is communication of media without physical connection. This technology today makes use of:

❖ **Infrared Transmissions**

This is a type of technology that makes use of very high frequencies approaching that of visible light in the electromagnetic spectrum to carry out close broadcast transmission in a close range. Infrared signals can

easily be blocked by opaque object objects and can equally receive interference from light, the reason why they are mostly made use of in command alarm or door opening systems in super markets, office buildings etc. Infrared transmissions are limited to short distances.

❖ **Microwave Transmission**

Just like the infrared technology, the microwave technology also makes use of high frequencies but involves both long and short distance communications especially that involving satellites. In this type of communication, the emitter and the receiver must be within the line of sight of each other.

❖ **Radio waves**

This is the old wireless technology that has often been used by the FM and AM radios.

❖ **The Bluetooth wireless transmission technology**

This is the most recent of the wireless technologies. It operates on a 2.4GHz frequency band with a speed of about 1 or 2 Mbps. With this technology, a single device can communicate continuously with several other devices within a room such as printers, keyboards laptops mobile phones etc. All these devices have in-built features that automatically adjust the signals for interference.

Two major hardware components used in the wireless communication technology are:

➤ **The wireless Access Point (WAP) or Access Point (AP)**

This is a small box with antenna(s) used to broadcast radio waves, used to send and receive data signals in both directions. Good broadcasting is recorded within a range (hotspot) of 10m to 16km after which the signal grows weaker as you move from the AP or WAP. There exist some devices that incorporate both the AP and a router e.g. Linksys, Cisco and 3COM.

➤ **Wireless adapters**

These are devices that are very similar to the network interface cards and are often connected in much the same way. There exist in many forms both internal and external to the computer.

Benefits of Wireless communication

- It's cheaper.
- Flexible.
- Data is transmitted faster and at high speed.
- Reduced maintenance and installation cost compared to other form of networks.
- Wireless network can be accessed from anywhere, anytime.

Limitation of Wireless communication

- It's less secure.
- Unreliable.
- More open to interference.
- Increased chance of jamming.

4. Types of attacks on networks

Four types of attacks are possible: **freeloading** to use the network or Internet connection without permission; **eavesdropping** to pick up the owner's data including passwords sent to systems elsewhere; **intrusion** to tamper with the owner's system; and **jamming** to prevent the use of the network, or degrade its performance, by deliberately transmitting radio waves that interfere with it.

5. Network classification based on communication

Based on communication, network can be classified as *private, public or international*.

➤ **Private communication Network**

In the Internet addressing architecture, a **private network** is a network that uses private IP address space to support the communication needs of a particular institution such as a school or college, university or organizations.

➤ **Public communication Network**

This is a network designed to provide the public with voice, video and data communication over a large geographical area. The users or subscribers pay a fee for using the network e.g. **Internet Service Providers (ISP)** (e.g. Camtel, MTN, Orange, Nexttel, Ringo).

➤ **International communication Network**

This is a network designed to provide users from different continents with voice, video and data communication facilities and teleconferencing services using the satellites.

Other types of network include the following:

➤ **Intranet**

An **intranet** is a private computer network that uses Internet Protocol technologies to securely share any part of an organization's information or network operating system within that organization. The term is used in contrast to *internet*, a network between organizations and instead refers to a network within an organization.

➤ **Extranet**

An **extranet** is a private network that uses Internet protocols network connectivity. An extranet can be viewed as part of a company's intranet that is extended to users outside the company usually via the Internet.

➤ **VPN (virtual private network)**

It is a private secure network connection established within a public network such as the Internet. The network nodes appear to be connected by private lines and so form a virtual private network.

Remark: Difference between Domains and Work groups

A **Domain** is a sub network made up of a group of client computers under the control of one central computer called the server.

A **workgroup** is a collection of computers on a local area network (LAN) that share common resources and responsibilities. Workgroups provide easy sharing of files, printers and other network resources. Being a peer-to-peer (P2P) network design, each workgroup computer may both share and access resources if configured to do so.

7. Network/communication protocols

The protocols in human communication are rules about appearance, speaking, listening and understanding. These rules, also called *protocols of conversation*, represent different layers of communication. They work together to help people communicate successfully. The need for protocols also applies to computing systems.

The Internet Protocol (IP) and the Transmission Control Protocol (TCP) are the most important of these, and the term Internet Protocol Suite, or **TCP/IP** suite, refers to a collection of its most used protocols. Most of the communication protocols in use on the Internet are described in the ***Request for Comments*** (RFC) documents of the ***Internet Engineering Task Force*** (IETF).

Some most used protocols of the TCP/IP suite include:

- **IPX/SPX:** (Internetwork Packet Exchange/Sequenced Packet Exchange) is a data transmission protocol developed by **Novell** and widely used in local area networking.
 - **ARP:** (Address Resolution Protocol) used to convert logical address to physical and vice versa.
 - **DHCP:** (Dynamic Host Configuration Protocol) used to assign automatically IP address in a network.
 - **FTP:** (File Transfer Protocol) used to transfer files over the network.
 - **HTTP:** (Hypertext Transfer Protocol) used to transfer web pages over internet.
 - **ICMP:** (Internet Control Message Protocol) used to manage errors on the internet.
 - **SCTP:** (Stream Control Transmission Protocol) transmission protocol that combines the best of UDP & TCP.
 - **SMTP:** (Simple Mail Transfer Protocol) used to transmit electronic mail on the internet.
 - **SNMP:** (Simple Network Management Protocol) used for administration task on distance computer.
 - **UDP:** (User Datagram Protocol) used to transfer packets of data called user datagram.
 - **VoIP:** (Voice Over Internet Protocol) used on the internet to make telephone calls.
-

CHAPTER: COMPUTER NETWORK AND THE INTERNET

Lesson 1: Computer Network

Competences:

- Describe the different types of networks
- Describe types of network topologies
- Describe the different network architectures

Introduction

Computer network is a collection of computers and other related devices that are connected together so they can communicate and share resources. The smallest network can be as simple as two computers linked together. The resources shared include files, folders, printers, disk drives and anything else that exists on a computer. Any computer or device on a network is called a node.

Networking is the term that describes the processes involved in designing, implementing, upgrading, managing and otherwise working with networks and network technologies.

Continue developing these notes from your notes in form 3. Type and print.

Lesson 2: The internet (See form 3 notes). Type and print.

CHAPTER: CLASSIFYING COMPUTERS

Competences:

- To know the history of the computer, the different types that exist with their main technological change and the types of data computers use.

Introduction

Computers differ in size and shape such that one used in a hospital laboratory is different from that used in an office and a computer that is used in weather forecasting is different from the two kind mentioned above.

To facilitate the study and understanding of this machine, they are often divided into groups based on certain criteria for example; Generation, Purpose, Size and Data representation.

1. Generation

Generation in computer terminology is a change in technology a computer was being used. Initially, the generation term was used to distinguish between varying hardware technologies but nowadays, generation includes both hardware and software which together make up an entire computer system. Each generation is characterized by a medium technological development which radically changed the way computer resulting in increasingly smaller, cheaper, more powerfully and more efficient machines and they include the 1st, 2nd, 3rd, 4th and 5th.

Following are the main five generations of computers:

- **First Generation:** The period of first generation: 1940-1956. Vacuum tube based. And used batch Oss. Inputs were based on punched cards and paper tape while output was displayed on print out.
- **Second Generation:** The period of second generation: 1952-1964. Transistor based. Still relayed on punched cards and print outs. In this generation assembly language and high level programming language like FORTRAN, COBOL was used. They were Batch processing and Multiprogramming Operating system used.
- **Third Generation:** The period of third generation: 1964-1972. Integrated Circuit based. Users interacted with computers using keyboards and monitors. An interface with operating system allowed the device to run more than one program at a time with a central program monitoring the memory.
- **Fourth Generation:** The period of fourth generation: 1972-1990. Very Large Scale Integrated circuits (VLSI) microprocessor based. In this generation Time sharing, Real time, Networks, Distributed Operating System were used.
- **Fifth Generation:** The period of fifth generation: 1990-onwards. Ultra Large Scale Integration (ULSI) microprocessor based. This generation is based on parallel processing hardware and AI (Artificial Intelligence) software.

2. Size and performance

Based on size, performance or cost, computers can be classified as: super computers, mainframe, midrange and microcomputers.

a. Super computers

These are the largest, fastest and most expensive computers. A typical super computer deals with very large quantities of data and can be used simultaneously by thousands of people who can be in different offices or towns who have access to it by mean of devices called terminals. Its speed is measured in floating points per second (FLOPS). These are mostly used where there is heavy demand for processing speed e.g. weather forecasting, creation of military weapons, space exploration etc. and are mostly found in big universities, research institutions, governmental agencies, and typically use operating systems such as LINUX and UNICOS.

b. Mainframe computers

This is the second class of largest computers and is similar to super computers in many ways but is generally smaller, cheaper and slower. They support more simultaneous processes than super computers even though a typical super computer will perform a single operation faster than it. Just like super computers, several terminals in different geographical locations can be connected to a mainframe thus making it possible for hundreds of people to use the computer at the same time. They are mostly used in banks, insurance companies and in the internet as servers. They usually have a speed measured in millions of instructions per second (MIPS).

c. Midrange computers

They are designed to serve tens of people at a time each sitting on a terminal. Although they may be accessed and used by the above number of users, these users are usually at proximity of the computers.

d. Microcomputers

These are the smallest, least expensive and slowest type of computers but are however the most diversified, affordable and least expensive type of computers. They are designed to be used by one person and are usually called personal computers. A typical microcomputer is fundamentally implemented with a microprocessor, memory, storage, input and output units.

3. Base on purpose

Here they are grouped as special and general purpose computers:

- **Special purpose computers:** Also called embedded computers, it is designed for a particular job only.
- **General purpose computers:** Also called jack-of-all trade, it is designed to solve multiple problems/tasks.

4. Based on Data Representation

There are 3 main types which are:

- **Digital computers:** It represents information in the form of discrete quantities. **E.g.** 1, 2, 3, $+\infty$
- **Analogue computers:** They represent data in the form of variable quantities like voltage. Generally, they are very fast since they can solve a complex question in the time a signal crosses the circuit.
- **Hybrid Computers:** This is a computer made by combining features of digital and analogue computers.

CHAPTER: COMPUTER ETHICS AND LEGISLATION

Competences

- Discuss the ethical and moral obligations of the users and managers of computerized information systems.

I. Computer Ethics

Introduction

Ethics refers to the principles of right and wrong that individuals acting as free moral agents, use to make choices that guide their own behavior. It places a value on human acts according to whether they are good or bad.

Note: moral ethics does not depend on the majority, what is good is good even if nobody is doing it and what is wrong is wrong even if everyone is doing it.

Computer ethics refers to standards of good conduct applied within the use of computers. It defines principles for judging computing acts whether they are good or bad.

1. Fundamental principles of Ethics

The fundamental principles of ethics formulated by the Computer Ethics Institute (CEI) as the “**ten commandments**” of computer ethics are:

1. Thou shall not use a computer to harm other people.
2. Thou shall not interfere with other people’s computer work.
3. Thou shall not snoop around in other people’s files.
4. Thou shall not use a computer to steal.
5. Thou shall not use a computer to bear false witness.
6. Thou shall not copy or use proprietary software for which you have not paid.
7. Thou shall not use other people’s computer resources without authorization or proper compensation.
8. Thou shall not appropriate other people’s intellectual output.
9. Thou shall think about the social consequences of the program you write or the system you design.
10. Thou shall use a computer in ways that show consideration and respect for your fellow humans.

2. Codes of Ethics and Professional Conduct

A code of ethics and professional conduct sets the standards for what is expected of a professional. They are promises by professions to regulate themselves in the general interest of the society. Code of ethics for information technology professionals encourage them to behave ethically and responsibly with the tools and information they have in their control. Codes of ethics are promulgated by associations such as the British Computing Society (BCS), the Association for Computing Machinery (ACM), the Institute of Electrical and Electronics Engineer (IEEE) etc.

a. The BCS (British Computing Society) Code of Ethics

This code sets out the professional standards required by the society as a condition of membership. It applies to members of all grades, including students, and affiliates, and also non-members who offer their expertise as part of the Society’s professional Advice Register.

Within this document, the term ‘relevant authority’ is used to identify the person or organization which has authority over your activity as an individual. If you are a practicing professional, this is normally an employer or client. If you are a student, this is normally an academic institution.

❖ **The public interest**

- 1) You shall carry out work or study with due care and diligence in accordance with the relevant authority’s requirements, and the interest of system users. If your professional judgment is overruled, you shall indicate the likely risks and consequences.
- 2) In your professional role you shall have regard for the public health, safety and environment.

❖ **Duty to relevant authority**

- 3) You shall avoid any situation that may give rise to a conflict of interest between you and your relevant authority. You shall make full and immediate disclosure to them if any conflict is likely to occur or be seen by a third party as likely to occur.
- 4) You shall not disclose or authorize to be disclosed, or use for personal gain or to benefit a third party.

❖ **Duty to the profession**

- 5) You shall uphold the reputation and good standing of the BCS in particular, and the profession in general, and shall seek to improve professional standards through participation in their development, use and enforcement.
- 6) You shall act with integrity in your relationships with all members of the BCS and with members of other professions with whom you work in a professional capacity.

❖ **Professional competence and integrity**

- 7) You shall seek to upgrade your professional knowledge and skill, and shall maintain awareness of technology developments, procedures and standards which are relevant to your field, and encourage your subordinates to do likewise.
- 8) You shall not claim any level of competence that you do not possess. You shall only offer to do work or provide a service that is within your professional competence.
- 9) You shall accept professional responsibility for your work and for the work of colleagues who are defined in a given context as working under your supervision.

b. The ACM (Association for Computing Machinery) Code of Ethics

1. General Moral Imperatives

As an ACM member I will...

- 1.1. Contribute to society and human well-being.
- 1.2. Avoid harm to others.
- 1.3. Be honest and trustworthy.
- 1.4. Be fair and take action not to discriminate.
- 1.5. Honour copyrights and patents.
- 1.6. Give proper credit for intellectual property.
- 1.7. Respect rights to limit access to computing and communication systems.
- 1.8. Respect the privacy of others.
- 1.9. Honour confidentiality.

2. More Specific Professional Responsibilities.

As an ACM Computing Professional I will . . .

- 2.1 Strive to achieve the highest quality, effectiveness and dignity in both the process and products of professional work.
- 2.2. Acquire and maintain professional competence.
- 2.3. Know and respect existing laws pertaining to professional work.
- 2.4. Accept and provide appropriate professional review.
- 2.5. Give comprehensive and thorough evaluations of computer systems and their impacts, including analysis of possible risks.
- 2.6. Honor contracts, agreements, and assigned responsibilities.
- 2.7. Improve public understanding of computing and its consequences.
- 2.8. Access computing and communications resources only when authorized to do so.

c. The IEEE (Institute of Electrical and Electronics Engineer) code of ethics

It states, we the members of the IEEE, in recognition of the importance of our technologies in affecting the quality of life throughout the world, and in accepting a personal obligation to our profession, its members and the communities we serve, do hereby commit ourselves to the highest ethical and professional conduct and agree:

1. To accept responsibility in making decisions consistent with the safety, health and welfare of the public, and to disclose promptly factors that might endanger the public or the environment.
2. To avoid real or perceived conflicts of interest whenever possible, and to disclose them to affected parties when they do exist.
3. To be honest and realistic in stating claims or estimates based on available data;
4. To reject bribery in all its forms.
5. To improve the understanding of technology, it's appropriate application, and potential consequences.
6. To maintain and improve our technical competence and to undertake technological tasks for others only if qualified by training or experience, or after full disclosure of pertinent limitations.
7. To seek, accept, and offer honest criticism of technical work, to acknowledge and correct errors, and to credit properly the contributions of others.
8. To treat fairly all persons regardless of such factors as race, religion, gender, disability, age, or national origin.
9. To avoid injuring others, their property, reputation, or employment by false or malicious action.

II. Legislation

Legislation is the act of making and passing laws.

1. The Data Protection Act

It is aimed at protecting the rights of the individuals to privacy. Some Data Protection Act rules are:

- If an organization holds data on individuals, it must be registered under the act.
- Personal data should be processed fairly and lawfully.
- Personal data should not be disclosed in anyway other than lawfully and within the registered purpose.
- Personal data should be adequate and relevant and not excessive for the required purpose.
- Personal data should be kept accurate and kept up to date.

- Data must be processed in accordance with the right of the data subject.
- Appropriate security measures must be taken against unauthorized access.

2. The Computer Misuse Act

The Act makes it an offence to access any computer to which you do not have an authorized right to use. It introduces three criminal offences:

- (1) Unauthorized access to computer material.
- (2) Unauthorized access with intent to commit or facilitate commission of further offences.
- (3) Unauthorized modification of computer material.

3. Copyright, Design and Patent Act

This Act is designed to protect all types of intellectual property and ensure that authors or creators of a piece of work receive both credit and compensation.

- **Copyright:** is a statutory grant that protects original work. Something that is copyrighted is not to be reproduced, published or copied without permission from the copyright holder. Ideas are not protected by copyright; only the specific presentation of the idea is copyrightable.
- **Design:** a design is the appearance or construction of something. A design is not immediately protected; it must be registered with the appropriate institution.
- **Patent:** a patent is a grant to inventors that give them exclusive monopoly over their invention. It gives them the right to stop others from producing, selling or using their invention. Unlike copyrights, patents protect the ideas or design of the invention rather than any tangible form of the invention.

4. Health and Safety Act

This act is designed to protect employees. The original Act and its many added regulations cover the range of hazards an employee may face like handling hazardous material. Some of the regulations that apply to the computing industry are:

- **Display Screen Equipment Regulations:** it covers the precautions that must be taken when an employee uses a visual display unit. The regulation covers items such as the chair which must be adjustable, the desk which must be at the appropriate height, the monitor which must be adjustable and the lighting which must be appropriate.
- **Moving and Handling Regulations:** these regulations lay down the rules for safe moving of heavy objects. All employees involved in such activities must receive proper training on avoiding injury when moving heavy objects.
- **Control of Substances Hazardous to Health (COSHH):** these regulations cover the safe storage and use of hazardous materials. This includes items such as laser printer toners and anyone involved in replacing such items must be made aware of the potentially toxic nature of toners.

CHAPTER: COMPUTER CRIME AND MEASURES TO COMBAT THEM

Introduction

A computer crime is any illegal act that involves the computer either as the target of the crime or as a tool used in committing the crime. When the computer is the target of the criminal act, the crime is said to be a computer-related crime (CRC). When the computer is a tool used to commit the crime, the crime is referred to as a computer-assisted crime (CAC).

1. Types of Computer Crimes

❖ Identity Theft

Identity theft is the crime of impersonation. It is a form of fraud in which someone pretends to be someone else by assuming that person's identity, typically in order to access resources or obtain credit and other benefits in that person's name.

❖ Phishing

Phishing is the criminally fraudulent process of acquiring or attempting to acquire sensitive information such as usernames, passwords and credit card details by masquerading as a trustworthy entity in an electronic communication.

❖ Software piracy

This is the illegal (unauthorized) reproduction of copyrighted or patented software for personal use, for sale or free distribution. It is the most widely practiced type of computer crime.

❖ Malware Attacks

Malware attacks include but are not limited to computer virus, worms, and Trojan horse, spyware and logic bombs.

❖ Virus:

It is a computer program that can copy itself and infect a computer where it destroys files and disrupts the operation of the computer. A virus can spread from one computer to another (in some form of executable code) when its host is taken to the target computer.

❖ Worm

It is a self-replicating malicious program which uses a computer network to send copies of it to other computers (nodes) on the network and it may do so without any user intervention. Unlike a virus, it does not need to attach itself to an existing program. Worms cause harm to the network by consuming bandwidth whereas viruses corrupt or modify files on a targeted computer.

❖ Trojan horse

It is malware that appears to perform a desirable function for the user prior to run or install but instead facilitates unauthorized access of the user's computer system. Once a Trojan horse has been installed on a target computer system, a hacker may have access to the computer remotely and perform various operations, limited by user privileges on the target computer system and the design of the Trojan horse.

❖ Spyware

It is software that monitors a computer user's activity without their knowledge and reports it to a central location. The purpose of spyware ranges from purportedly benign (enforcing copyrights, displaying targeted advertisements) to very malicious (stealing passwords and credit card numbers). The most common way to get spyware on your computer is to install it yourself when you are tricked into installing free software.

❖ Logic bomb

Also known as **slag code**, is a piece of computer code that executes a malicious task such as clearing a hard drive or deleting specific files when it is triggered by a specific event. It is secretly inserted into the code of a computer's existing software, where it lies dormant until that event occurs. This event may be a specific date and time or failure to input a command at a certain time.

❖ Software Key loggers

It is software that record keystrokes entered by a user, usually to secretly monitor and/or maliciously use this information. They can record instant messages, email, passwords and any other information you type at any time using your keyboard. Software key loggers may also be embedded in spyware, allowing your information to be transmitted to an unknown third party over the Internet.

❖ Denial or Degradation of Service (DoS) Attack

It is an attack to a computer system that puts it out of action by overloading it with data in a way that the system was never prepared to handle. A DoS attack makes the system unavailable to its intended users.

❖ **Social Engineering**

It refers to a non-technical kind of intrusion that relies heavily on human interaction and often involves tricking other people to break normal security procedures. A person using social engineering to break into a computer network might try to gain the confidence of an authorized user and get them to reveal information that compromises the network's security. Social engineers often rely on the natural helpfulness of people as well as on their weaknesses.

❖ **Cyber stalking Cyber bullying**

It is a crime in which the attacker harasses a victim using electronic communication, such as e-mail or instant messaging (IM), or messages posted to a web site or a discussion group. Cyber stalking messages differ from ordinary spam in that a cyber-stalker targets a specific victim with often threatening messages, while the spammer targets a multitude of recipients with simply annoying messages.

❖ **Cyber terrorism**

Cyber terrorism can be defined as an act of terrorism committed through the use of cyberspace or computer resources. As such, a simple propaganda in the Internet, that there will be bomb attacks during the holidays can be considered cyber terrorism.

❖ **Spamming**

This is the act of sending unwanted bulk of e-mail for commercial purposes.

Other types of computer crime are: *scamming, theft of computer equipment, pharming, spoofing, social engineering and phreaking.*

2. Measures to Combat Computer Crimes

- Install strong doors and locks to computer rooms to prevent computer equipment theft.
- Use access control mechanisms that will ensure confidentiality, integrity and availability.
- Encrypt confidential data stored in computers or transmitted over communication networks.
- Install anti-virus software and update them regularly.
- Install intrusion detection systems to help detect any unauthorized access to the system.
- Install firewalls to prevent unauthorized access to local networks.

3. Computer Security

Computer security is the process of preventing and detecting the unauthorized use of computer systems from accidental or intentional harm by unauthorized users. Prevention helps stop unauthorized users from accessing any part of the computer system by controlling access to the system, while detection helps determine whether or not someone attempted to break into the system, if they were successful, and what they may have done. Computer security has three main goals, **confidentiality, integrity and availability**, which can be conveniently summarized by the acronym "**CIA**":

- Confidentiality ensures that information is not accessed by unauthorized persons.
- Integrity ensures that information is not altered by unauthorized persons in a way that is not detectable by authorized users.
- Availability ensures that the system is running and reachable.

Different mechanisms are used to ensure the security of computer systems.

a. Authentication

Authentication is the process of determining if someone is who they declare to be. Three basic authentication strategies are:

- something the user knows (password)

- something the user has (smartcard)
- something the user is (biometrics)

❖ Passwords

When authentication is done through the use of a password, knowledge of the password is assumed to guarantee that the user is authentic. Passwords can be guessed or "cracked" and so if you are using a password to protect your system, the following guidelines will help make them more secure:

- Keep your password secret.
- Change your password regularly.
- Make your password at least eight characters long.
- Do not use proper words or phrases - these can be found using a dictionary cracker.
- Use a mixture of upper and lower case letters and numbers.
- They should be different for each system that is used.
- The number of attempts to enter a correct password should be limited so as to frustrate intruders or hackers.

❖ Smart Card

A smart card is a small card that holds user authentication information. When the card is inserted into a card reader, electrical fingers wipe against the card. The information in the card is read and used to authenticate the person. Cards can be stolen and so are not as reliable as biometrics.

❖ Biometric

Biometrics is the science and technology of measuring and analyzing biological data. In computer security, biometrics refers to the use of measurable biological characteristics such as fingerprints, eye retinas, iris patterns, facial patterns, voice patterns or hand measurements, to identify a person. It is the safest authentication technique.

b. Encryption

Encryption is the process of transforming data or information using an algorithm into a form unreadable by anyone except the intended recipient. The original message is known as plaintext, the algorithm is cipher and the encrypted text is the cipher text. To read an encrypted data, one must have access to a secret key or password that enables you to decrypt it. The original data is known as plain text, the algorithm is cipher and the encrypted data is cipher text. The reverse process is referred to as decryption.

c. Firewall

A firewall is a computer program or a device designed to prevent unauthorized access to or from a private network. Firewalls are implemented in either hardware or software form, or a combination of both. They prevent unauthorized Internet users from accessing private networks connected to the Internet. All messages entering or leaving the network must pass through the firewall which examines each message and blocks those that do not meet the specified security criteria. Some Operating Systems like Windows XP, 7, 8, Mac OS X, and more have built-in firewalls.

d. Intrusion Detection

Intrusion detection is the art and science of sensing when a system or network is being used inappropriately or without authorization. An intrusion-detection system (IDS) monitors system and network resources and activities and, using information gathered from these sources, notifies the authorities when it identifies a possible intrusion.

e. Digital Signatures

A digital signature is basically a way to ensure that an electronic document is authentic. Authentic means that you know who created the document, and you know that it has not been altered in any way since that person created it. A digital signature is a computed digest of the text that is encrypted and sent with the text message. The recipient decrypts the signature and compares it with the received text. If they match, the message is authenticated and proved intact from the sender.

Remark: Physical security

Physical security measures are tangible defenses that can protect your facility, equipment, and information from theft, tampering, careless misuse, and natural disasters. In some ways, physical security is the easiest and the most rewarding type of security. The following are some hazard and basic measures to prevent or protect your system.

➤ Thieves

Your computer should be in the room or office that has locks and alarms so only authorized people can get access to it to prevent your storage media or the whole computer from thief.

➤ Fire and smoke

- Install smoke detectors near your equipment and check them periodically.
- Keep fire extinguishers in and near your and be sure that everyone knows they are there.

➤ Climate

- Keep all rooms containing computers at reasonable temperatures (approximately 50-80 degrees Fahrenheit or 10-26 degrees Celsius) and keep the humidity level at 20-80 percent.
- Install gauges and alarms that warn you if the temperature or humidity is getting out of range.

➤ Water

- If your computer does get wet, let it dry thoroughly before you attempt to turn it on again.
- Remember that the presence of water increases the likelihood of electrical shock. Use greater caution in the case of flooding emergencies in equipment areas of a smoke alarm.
- Install a water sensor where appropriate. Simple ones are available for the price.

➤ Electricity

- Your computer will suffer if it gets too much or too little electricity.
- For best results, install an uninterruptible power supply (UPS). It will absorb surges and provide extra voltage during brownouts, and if power fails completely blackout, it will provide power until you're able to shut down the system. Note that surge protection won't work unless your electrical system is well grounded.

CHAPTER: SOCIAL AND ECONOMIC IMPACTS OF COMPUTERS

Competences:

- Explain Economic reasons for using computers and the effects of their use across a range of application areas.
- Explain the social impacts of computers.

Introduction

In as much as the computer is a very vital tool for every daily use, it can also be a very harmful tool if poorly used. For this reason, users must ensure that they follow health measures and apply safety precautions as they use the computer.

The widespread use of computers has affected people and organizations in many ways. Information Technology has completely broken distance and time barriers, transforming the world into a global village that is a community whereby communication on a world scale has been reduced to communication on a village scale. Information Technology which is the embodiment of computer technology, communication technology, and digital technology has given rise to phenomena like information society, digital revolution, digital economy, and information age.

- **Information society:** it is a society in which the acquisition, manipulation, and distribution of information plays a central role in most sectors of life (e.g. social, cultural, economic, and political). Such a society is usually integrated by complex communication networks.
- **Digital revolution:** it is the marking feature of the information age.
- **Digital economy** is a term for all the economic processes, transactions, interactions, and activities that are based on digital technologies mainly the computer. These activities could be carried with or without the use of Internet connectivity.
- **Information age:** it is the name given to the present era in which we live. This era began when digital computers and related technologies were developed in the second-half of the 20th century.

These computers or computer-related technologies take up new roles in various forms. Some people say these technologies have made life easier and more convenient. Others say they have made life more complex and stressful. Some of the impacts of computers include:

1. Positive impacts

ICT has impacted the world positively in several ways. The following are some of the benefits of ICT to mankind:

- (1) Fostering of globalization: ICT has allowed different regions of the world not only to interact with one another but also to be interdependent on one another. These regions share information quickly and efficiently in many different areas, for example, governments, education, technology, commerce, medicine, and culture.
- (2) Cost effectiveness of businesses: the computerization of business processes has rendered the business more cost effective.
- (3) Faster and cheaper communication: with the help of ICT, communication has also become faster, cheaper, and more efficient.
- (4) Job creation: one of the greatest advantages of IT is the creation of new and interesting jobs. Database administration, computer programmers, system analysts, hardware developers, software developers, web designers, and computer technicians, etc. etc.
- (5) Unlimited working hours: it is now possible with the help of ICT for companies all round the world to open their doors all day making purchase from other parts of the world easier and more convenient.
- (6) Faster and easier operation on data: a computer allows a user to manipulate data easily and quickly for example downloading information from the Internet, sending text and images over the Internet.
- (7) Broader market for sellers and buyers, faster and less-problematic bookings, advancement of science and technology, improvement of security systems.

2. Negative impacts

- (1) Unemployment and Reliability is not guaranteed i.e. insecurity like privacy concerns, phone call interceptions, e-mail hacking, stealing of personal information, etc. etc. is the order of the day with IT.
- (2) **Dominant culture:** ICT has contributed to some cultures dominating others. The United States for example is a country whose culture is known to influence cultures in other countries. Languages too

have become overshadowed with English becoming the principal communication language for business and many other things.

- (3) **Health problems:** extended use of computers may cause finger and eyesight disorders such as repetitive strain injury (RSI) and carpal tunnel syndrome (CTS). RSI refers to an injury to muscles and tendons caused by continuous repetitive use of particular muscles especially by using a keyboard. CTS refers to a painful disorder caused by compression of a nerve in the carpal tunnel; characterized by discomfort and weakness in the hands and fingers and by sensations of burning or numbness. Other examples of ICT-related health problems are: visual strain, headache etc.
 - (4) **Lack of human abilities:** computers are unable to reason, learn, or decide. They cannot understand and don't have emotions. They cannot adapt to unexpected circumstances. Consequently, they are incapable of doing some of the things that human beings would normally do.
 - (5) **Addiction:** games, chat rooms, search engines, shopping sites that can keep users occupied for hours and days have cause some people to forgo their basic daily duties because of their strong commitment to these exciting Internet services.
 - (6) **Electronic waste (E-waste):** computer and related devices usually generate e-waste. E-waste is the collective name for all electronic devices that are no longer useful as originally intended. E.g. computers, TV, DVD players, photocopiers are examples of e-waste. These wastes can be recycled. It is the fastest growing segments of the world's waste stream.
 - (7) **Digital divide:** It is the gap between those with regular effective access to digital technologies and those without i.e. the use of IT widens the gap between the developed (rich) countries and the developing (poor) countries. Many developing countries do not have the expertise or the money to invest on IT and these countries consequently tend to become poorer and poorer. Developed countries on the other hand become richer and richer. Hence IT fosters digital divide.
-

IMPACTS OF SOCIAL NETWORKS

The use of social networking has become increasingly relevant today. Smartphones have added great potential by enabling an increase in the use of social networking and in the number of hours spent on such sites. Being online for a long time and being able to access different information from different sources at the same time could cause information overload. People also could face problems in filtering the information they receive and they might find it difficult to decide which sources they can trust and, therefore, which to select.

Social networking can be defined as “the relationship that exists between networks of peoples”. Online social networks give people the ability to communicate and share their interests with others over long distances. However, social networking sites provide information for a group of people who share common interests. Overall, the term ‘social media’ is broader than ‘social networking sites’.

Some of the positive impacts of social networking are highlighted as follows:

- *It enables easy access to a vast quantity of materials related to ones need.*
- *It makes peoples more sociable.*
- *Individual identity and self-expression.*
- *Creativity.*
- *Sense of belonging and collective identity.*
- *It improves the academic experience in general.*
- *It is useful for clarification of news.*

- *It is useful to keep in touch with family and friends.*
- *It is useful for sharing tutorials.*

On the other hand, the negative impacts of social networks are:

- *It distracts users' attention.*
- *It presents privacy issues for individuals.*
- *It can be very time-consuming, and such time could be better utilized.*
- *Sometimes students neglect their responsibility for studying because of social networking.*

TYPES OF COMPUTING ENVIRONMENTS

- **Cloud computing:** It is a collective use of software and hardware to deliver services over a network especially the Internet. It works by giving users data and information on a cloud available to have access to anywhere, anytime. Its categorized into cloud computing networks as follows; public, private, community and hybrid networks and provides its services in three ways; infrastructure, platform and software as a service.

Advantages:

- Less cost.
- Available 24/7 anywhere on any computer related device.
- Flexible in capacity.
- Automated updates on software.
- High security and easily managed.

Disadvantages

- Lack of personnel's
- Difficult to fix what you can't see.
- Lack of options.

- **Time sharing environment:** This type of computing allows multiple users to share the system simultaneously. Each user is provided a time slice and the processor switches rapidly among the users according to it.
 - **Client server environment:** Here the client requests a resource and the server provides that resource. A server may serve multiple clients at the same time while a client is in contact with only one server.
 - **Personal computing environment:** Here there is a single computer system where all the processing is done.
 - **Distributed computing environment:** It contains multiple nodes that are physically separate but linked together using the network. All the nodes in this system communicate with each other and handle processes in tandem. Each of these nodes contains a small part of the distributed OS.
 - **Cluster computing environment:** It is similar to parallel computing as they both have multiple CPU's. however, a major difference is that clustered systems are created by two or more individual computer systems merge together which then work parallel to each other.
-

PRACTICAL: WORD PROCESSING, SPREADSHEET, POWERPOINT PRESENTATION, and PUBLISHER

I. WORD PROCESSOR APPLICATIONS the case of MICROSOFT WORD

Definition of word processing: It is the act of using the computer as a tool to type, edit, format, save, and print documents. A piece of software that is used for this purpose is called a word processing program or word processor. A typical word processor acts very similar to a typewriter with some very advanced features. For example, instead of hitting the —Return key at the end of a line to begin typing a new line, word processors have a —word wraparound feature. This means that you continue to type and as soon as your text reaches the end of a line, the word that would not fit is moved in its entirety to the next line. This also means that when you change margin widths, the text will fit itself inside its new boundaries. The main advantage of word processors is that, they can easily change what has been done. Some of the most commonly used word processors are Microsoft Word, Wordpad, NotePad, and WordPerfect.

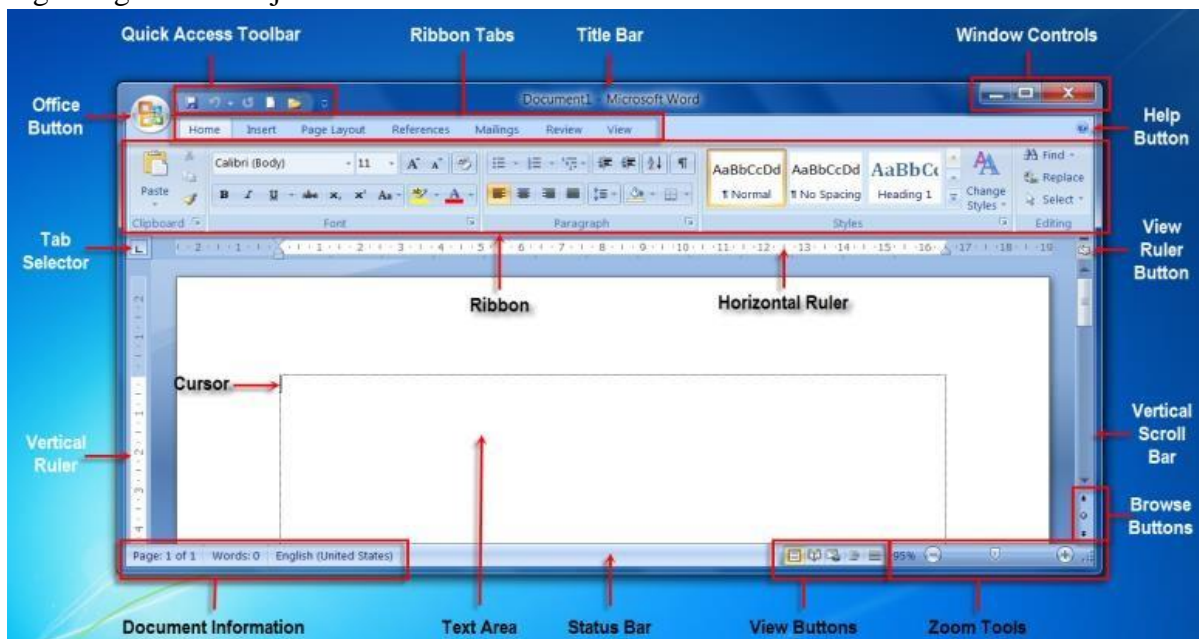
Characteristic feature of Word Processors

Word processors have some similarities with other application packages. However, there are several features which make word processors different from these software applications.

Some of these characteristic features of word processing program include:

1. **Typeface:** The type face or font allows different styles to be used in a document.
2. **Cut, Copy & Paste:** The cut facility allow text to be cut off from a document. This could be discarded or pasted back in the document at a different point. Copying allows a copy of the text to be pasted into other parts of the document. The cut, copy and paste facilities also apply to graphics which have been placed in the document.
3. **Word-wrap:** This means you that when typing you do not have to press enter at the end of each line to start a new line as the computer automatically starts a new line when one is needed. Pressing the enter key is used to start new paragraphs.
4. **Find and Replace:** Find allows you to search a document for all occurrences of word or phrase. Replace allows the occurrences found to be replaced with another word or phrase. For example, a secretary could use find and replace to change Mr. Smith with Miss Jones so that a letter can be used again but sent to a different person.
5. **Line spacing:** Line spacing is used to change the amount of space between lines of text. Normal text is single line space. This can be altered to 1.5 times or double or a number of points
6. **Spell Checker:** This uses a built-in dictionary to check all the text in the document.

7. **Alignment:** It is use to position the text on the page. We the left alignment, center alignment, right alignment and justified text.



More on how to work with MS Word (in the computer laboratory)

II. **SPREADSHEET APPLICATIONS the case of MICROSOFT EXCEL**

Definition of spreadsheet: It is application software that allows the user to work with numbers, performs calculations, and creates graphs. It consists of a workbook which have one sheet by default and the sheets can be added to so many sheets arranged in the form of a grid made up of vertical columns labelled by letters (A, B, C, D...) and horizontal rows labelled by numbers (1, 2, 3, 4, 5,...) that manipulate, analyse, and display numerical character data. The boxes at the intersection of the column and row is called a cell. **A cell** therefore is a position on the grid where a row and a column intersect e.g. A1, D41.

It is applicable in areas such as student 's records (report cards), charts and graphs, accounting, budgeting, forecast, reports, etc. One of its great ability is that it can change figures and words in the cell without the user having to do anything once a formula is introduced automatically.

Vocabulary: Our study focuses on the type of spreadsheet called Microsoft Excel.

1. An Excel file is also called a **Workbook**.

- Default title is Book1 but can be renamed to the name of your choice.

2. **Ribbon** broken into **Tabs** (Home, Insert, Page Layout, formulas, data, review, view, and the helper "tell me what you want").

Tabs are broken into groups (Clipboard, Font, Alignment)

3. **Name box** (left) and **formula bar** (right) : Name box shows address of current cell; Formula bar shows contents of current cell.

4. Columns Headings are Lettered, Rows

Headings are numbered.

5. Worksheet navigation buttons, Worksheet tabs.: default Sheet1 but can be increased to so many.

6. Status bar : Excel behaves differently depending on the current "mode"

❖ Types of spreadsheet Applications.

MS. Excel, Lotus 1-2-3 and Lotus Symphony, Quattro Pro, Google sheets, VisiCalc, Open Office, Zoho Sheet (web-based spreadsheet), IWork numbers (Apple)), Libre Office.

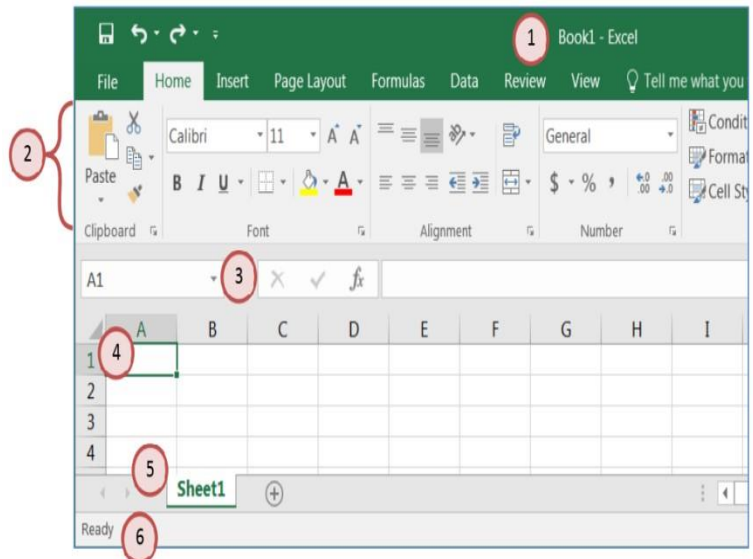
❖ Characteristics of a cell in MS Excel

A cell can contain any of the three types of data:

- **Labels:** labels consist of text.
- **Value:** the second type of data a cell can contain is a numerical value which is moved to the right of the cell.
- **Formula:** the third and most powerful data a cell can take is a formula. A formula instructs the computer to mathematically calculate the value to be displayed in the cell. To enter a formula or function in MS Excel, you must first begin with an **equality sign (=)**.

❖ **Cell referencing:** Formulas in an Excel worksheet usually involve functions performed on the values contained in one or more other cells on the worksheet (or on another worksheet). A reference that you make in a formula to the contents of a worksheet cell is either a *relative reference*, an *absolute reference*, or a *mixed reference*. Absolute and Mixed cell referencing can be obtained with the F4 key.

- A **relative reference** to a cell takes the form *A1*. When you copy or fill a formula from the original cell to other cells, a relative reference changes to maintain the relationship between the cell containing the formula and the referenced cell. For example, copying a formula that refers to cell A1 one row down changes the A1 reference to A2; copying the formula one column to the right changes the A1 reference to B1.
- An **absolute reference** takes the form *\$A\$1*; \$A indicates an absolute reference to column A, and \$1 indicates an absolute reference to row 1. When you copy or fill a formula from the original cell to other cells, an absolute reference will not change — regardless of the relationship to the referenced cell, the reference stays the same.



- A **mixed reference** refers absolutely to either the column or row and relatively to the other. The mixed reference **A\$1** always refers to row 1, and **\$A1** always refers to column A. You can reference cells in other worksheets within the workbook.

Merge cells: This option merges the cells across the selected rows and columns and maintains default alignment for the data type of the first cell of the merged cells.

To merge selected cells → On the Home tab, in the Alignment group, display the Merge & Center list, and then click Merge Cells to merge the entire selection, maintaining the horizontal alignment of the data type in the first cell.

❖ Working with multiple sheets

By default, a new workbook includes only one worksheet. You can add blank worksheets to the workbook or copy or move worksheets from another workbook.

To insert a new worksheet

→ Click the New sheet button at the right end of the worksheet tab section.

→ On the Home tab, in the Cells group, click the Insert arrow, and then click Insert Sheet. **To rename a worksheet.**

- Right-click the worksheet tab and then click Rename.
- Enter the new worksheet name and then press Enter.

Excel allows you to build formulas and functions that reference data stored on different worksheets within the same workbook. So you can be on worksheet3 and refer back to a cell worksheet1. when referring to a cell on a different worksheet, you type the name of the worksheet followed by an exclamation sign (!) and then the column letter and the row number. **If you are on worksheet2 in cell D9 and want to refer back to cell C4 on worksheet1, the reference would look like this: D9=worksheet1!C4.**

If you are on a worksheet named March, and you want to refer back to cell C7 on a sheet name January, the reference would look like this: **=January!C7. If you want to make that an absolute reference, it would look like this: =January!\$C\$7.**

Excel also allows you to reference data stored in a different workbook i.e. a different Excel file. **A cell reference to a different excel workbook (file) would look like this: [workbook name]worksheet name cell name, e.g. =[workbook1]worksheet1!N10.** If its absolute then it would look like this: **=[workbook1]worksheet1!\$N\$10**

❖ Functions

Spreadsheets usually include some built-in formulas called **functions which are used for performing predefined operations using the operations keyword. E.g. =SUM(D2:D15) is a function with the keyword “sum” and this =D2+D3+D4+D5 is a formula.**

Different calculations: The following are some of the many other functions for performing mathematical calculations on spreadsheet.

- Copy a formula: to copy in a spreadsheet is just like in MS Word, click on the start cell and drag until you reach the desired cell, then right click and chose copy.

The following are mathematical functions (**sum, product, average, division (keyword is quotient), subtraction (uses only a formula). Other advanced functions.**

- Exponents: $D4^{B2}$,
- Square root : =SQRT(D4),
- Minimum : =MIN(D2:D10),
- Maximum : =MAX(D2:D10),
- ROUND() to round a set a values to a specified number of decimal places,
- TODAY () to show the current date,
- Rank: =RANK(D2,D\$2:D\$10,O or 1). 0 is decreasing order and 1 is increasing,
- COUNT: =COUNT(D2:D10) returns the number of cells that contents numeric value,
- Count-if: =COUNTIF(D2:D10, “condition”),
- The SUM-IF: =SUMIF(D2:D10, “condition”),
- IF: =IF(logic test, “condition if true”, “condition if false”),
- Nested if: it is the use of more than one IF function in a function e.g. =if (logic test, “condition”, if (logic test, “condition”, if (logic test, “condition”, if (logic test, “condition”))))). Mostly used to give grades to students‘ scores like A grade, B grade, C grade etc.
- Concatenation: the function concatenate is used to relate up to 255 chain of text in a single chain. The elements to be related can be text, numbers, and cell reference of cells or a combination of all. For example if in the worksheet the surname of a person is in cell A1 and the name is in cell B1, these two elements can be combined in one value in another cell with the help of this function.

Syntax: =concatenate (text1, text2, text3, ...) OR concatenate (A1, B1, C1, ..) Which relates the texts or contents of the cells without a space.

=concatenate(A1, “ ”,B1). Relates the contents of the cells with a space i.e. a space between the contents of A1 and that of B1. **NB: the next argument is a space.**

Remark: you can equally use the ampersand or character “&” like the operator to replace the concatenation function with a formula. **E.g. =A1 & B1** which is equivalent to the function =CONCATENATION(A1, “&”, B1).

- **COUNTA:** =COUNTA(D2 :D10) Returns the number of cells that contain any content (are not empty).
- **COUNTBLANK:** =COUNTBLANK(D2 :D10) Returns the number of empty cells.

To hide selected rows or columns.

1. On the Home tab, in the Cells group, display the Format list.
2. In the Visibility section of the Format list, point to Hide & Unhide, and then click Hide Rows to hide the selected row(s) or Hide Columns to hide the selected column(s).

To find hidden rows or columns in a worksheet

Open the Go To Special dialog box, click Visible cells only, and then click OK. In the highlighted content, cells adjacent to hidden cells have a thin white border.

To unhide rows or columns.

1. Select the columns or rows on both sides of the hidden column(s) or row(s).
2. Right-click the selection, and then click Unhide.

Or

1. Select the rows or columns on both sides of the hidden rows or columns.
2. On the Home tab, in the Cells group, display the Format list.
3. In the Visibility section of the Format list, point to Hide & Unhide, and then click Unhide Rows to display the hidden row(s) or Unhide Columns to display the hidden column(s).

To hide a worksheet

➔ Right-click the worksheet tab, and then click Hide. **To display a hidden worksheet**

1. Right-click any visible worksheet tab, and then click Unhide.
2. In the Unhide dialog box, select the worksheet you want to display, and then click OK.

Error Types: Certain types of errors happen in excel because of one of the following reasons.

Type	When It Happens
#DIV/0!	When you divide by ZERO
#N/A!	When a formula or a function inside a formula cannot find the referenced data
#NAME?	When the text in a formula is not recognized.
#NULL!	When a space was used instead of a comma in formulas that reference multiple ranges. A comma is necessary to separate range references
#NUM!	When a formula has numeric data
#REF!	When a reference is invalid
#VALUE!	When the wrong type of operand or function argument is used
#####	When a number too big

MORE IN THE COMPUTER LABORATOR

SBA PROJECTS

1. THEMATIC AREA: DATA COLLECTION AND MANAGEMENT

Title: Organization of Data

Question: Collect and organize data on specifications of computers in an environment. (This might not have a folder)

2. WORD PROCESSING

Title: Production of a document

Computer Network

Many years ago, communication was very difficult. In our traditional societies, there was the use of **drums, whistles, xylophones, flutes** etc. in communication. With the advent (coming) of computer a network, communication has been facilitated through media such as **internet, phones, TV, radio**.

The term computer network may sound very familiar because it is now mostly used in institutions and in schools. The purpose of computer network was to link separate computers together to aid communication.

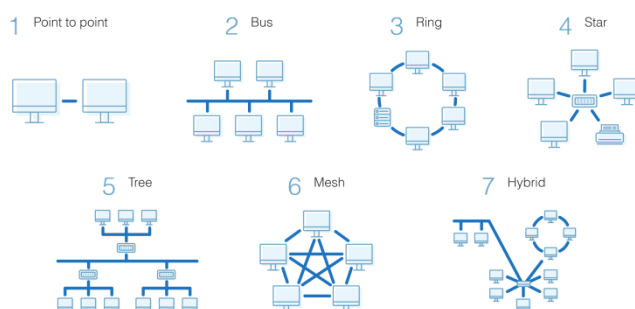
In a broad scale, computer network is a collection of multiple computers, printers, scanners etc. Networking has made life very easy for people in their professions and in the society.

There are several types of computer networks. Computer networks can be characterized by their **size**, as well as by their **purpose**. We have the following types:



Based on sized	PAN (Personal Area Network)
	LAN (Local Area Network)
	MAN (Metropolitan Area Network)
	WAN (Wide Area Network)
Based on purpose	SAN (Storage Area Network)
	EPN (Enterprise Private Network)
	VPN (Virtual Private Network)

❖ Types of physical network topologies include :



❖ Network Architecture :

- 1) **Peer-to-Peer network:** Each computer independently stores its own software and information but can access the information on the other computers without a server intermediary.
- 2) **Client/server network:** This is a network in which one or more computers act as servers and provide services to the other computers which are called **clients**.

1. Type the text given in **Figure 1** using a word processor and save it as **Task Word SBA**. You are not required to draw the border around the text.
2. Insert the graphics as shown on the same place on the text. (The graphics are found in folder provided by the teacher).
3. Set all the margins to 1.27 centimeters.
4. Set the page size to “A4” and the orientation to “Portrait”.
5. Set all the text to font type “Times New Roman” and the font size to 12 points.
6. Set the text line spacing to “1.5”.
7. Text should be justified.
8. Set font size of heading to 16 points and center the heading.
9. Insert a page header with the following text: “GBHS Dschang FORM 3”
10. Insert a page number as footer and type the following text: “Source: <https://itgeeks.com/OL/Notes>”
11. Set the page background color to “Aqua”
12. Print your work.

3. SPREADSHEET

Title: Market statistics

	A	B	C	D	E	F	G	H
1	Amount Ordered per item	250						
2	item	Cost price	sale price	Quantity sold	Total Profit	Quantity left	Status	Rank
3	school trousers	2,250FCFA	2,750FCFA	150				
4	school jumpers	3,500FCFA	4,000FCFA	100				
5	Boy's blazer	2,500FCFA	3,000FCFA	125				
6	Girls's skirt	2,500FCFA	3,000FCFA	130				
7	Girl's black trousers	2,250FCFA	2,750FCFA	125				
8	Girl's school jumpers	3,500FCFA	4,000FCFA	220				
9	Tie	3,500FCFA	4,000FCFA	245				
10	Girls PE top with logo	3,000FCFA	3,500FCFA	175				
11	Boy's PE top with logo	3,000FCFA	3,500FCFA	210				
12	Total							
13	Highest Profit							
14	Number of items with quantity left less than 100							
15								

- 1) Carry out the following activities.
 - Enter the above information using a suitable spreadsheet package.
 - Set the font type of the cells that carry data to **Arial**.
 - Set the font size to 11.
 - Wrap text on all the cells.
 - Format cells in ranges **B3:C11** and **E3:E12** to display values with a thousand separator “,” and currency symbol “**FCFA**”.
 - Format cells **A1**, **B1**, **A2:G2**, **D12** and **E12** to display values in Bold.
- 2) Inserting the following formulas in corresponding cell in the worksheet:

- a) In cell **E3**, a formula to compute the Total Profit. Then copy this formula to compute the other Total. Profits up to Row 11.
[N.B. Total Profit is Profit per Item multiplied by Quantity Sold].
 - b) The Amount Ordered (Per Item) is shown in cell **B1**. Using absolute referencing give a formula to compute the Quantity left in cell **F3**. Then copy this formula to compute the other Quantity left up to Row 11.
[N.B. Quantity left is Amount Order (Per Item) Minus Quantity sold].
 - 3) Give the IF statement that should be used in cell **G3** to display the **Stock level okay** or **Order more stock** message with respect to quantity left.
[N.B. Quantity left greater than or equal to 50 equals **Stock level okay** and **Order more stock** otherwise].
 - 4) In cell **H3**, enter the formula to order the item in descending order based on the total profit. Then copy the formula up to cell **H11**
 - 5) Copy the corresponding formula inserted in cell **G3** to the corresponding cells, up to Row 11.
 - 6) Write the formula in cell **E12**, to calculate the Total profit.
 - 7) Write the formula in cell **E13**, to determine the highest profit.
 - 8) Write the formula in cell **E14**, to count the number of item with quantity left less than 100.
- Save your work as **Task Spreadsheet SBA**.

4. WEB AUTHORING

Title: Inserting an image on a particular side on a web page.

Task:

1.	<!DOCTYPE html>
2.	<html lang="en">
3.	
4.	<head>
5.	<title>Cameroon-Region</title>
6.	<link rel="stylesheet" href="mystyle.css">
7.	</head>
8.	<body>
9.	<div>
10.	
11.	<h1> Cameroon </h1>
12.	<i>Peace-Work-Fatherland</i>
13.	</div>
14.	<p>Cameroon, officially the The Republic of Cameroon, is a country in
15.	the West-central Africa. It is bordered by Nigeria to the west and North; Chaf to the northeast;
16.	the Central African republic to the east; and Equatorial Guinea, Gabon and the Republic of
17.	congo to the south.</p>
18.	<p>The Country has 10 regions with their headquarters as follows:</p>
19.	<table border="1">
20.	<tr>
21.	<th>Region</th>
22.	<th>Headquarters</th>
23.	</tr>
24.	<tr>
24.	<td>Adamawa</td>
26.	<td>Ngaoundere</td>
27.	</tr>

28.		<td>Center</td>
29.		<td>Yaounde</td>
30.	</tr>	
31.	<tr>	
32.		<td>East</td>
33.		<td>Bertua</td>
34.	</tr>	
35.	<tr>	
36.		<td>Far North</td>
37.		<td>Maroua</td>
38.	</tr>	
39.	<tr>	
40.		<td>Littoral</td>
41.		<td>Douala</td>
42.	</tr>	
43.	<tr>	
44.		<td>North</td>
45.		<td>Garoua</td>
46.	</tr>	
47.	<tr>	
48.		<td>Northwest</td>
49.		<td>Bamenda</td>
50.	</tr>	
51.	<tr>	
52.		<td>South</td>
53.		<td>Ebolowa</td>
54.	</tr>	
55.	<tr>	
56.		<td>Southwest</td>
57.		<td>Buea</td>
58.	</tr>	
59.	<tr>	
60.		<td>West</td>
61.		<td>Bafoussam</td>
62.	</tr>	
63.	</table>	
64.	</body>	
65.	</html>	
66.		
67.		

Type the HTML code given below in a text editor like notepad or block note to create a web page. After viewing the output, report on it.

Save the file as **Task WEB SBA.html**

Look for the image Cameroon.png and insert.

5. PROGRAMMING

Title: Using the WHILE loop.

Task:

The Figure below shows a program written in C.


```
#include <stdio.h>
int main() {
    int i, j, number, max;
    printf("Enter a number: ");
    scanf("%d", &number);
    max = 10;
    i = 1;
    while (i <= number) {
        for (j = 1; j <= max; j++) {
            printf("%d x %d = %d\n", j, i, i*j);
        }
        printf("\n");
        i++;
    }
    system("PAUSE");
    return 0;
}
```

- 1) Carry out the following tasks.
 - Launch either C program development environment and type the program.
 - Keep compiling and correcting the program until no errors are reported.
 - Save your work as **Task PROG SBA**.
 - Make a screen capture of your program. Then launch your word processor and paste your screen capture on the blank word processor screen. Save as **Task PROG SBA SCREEN CAPTURE**.
- 2) Run the program and provide the number 3 as input. Observe and write the output in your report.
- 3) Explain briefly what the program does in your report.
- 4) On the line that begin with the word **while**, change the sign from < to <=, and then compile and run the program again with input 3. Explain your observation in your report.

6. GRAPHICS AND VISUALIATION

Title: The Cameroon Flag

Task: You are required to design the Cameroon Flag. The figure below shows a sample.



Launch a Graphic Software of your choice.

Using the various tool, shapes and colors available, design the Cameroon Flag.

Save as **Task GV**.

7. COMPUTER MAINTENANCE

Title: Software Installation

Question: Give the detail steps on how to install Window's Operating System from a USB key.

8. DATABASE

Title: Annual Sponsored Car Wash

Task: Part of the database to record information about the cars involved in the school's annual sponsored car wash is shown below.

CarRegNumber	CarMake	CarModel	TeacherName	CleaningInside?	AmountPaid	CarWashDate
CT03 OEN	Citroen	CT3	Mrs Jane	N	\$4.00	05/09/2021
FR14 ODF	Ford	Fiesta	Mr John	N	\$4.00	05/09/2021
WX07 GIF	Vauxhall	Astra	Miss Jacewitz	Y	\$4.50	05/09/2021
PG17 HGF	Peugeot	308	Miss Brook	N	\$4.00	05/10/2021
B4 BMW	BMW	M5	Mr Thomas	Y	\$4.50	05/10/2021
NA64 OLP	Nissan	Juke	Mr Styles	N	\$4.00	05/10/2021
HI18 PPN	Hyundai	Santa Fe	Mr Willian	Y	\$4.50	05/11/2021
FT15 MIS	Fiat	500	Miss Price	Y	\$4.50	05/11/2021

- 1) Create a database and name it Task DB_SBA
- 2) Use the information given above to create a table in the database and save it as "car" with the following structure.

Field Name	Data types
CarRegNumber	Text
CarMake	Text
CarModel	Text
TeacherName	Text
CleaningInside?	Yes/No
AmountPaid	Currency
CarWashDate	Date/Time

File the information given above in the table "car" you have created

- 3) Identify an attribute from the table that can be used as the primary key. Set it (that is the attribute) as the primary key in the table "car" and explain it in your report.
- 4) The CleaningInside? attribute has only two possible values, mention the special name given to this type of attribute in your report.
- 5) Create a report to show how many teachers said "N" to the attribute CleaningInside". Save the query as **Task Query DB**.
- 6) Use the information in the table to create a form to input data into the table. Save it as **Task form DB**.
- 7) Use the information in the table to create a report. Save it as **Task Report DB**.

9. COMPUTER NETWORKS

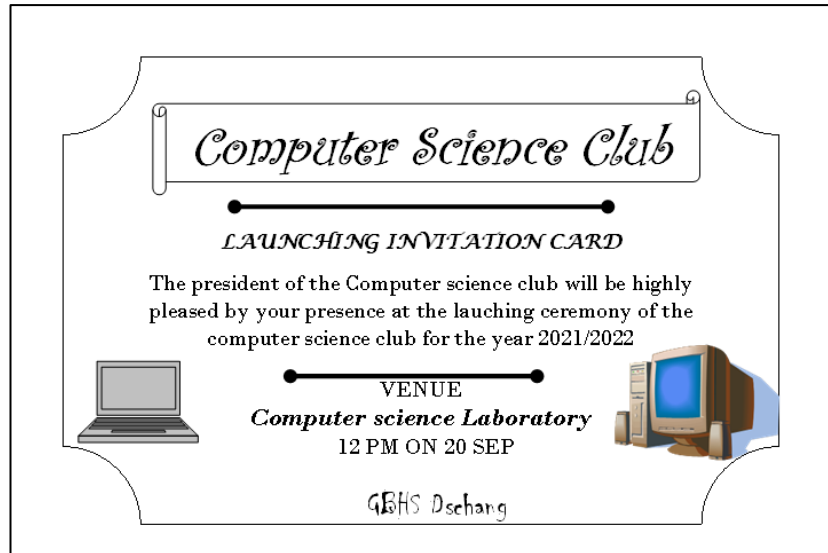
Title: Installing a computer network

Task: propose materials for installing and configuring a network in computer laboratory of your school.

10. DESKTOP PUBLISHING

Title: Computer Science Club Invitation Card

Task Question: You are required to design an invitation card. A sample of the card is soon below



1. Launch Desktop Publishing Software.
2. Choose the size paper “sided-fold, quarter sheet”.
All the objects on the card are centered and are within the guide lines (cyan lines).
3. Place a background and give a “sky blue” color to it.
4. Insert the frame work as shown.
5. Insert the various texts:
 - Set the title font text to “Curlz MT” with size 26 in bold and italic.
 - Set the invitation message to font “Bodoni MT” with size 11.
 - Set the text “Launching Invitation” font to “Lucida Calligraphy” with size 10.
 - Set the text “GBHS Dschang” font to “Chiller” with size 16.
6. Insert the images to the left and the right of the invitation message as shown on the figure.
Save your work as **Task DP SBA**.
Print your work.

EXPLANATORY NOTES

1) Web Authoring

The report should state the title of the mini project, outline the tools used (editor and browser), the tags used and their purpose, the output design, the sample code, the steps used to run the HTML code, the resulting output, difficulties encountered, proposed solutions and other suggestions.

An example structure of report in this section could be:

Introduction: Candidates can discuss the purpose of the project, tools used, the main tags used (no need to discuss standard tags like <HTML>, <title>,<body>,...), ...

Design: Candidates can give a sketch of the expected output. For example the teacher can explain the project to students and ask them to sketch how the output would look like.

Implementation: Candidates are expected to present the source code (screen captures, written, ...), outline the steps used in implementation (launch editor, type code, save as HTML document,...) and present the output (screen captures, written, ...).

Testing: Candidates are expected to outline strategies used in ensuring that their results match the expected output. Examples of strategies are: Meeting the teacher to validate, comparing their output with the initial design,

Evaluation/Conclusion: Candidates are expected to outline the problems encountered and how they solved them, propose new methods of solving the same/similar problems, ...

NOTE: This report may not exceed four pages.

2) Programming

The report should state the title of the mini project, outline the tools used (language, IDE), the instructions (input, output, control structures, ...) used and their purpose, the output design, the sample code, the steps used to run the code, the resulting output, difficulties encountered, proposed solutions and other suggestions.

An example structure of report in this section could be:

Introduction: Candidates can discuss the purpose of the project, tools used.

Design: Candidates can give the algorithm used (pseudocode or flowchart). For example the teacher can explain the project to students and ask them to draw the flowchart or write down the pseudocode, results of dry running, etc

Implementation: Candidates are expected present the source code (screen captures, written,...), outline the steps used in implementation (launch an IDE, type code, save with the appropriate extension,...) and present the output (screen captures, sketch, ...).

Testing: Candidates are expected to outline strategies used in ensuring that their results match the expected output. Examples of strategies are: Meeting the teacher to validate, comparing their output with the initial design, testing with a set of values,

Evaluation/Conclusion: Candidates are expected to outline the problems encountered and how they solved them, propose new methods of solving the same/similar problems, ...

NB: This report may not exceed four pages.

3) Word Processing

Write a report that outlines the word processor used, its version, steps in achieving specific tasks and difficulties encountered.

An example structure of report in this section could be:

Introduction

Candidates can discuss the purpose of the project, tools used,

Design

Candidates are expected to identify the editing, formatting and other features used (plan of text layout: text in 1,2, ... columns, mail-merging, ...)

Implementation

Candidates are expected to present the text document (printout), outline the steps used in implementation (launch word processor, type/add text, save,...). Outline steps used to achieve specific actions (mail merging, adding a table, adding an image,)

Testing

Candidates are expected to outline strategies used in ensuring that their results match the expected output. Examples of strategies are: Meeting the teacher to validate, comparing their output with the initial design, proof-reading and editing,

Evaluation/Conclusion

Candidates are expected to outline the problems encountered and how they solved them, propose new methods of solving the same/similar problems, ...

NB: This report may not exceed two pages.

4) Spreadsheets

Write a report that outlines the spreadsheet used, its version, the formatting done, the steps used to achieve them, formulas used and their purpose, steps used to copy the formula to other cells, steps used to chart data and difficulties faced during the project.

An example structure of report in this section could be:

Introduction

Candidates can discuss the purpose of the project, tools used, ...

Design

Candidates are expected to identify the input data, formulae, editing, formatting and other features used

Implementation

Candidates are expected to present the document (printout), outline the steps used in implementation (launch spread sheet, type/add text, save,...). Outline steps used to achieve specific actions (formulae, charts, adding an image, linking sheets, ...)

Testing

Candidates are expected to outline strategies used in ensuring that their results match the expected output. Examples of strategies are: Meeting the teacher to validate, comparing their output with the initial design, proof-reading and editing, testing formulae with a set of values

Evaluation/Conclusion

Candidates are expected to outline the problems encountered and how they solved them, propose new methods of solving the same/similar problems, ...

NB: This report may not exceed two pages.

5) Databases

Write a report that outlines the DBMS used, its version, the tables used, the steps used to create them, queries used, steps used to create forms and reports, steps used to import/export data and difficulties faced during the project.

An example structure of report in this section could be:

Introduction

Candidates can discuss the purpose of the project, tools used,...

Design

Candidates are expected to describe the table structure, identify table constraints (primary and foreign keys) and describe simple query designs.

Implementation

Candidates are expected to describe procedures for the creation of tables, forms, queries, reports used in their project and make appropriate screen captures.

Testing

Candidates are expected to outline strategies used in ensuring that their results match the expected output. Examples of strategies are: Meeting the teacher to validate, comparing their output with the initial design, populating tables and appreciating the results of queries,...

Evaluation/Conclusion

Candidates are expected to outline the problems encountered and how they solved them, propose new methods of solving the same/similar problems, ...

NB: This report may not exceed two pages.

6) Computer maintenance

Write a report that outlines the purpose of the project, tools and steps used to achieve the results, and difficulties faced during the project.

An example structure of report in this section could be:

Introduction

Candidates can discuss the purpose of the project, tools used,...

Procedure

Candidates are expected to describe procedures for achieving the results.

Evaluation/Conclusion

Candidates are expected to outline the problems encountered and how they solved them, propose new methods of solving the same/similar problems, ...

NB: This report may not exceed a page

7) Computer networks

An example structure of report in this section could be:

Introduction

Candidates can discuss the purpose of the project, tools used, (hardware and software) ...

Procedure

Candidates are expected to describe procedures for achieving the results.

Evaluation/Conclusion

Candidates are expected to outline the problems encountered and how they solved them, propose new methods of solving the same/similar problems, ...

NB: This report may not exceed a page.

8) Data collection and management

An example structure of report in this section could be:

Introduction

Candidates can discuss the purpose of the project, tools used, ...

Procedure

Candidates are expected to describe procedures for achieving the results.

Evaluation/Conclusion

Candidates are expected to outline the problems encountered and how they solved them, propose new methods of solving the same/similar problems, ...

NB: This report may not exceed a page.

9) Desktop publishing

An example structure of report in this section could be:

Introduction: Candidates can discuss the purpose of the project, tools used ...

Design: Candidates are expected to: sketch how the publication will look, choose a template that suits the sketch ...)

Implementation: Candidates are expected to present the publication (printout), outline the steps used in implementation (launch software, choose template, choose paper size ...). Outline steps used to achieve specific actions like linking text boxes, dividing content in to columns ...

Testing: Candidates are expected to outline strategies used in ensuring that their results match the expected output. Examples of strategies are: Meeting the teacher to validate, comparing their output with the initial design, proof-reading and editing, ...

Evaluation/Conclusion: Candidates are expected to outline the problems encountered and how they solved them, propose new methods of solving the same/similar problems, ...

10) Graphic software

An example structure of report in this section could be:

Introduction: Candidates can discuss the purpose of the project, tools used, images and additional objects used ...

Design: Candidates are expected to: draw or sketch what they want to produce, identify objects and features needed ...)

Implementation: Candidates are expected to present the work done (printout), outline the steps used in implementation (launch software, choosing a tool...). Outline steps used to achieve specific actions like filtering an image, cropping, drawing, grouping...

Testing: Candidates are expected to outline strategies used in ensuring that their results match the expected output. Examples of strategies are: Meeting the teacher to validate, comparing their output with the initial design, ...

Evaluation/Conclusion: Candidates are expected to outline the problems encountered and how they solved them, propose new methods of solving the same/similar problems, ...

NB: This report may not exceed two pages.

Suggested SBA Task Reporting Format

1) Title of project

2) Introduction

Here students are required to specify clear objectives and brief description of the task. You may use flow charts to show clear specifications. Your analysis should establish and document the input, processing and output requirements.

3) Design (specification)

The design should be specified in sufficient detail. Showing how technically you would implement your solution. It is important that you do some of the design work on paper before you start implementing, though you may alter it when implementing. These sketches or plans may be used as evidence to complete your portfolio.

4) Implementation (How the project was carried out)

This should provide valuable information that the assignment was actually done. You should explain how the task was performed. It is good at this level to include evidence of any difficulties encountered in carrying out the task. It is important that you show that you have successfully carried out the task.

5) Testing (How did you verify to ensure that the project is working as specified?)

You should show evidence of testing in the form of screenshots or printed output. This output must be linked to the original test plan. Make sure you highlight what your test is expected to show and how you actually show it in your assignment.

6) Evaluation (What problems did you encounter? How did you solve them?) \

Check on the objectives or the title of the assignment and say to what extent the activities expected have been carried out. Give suggestions on how the solution could be made better or what the weaknesses were.

7) Conclusion

What new method/approach did you use or discover when carrying out the assignment. Did you solve the problem you set out for?

NOTE: this report may not be more than four pages type, 1.5 line spacing, and font size: 12pts. Long reports are not desired; however all key sections should be highlighted.

GENERAL CERTIFICATE OF EDUCATION (GCE) BOARD
General Certificate of Education Examination

0595 COMPUTER SCIENCE 1

JUNE 2021

ORDINARY LEVEL

Centre Name	
Candidate Identification No.	
Candidate Name	

Mobile phones or calculators are NOT allowed in the examination room.

MULTIPLE CHOICE QUESTION PAPER

One and a half hours

INSTRUCTIONS TO CANDIDATES

Read the following instructions carefully before you start answering the question in this paper. Make sure you have a soft HB pencil and an eraser for this examination.

1. USE A SOFT HB PENCIL THROUGHOUT THE EXAMINATION.
2. DO NOT OPEN THIS BOOKLET UNTIL YOU ARE TOLD TO DO SO.

Before the examination begins:

3. Check that this question booklet is headed “**Ordinary Level -0795 Computer Science 1**”.
4. Fill in the information required in the spaces above.
5. Fill in the information required in the spaces provided on the answer sheet using your HB pencil:

Candidate Name, Exam Session, Subject code and Candidate Identification Number.

Take care that you do not crease or fold the answer sheet or make any marks on it other than those asked for in these instructions.

How to answer the questions in this examination

6. Answer **ALL** the **50** questions in this Examination. All questions carry equal marks
7. Each question has FOUR suggested answers: **A, B, C** and **D**. Decide which answer is appropriate. Find the number of the question on the Answer Sheet and draw a horizontal line across the letter to join the square brackets for the answer you have chosen.
For example, if **C** is your correct answer, mark **C** as shown below:
[A] [B] {C} [D]
8. Mark only one answer for each question. If you mark more than one answer, you will score a zero for that question. If you change your mind about the answer, erase the first mark carefully, then mark your new answer.
9. Avoid spending too much time on any one question. If you find a question difficult, move on to the next question. You can come back to this question later.
10. **Calculator are NOT allowed.**
11. Do all rough work in this booklet using the blank spaces in the question booklet.
12. **At the end of the examination, the invigilator shall collect the answer sheet first and then the question booklet. DO NOT ATTEMPT TO LEAVE THE EXAMINATION HALL WITH IT**

-
1. Which of the following software does not display graphics?
- A Text editor
 - B Word processor
 - C Desktop publishers
 - D Presentation
-
2. The correct arrangement in increasing order of time unit is:
- A Nanoseconds, Picoseconds, Microseconds
 - B Microseconds, Picoseconds, Nanoseconds
 - C Nanoseconds, Microseconds, Picoseconds
 - D Picoseconds, Nanoseconds, Microseconds
-
3. ___ deals with the design of equipment and the workplace to ensure safety and comfort.
- A Biometrics
 - B Ergonomics
 - C Stylistics
 - D Modeling
-
4. Having unauthorized access to a computer system and collecting sensitive data from it is called:
- A Copy rights
 - B Bridging
 - C Plagiarism
 - D Cracking
-
5. Which of the following has the fastest access speed?
- A RAM
 - B Registers
 - C Hard drive
 - D CD/DVD
-
6. The file extension .avi holds what type of files?
- A Sound
 - B Graphics
 - C Video
 - D Text
-
7. One application of infrared signals is in ____
- A Bluetooth
 - B Traffic lights
 - C Remote controller
 - D Wireless networks
-
8. The health concern RSI stands for?
- A Repeated Strain Injure
 - B Repetitive Stress Injury
 - C Repetitive Strain Injury
 - D Repeated Strain Injury
-
9. What characteristic of RAM makes it not suitable for permanent storage?
- A It is slow
 - B It is volatile
 - C It is the main memory
 - D It is often in use by the CPU
-
10. When a computer is switched on, the operating system is loaded in a process called
- A Compiling
 - B Formatting
 - C Booting
 - D Debugging
-
11. The main use of defragmentation utility program is to
- A Reduce data access
 - B Increase the free disk space
 - C Delete any unused data and files
 - D Delete and eliminate viruses
-
12. Software is said to be user friendly if:
- A It is easy to use and makes friends
 - B It is easy to learn and use
 - C The user can use it for other things
 - D It contains mainly pictures
-
13. The result of the binary operation $1101-1010$ is:
- A 101
 - B 011
 - C 100
 - D 010
-
14. An application software designed to perform a wide range of tasks and can be used by a variety of users is known as;
- A Specialized software
 - B Bespoke software
 - C Integrated software
 - D Generic software
-
15. A data type in which data items can only have one of two possible values is a(n)
- A Record
 - B String
 - C Array
 - D Boolean
-

16. A communication mode where data is transmitted in one direction at a time is referred to as
- A Simplex
 - B Duplex
 - C Half duplex
 - D Half Simplex
-
17. A collection of rules for the transmission of signals across networks is referred to as:
- A Topologies
 - B Protocol
 - C Hypertext
 - D Procedure
-
18. Input, processing, output and storage are collectively referred to as the:
- A System unit cycle
 - B System operation cycle
 - C Communication link cycle
 - D Information processing cycle
-
19. Which of the following is NOT a database?
- A An address book
 - B A telephone directory
 - C A class list of form 5 students
 - D A list of 3 names.
-
20. Which of the following means the same thing as a row of data in a relation or table in a database is?
- A Tuple
 - B Attribute
 - C Field
 - D File
-
21. What name is given to a column in a relation or table in a database?
- A Tuple
 - B Attribute
 - C Entity
 - D File
-
22. The use of the computers to create, store, revise and produce text is known as:
- A Tele processing
 - B Voice processing
 - C Word processing
 - D Data processing
-
23. A device capable of converting analog signal to digital signal and vice versa:
- A Multiplexers
 - B Demultiplexers
 - C Modem
 - D Coaxial cable
-
24. A Company network that allows only controlled access from the outside and for specific purposes is called
- A Internet
 - B Intranet
 - C Extranet
 - D Firewall
-
25. A logic gate whose functionality is the reverse of an OR gate is:
- A OR
 - B XOR
 - C NOR
 - D AND
-
26. How many combinations of input values in a two- input OR gate result in an output of 1?
- A 3
 - B 1
 - C 4
 - D 8
-
27. The binary equivalent of the decimal 133 is
- A 10000101
 - B 11000101
 - C 10011001
 - D 11100101
-
28. In a flow chart, the symbol below represents:
- A Decision
 - B A process
 - C An output
 - D A stop
-
29. A printer whose printing mechanism involves pressing the characters against an inked ribbon on to a paper is:
- A Non-impact printer
 - B Impact printer
 - C Inkjet printer
 - D Laser Printer
-
30. _____ is a transmission mode in which data is transmitted one bit at a time.
- A Parallel transmission
 - B Serial transmission
 - C Duplex transmission
 - D Half duplex transmission
-

31. Which of the following network topologies uses a token?
- A Mesh topology
 - B Bus topology
 - C Star topology
 - D Ring topology

32. A network hardware device that connects two dissimilar networks is a :
- A Modem
 - B Hub
 - C Router
 - D Bridge

33. Computers in offices in the school administrative block are connected so they can share resources.
What type of network is most likely used?
- A PAN
 - B WAN
 - C LAN
 - D MAN

34. A hard disk is divided into tracks which are further divided into:
- A Clusters
 - B Sectors
 - C Heads
 - D Sub tracks

35. The performance of a computer system is affected by all except:
- A The clock speed
 - B The RAM size
 - C The Hard disk size
 - D its power rating

Question 36 to 38 are based on the following algorithm:

```

1.  Start
2.  Input x
3.  If (x mod 2 = 0) then
    3.1 set y to x
    3.2 set counter to 1
    3.3 while counter <= 3 do
        set y to y+2
        Increment counter by 1
    Endwhile
    3.4 print y
  Else
    3.5 print x
  Endif
4.  Stop

```

36. In what form has the algorithm been represented?
- A Flowchart
 - B Pseudo code
 - C Source code
 - D Machine code

37. What construct is used in line 3.3?
- A Looping
 - B Selection
 - C Sequence
 - D Branch

38. What value of y is printed when x is 4?
- A 4
 - B 6
 - C 8
 - D 10

39. The input to a compiler is known as:
- A Source code
 - B Object code
 - C Instruction code
 - D Program code

40. A communication medium in which messages are transmitted as light pulses.
- A Coaxial cable
 - B Twisted pair
 - C Optic fibre
 - D System bus

41. _____ enables a wireless network to be connected to a wired network
- A Hub
 - B Switch
 - C Access point
 - D Network interface card

42. A barcode reader is an example of _____ input technology:
- A OCR
 - B OMR
 - C MICR
 - D Biometric

43. Uploading and downloading data to or from a remote computer is done using?
- A File transfer protocol
 - B Inter relay chat
 - C Download manager.
 - D Data transmission

44. A technique of developing a miniature of system with all functional components is called:
- A Systems Development life cycle
 - B Stepwise refinement
 - C Modeling
 - D Prototyping

45. In a PERT chart, tasks are represented using:
A Nodes
B Numbers
C Letter
D Arrows.
-
46. A task that must be completed before another task can begin is called a:
A Dummy task
B Milestone task
C Predecessor task
D Critical task
-
47. Which of these software is suitable for storing, retrieving and manipulating very large quantities of data?
A Spreadsheet
B Database Management system
C Decision Support System
D General Purpose software
-
48. On typing a document, instead of typing 456 the typist types 457. What kind of error is this?
A Transposition error
B Range check error
C Data type error
D Transcription error
-
49. Digital signals are stepwise and discrete while analog signals are:
A Square and continuous
B Stepwise and synchronous
C Smooth and continuous
D Discrete and continuous
-
50. In computer programming, what is a semantic error?
A An error that occurs in the execution of a program
B A compilation mistake.
C A mistake due to use of the wrong instruction
D A mistake due to an instruction not having the right form
-

STOP

GO BACK AND CHECK YOUR WORK

GENERAL CERTIFICATE OF EDUCATION (GCE) BOARD

General Certificate of Education Examination

Computer Science 2
0595**JUNE 2021****ORDINARY LEVEL**

Subject Title	Computer Science
Paper No.	2
Subject Code No.	0595

Two Hours*Answer any FIVE questions**All questions carry 20 marks each. For your guidance, the approximate mark for each part of question is indicated in the brackets**You are reminded of the necessity for good English and orderly presentation in your answers.**In calculations, you are advised to show the steps in your working, giving your answer at each stage.**Calculators are NOT allowed.*

1. (a) (i) Write the following acronyms in full as used in computing:
SDLC, RAM, CPU, BIOS, POST (5 marks)
 - (ii) What is a port? (2 marks)
 - (iii) Name three (03) computer ports and state a device that can be connected to each port you name. (6 marks)
 - (b) (i) State what you understand by 'network topology' (1 mark)
 - (ii) Draw labelled diagrams for a **Star** network topology and a **Bus** network topology. (4 marks)
 - (iii) State a difference between a star topology and a ring topology. (2 marks)
-
2. (a) Study the following algorithm about student test marks and answer the questions that follow.
 1. Start
 2. Get Test 1 and Test 2 marks
 3. If (Test 1 mark < 0 **OR** Test 2 mark < 0) THEN
 - 3.1.1 Display 'A mark cannot be negative'
 - 3.1.2 Get Test 1 and Test 2 marks
 - 3.1.3 Go back to Line 3
 - END IF
 - 3.2.1 Average = (Test 1 + Test 2) / 2
 - 3.2.2 Display Test 1, Test 2, Average
 - 4 Stop
 - (i) What is the algorithm expected to compute? (2 marks)
 - (ii) State the line numbers with statements that constitute a loop. (2 marks)
 - (iii) Using symbols T1 for Test 1, T2 for Test 2, Avg for Average, represent the algorithm as a flowchart. (6 marks)
 - (iv) State the expected output for the following pairs of marks inputs. Give a reasons for each of your answers.

Test 1 = 15, Test 2 = 9

Test 1 = 8, Test 2 = -4
 - (b) Name and explain the function of the three types of computer system buses. (4 marks)
-
3. (a) Namondo wants to purchase a printer for her office computer to print **hard copies** of her photographs. She wants to know which printer type is cheaper: **Impact** or **non-impact**. She is advised that although impact printers are cheaper, the most important things to consider in buying a printer are **print quality**, and the **cost and rate of consumption of ink**.
 - (i) Which printer is she likely to select? Justify your answer. (3 marks)
 - (ii) What do you understand by the terms?
 - Hard copy
 - Impact printer
 - Non-impact printer
 - Print quality
 - (iii) State a difference between impact and non-impact printer in terms of their print technology. (6 marks)

Consider the logic circuit diagram in Figure 1 below:

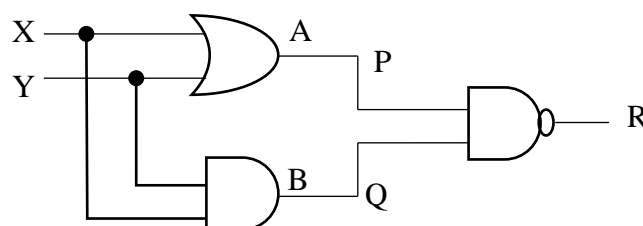


Figure 1

- (i) State the names of the logic gates labeled A, B and C. (3 marks)
- (ii) Based on Figure 1, copy and complete the truth table in Figure 2.

X	Y	P	Q	R
0	0			
0	1			
1	0			
1	1			

Figure 2

- (iii) Write the logic equations for outputs **P**, **Q** and **R** in terms of X and Y. (3 marks)

4. (a) A team of system developers has identified six tasks described in the table below:

Task No.	Task Description	Task Constraints	Duration (in days)
A	System specification	None	3
B	Try software	Starts after system specification	2
C	Customize Test software	Starts after software trial	4
D	Purchase of Test hardware	Starts after system specification	3
E	Install software	Starts after Hardware Testing	2
F	Train staff	Starts after software customization	1

- (i) What is use of Gantt charts in projects (2 marks)
- (ii) Copy and complete Table 2 below to produce a Gantt chart. (6 marks)

Table 2

	Days										
Tasks	1	2	3	4	5	6	7	8	9	10	11
A											
B											
C											
D											
E											
F											

- (iii) Define the terms lag time and critical path as used in project development. (2 marks)
- (iv) State the critical path of the project above and hence determine the project duration. (2 marks)
- (b) A school's computer resource center has stand-alone computers. The school has now decided to connect the computers into a local network and to the internet.
- (i) State what you understand by the network terms ISP and protocol. (2 marks)
- (ii) Give the name of a protocol that
- governs the movement of data across the internet.
 - is used to access pages on a web server. (2 marks)
- (iii) Briefly explain the following database concepts :
- Primary key
 - Field
 - File
 - Query

(4 marks)

5. (a) In computer security,

- (i) What is the meaning of the term hacking? **(2 marks)**
(ii) State three measures that can be implemented to prevent hacking **(3 marks)**
(iii) List three problems that can result from unethical hacking. **(2 marks)**
- (b) Showing all steps in solving the following number representation problems.
(i) Convert the hexadecimal number 2C into a binary number. **(2 marks)**
(ii) Convert the octal number 67 into hexadecimal. **(3 marks)**
(iii) Perform the binary addition $1011_2 + 1101_2$ **(3 marks)**
- (c) (i) State what you understand by backup and give one characteristic of a backup storage device
(ii) Briefly explain the term portability in relation to:
- Storage devices
- Software **(2 marks)**
-
6. (a) (i) With the aid of diagrams, distinguish between serial and parallel data transmission. **(5 marks)**
(ii) Briefly describe the following modes of transmission giving an example in each case where they are used :
Simplex, half duplex, full duplex. **(6 marks)**
- (b) (i) Name and briefly explain the function of the three main parts of the CPU. **(6 marks)**
(ii) State three main stages of the machine cycle. **(3 marks)**
-
7. (a) (i) State the main technological feature that distinguished each of the following computer classifications:
- 1st generation
- 2nd generation
- 3rd generation
- 4th generation **(4 marks)**
- (ii) In computer programming:
- What are mnemonics? **(2 marks)**
- State two disadvantages of using machine code. **(2 marks)**
- State two difference between a compiler and an interpreter. **(2 marks)**
- (b) One of the health hazard of using computers is RSI.
(i) What is RSI in full. **(1 mark)**
(ii) State two body parts that are likely to be affected by RSI. **(2 marks)**
(ii) What should we do in order to prevent RSI? **(1 mark)**
- (c) (i) State two advantages and two disadvantages of using electronic mail as a means of communication. **(4 marks)**
(ii) State a difference between intranet and extranet. **(2 marks)**

REGISTRATION CENTRE NUMBER		CENTRE NAME	
CANDIDATE'S FULL NAMES			
CANDIDATE IDENTIFICATION NUMBER	SUBJECT CODE	PAPER NUMBER	
	0595 3 Group Three		
FOR OFFICIAL USE ONLY (Candidate Random Code):		⇒	
GENERAL CERTIFICATE OF EDUCATION (GCE) BOARD ORDINARY LEVEL EXAMINATION			
SUBJECT TITLE COMPUTER SCIENCE		SUBJECT CODE	PAPER NUMBER
		0595 3 Group Three	
		EXAMINATION DATE: JUNE 2021	

FO
←

Two and a Half hours

Enter the information required in the shaded boxes.

For your guidance, the approximate mark for each part of question is indicated in the brackets

You are reminded of the necessity for good English and orderly presentation in your answers.

In calculations, you are advised to show the steps in your working, giving your answer at each stage.

Calculators are NOT allowed.

Turn Over

<i>FOR EXAMINERS' USE ONLY</i>	
<i>Marked by:</i> <i>Signature:</i> <i>Date</i>	<u>SCORE</u>
<i>Checked by:</i> <i>Signature:</i> <i>Date</i>	

Do all tasks (Task 1, Task 2 and Task 3) specified in this question paper.

TASK 1 (20 marks)

Examine the text below and answer the questions that follow.

Prevalence of ICT's in Bangoh District

The spread and adoption of information and communication technologies (ICT's) throughout the country was phenomenal in the early 2000's and Bangoh District was not left behind. More people than ever are today using the following ICTS :

Radio

Smart phones

Television, etc.

However, only relatively few people have reliable access to the internet because of the high costs. Even with this limitation, mobile phone technology is revolutionizing the technology landscape and today, is by far the fastest growing ICT in the country.

Smart Telecoms was the first mobile provider in with a fair coverage in /bangoh. New Way Telecoms and Big Brains Communications followed later, and all three are currently doing well in terms of coverage and stability.

Formerly, TV signals were only possible via satellite. But today many antennas have been raised around the community and TV signals are available both terrestrially and by satellite. Even cable TV operators are doing good business.

The table below indicates the level of usage of ICT tools in Bangoh District.

ICT Tools	Radio	Television	Smart phones	Internet
Usage	60%	70%	65%	20%

1. Launch a word processor. Set the page orientation to portrait, and the page size to A4. Type the given passage.

You are not required to place a border around the passage.

(8 marks)

2. Format the heading of the passage as follows:

(4 marks)

- a. Font size: 18
- b. Font name: Arial
- c. Alignment: Centre
- d. Case: Upper case

3. Format the rest of the text as follows:

(4 marks)

- a. Font size: 13
- b. Line spacing: 1.5
- c. Alignment: Full justification
- d. Font name: Times New Roman

4. Format the table as follows:

(2 marks)

- a. Centre all table contents
- b. Bold the row headings, i.e “ICT Tools” and “Usage”

5. Use bullets to itemize the list of ICT tools in the passage. **(2 marks)**
6. Save your work as Task 1
7. Print Task 1.

TASK II (20 marks)

The worksheet below shows the prices of various items in local supermarkets. Study it and answer the questions that follow.

	A	B	C	D	E	F	G
2			Supermarkets				
3			Lowcost	PicknPay	GreenShop	Rainbow	
4	Items	Milk	1400	1200	1250	1150	
5		Chocolate	1450	1560	1500	1500	
6		Honey	900	1000	1210	1200	
7							
8							
9							

1. Launch your spreadsheet software. Enter and format the data as shown. **(4 marks)**
 2. Select the range containing prices and format them to display numbers as currency. **(2 marks)**
 3. Format the fonts in the merged cells as follows: Times New Roman, bold, and 16 point size. **(2 marks)**
 4. Type the label “Total” in cell B7. Then insert a formula to calculate the total amount for sales by LowCost Supermarket in Cell B7. Copy the formula to corresponding adjacent cells to compute the total sales for the order three supermarkets. **(2 marks)**
 5. Write in the space below, the formula in cell F7 after the copy procedure above is done. **(1 mark)**
-
6. Type the label “Average” in cell G3. Then insert a formula to calculate the average cost of milk in Cell G4. Copy the formula to the cells in the range G5:G7. **(2 marks)**
 7. Write in the space below, the formula in cell G7 after the copy procedure above is done. **(1 mark)**
-
8. Select the range B3:G7, and format the cells in the range to have single borders. **(2 marks)**
 9. Create a column chart using the entries in the range B3:F6, with prices on vertical axis and supermarkets in the horizontal axis. For each supermarket, a separate vertical bar should be draw for each food item. **(4 marks)**
 10. Save your work as Task 2
 11. Print Task 2.

TASK 3 (10 marks)

In modular arithmetic, when we divide two whole numbers, the result is a whole number (the dividend) and another whole number (the remainder). For example, $7/3$ gives a dividend of 2 and a remainder of 1. In programming, two operators are used to do the division (e.g., “/” and “%” in C; and “div” and “mod” in pascal).

Examples

C	Pascal
$7 / 3 = 2$	$7 \text{ div } 3 = 2$
$7 \% 3 = 1$	$7 \text{ mod } 3 = 1$

The C and Pascal programs below perform the same task using modular arithmetic. Select any one of them and answer the questions that follow.

C Program

```
#include <stdio.h>
int main (void) {
    int i, m , km, num ;
    i = 1 ;
    while (i <= 3 ) {
        printf ( "i = %d\n" , i ) ;
        printf ("Enter number of metres :  ") ;
        scanf("%d", &num) ;
        km = num / 1000 ;
        m = num % 1000 ;
        printf ( "%d m is equivalent to %dkm and %dm\n\n", num, km, m ) ;
        i = i+1 ;
    }
    char c = getchar( ) ;
}
```

Pascal program

```
Program Numbers ;
var i, m , km, num : integer ;
BEGIN
    i := 1 ;
    while (i <= 3 ) do
    begin
        writeln ( 'i = " , i ) ;
        write ( 'Enter number of metres :  ' ) ;
        readln (num) ;
        km := num div 1000 ;
        m := num mod 1000 ;
        writeln ( num, 'm is equivalent to ', km, 'km and ', m, 'm' ) ;
        writeln ;
        i := i+1 ;
    end ;
```

1. Launch either a C or Pascal program development environment, and key in the corresponding programs, compile the program. If any errors, keep correcting and compiling until all the errors are corrected. Save as Task 3. (2 marks)
2. Run the program and provide 25, 300, and 4500 when prompted for a number, pressing the <Enter> key after each number is entered. Write the output you observe. (3 marks)

3. State what the program is designed to do. (3 marks)

4. The keyword “while”, which is used in the program is the program is an example of which programming construct? Explain how the stated programming construct works. (2 marks)

Programming construct :

Explantation :

5. Save your work as Task 2.
6. Print your work.

-
1. Transmission of signals between the monitor and the system unit is done through the:
- A Parallel cable.
 - B Power cable.
 - C Video cable
 - D Digital cable.
-
2. The equivalence of the number 1001000001_2 in the octal scale is:
- A 1101.
 - B 441.
 - C 373.
 - D 31.
-
3. A(n) _____ is software used to create and modify text files.
- A Binary file editor.
 - B Equation editor.
 - C Text editor.
 - D File editor.
-
4. A system installed in a factory turns on a heater if the temperature drops below 0°C and turns on a cooler if the temperature rises above 30°C . This is an example of a :
- A monitoring system.
 - B control system.
 - C relay system.
 - D regulatory system.
-
5. The spreadsheet cell range **C2:E7** has _____ cells.
- A 6
 - B 7
 - C 18
 - D 21
-
6. At what stage in the system development life cycle is a decision made on what type of input methods to use?
- A Analysis.
 - B Design.
 - C Implementation.
 - D Maintenance
-
7. The rate of data transmission along a data path is measured in:
- A bits per cycle
 - B bits per second.
 - C cycles per second
 - D micro seconds.
-
8. Which of the following is in the correct order in the machine instruction cycle?
- A Decode- execute- fetch.
 - B Decode-fetch-execute.
 - C Fetch-execute-decode.
 - D Fetch-decode-execute
-
9. What is an email mailbox?
- A A folder/directory in an email server that holds all user's messages.
 - B A computer that stores all user's email messages.
 - C A folder/directory in an email server that holds a particular user's messages
 - D A folder/directory in the user's computer into which his/her email messages are downloaded.
-
10. A company uses 'What-if-analysis' as a guide to business management. This is an example of:
- A monitoring
 - B modeling.
 - C simulation.
 - D control.
-
11. A measure that will protect files against accidental damage is
- A access privileges.
 - B backup.
 - C passwords.
 - D encryption
-
12. _____ is a network topology in which each network device is connected to a main cable.
- A Star
 - B Mesh
 - C Bus
 - D Tree
-
13. Software that can be used to improve the performance of a computer system is:
- A Desktop publishing software.
 - B Programming software.
 - C Bespoke software.
 - D utility software
-
14. There are _____ nibbles in 2 bytes
- A 4
 - B 8
 - C 16
 - D 32
-
15. The term software is best described as:
- A electronic copy.
 - B computer output.
 - C photocopy.
 - D soft paper copy
-
16. Modification on an installed system is done _____ at _____ stage of the system life cycle.
- A feasibility
 - B analysis
 - C maintenance
 - D design
-

17. A device that selects the best path for a data packet from one network to another is:
- A switch.
 - B bridge.
 - C router.
 - D hub.
-
18. The abbreviation ASCII stands for:
- A American Standard Commission for Information Interchange.
 - B American Standard Code for Information Interchange.
 - C American Storage Code for Information Interchange.
 - D American Storage Code for Internal Interchange.
-
19. Which one of the following features can be used in a biometric system?
- A Height.
 - B Fingerprint
 - C Blood pressure.
 - D Weight.
-
20. The set of rules that govern the transmission of data across a network is called:
- A topology.
 - B protocol.
 - C controller.
 - D transceiver.
-
21. The attribute of software stating that it does not waste resources when running is referred to as:
- A portability
 - B reliability
 - C efficiency.
 - D usability
-
22. Convert 50millionseconds to seconds _____
- A $\frac{1}{200}$.
 - B $\frac{1}{20}$.
 - C 20.
 - D 200.
-
23. Software is referred to as free and open source if it has:
- A No commercial license and cannot be altered .
 - B A commercial license and can be altered
 - C No commercial license and can be altered
 - D A commercial license and cannot be altered.
-
24. Sending a file from your computer to a server is referred to as:
- A downloading.
 - B reading.
 - C writing.
 - D uploading.
-
25. _____ is a technology that can be used to locate an elephant remotely in a forest.
- A Geographic Information System
 - B Location Information System
 - C Transmitter
 - D Geographic Positioning system
-
26. Communication on cell phone is an example of _____ communication.
- A multiplex
 - B simplex
 - C half duplex
 - D full duplex
-
27. The binary code for ASCII character **b** is, 01100010. What is the binary code for ASCII character **d**?
- A 01101101.
 - B 01101010.
 - C 01101100.
 - D 01100100.
-
28. In a typical Client-Server network:
- A the server computer initiates all communication.
 - B the client computer makes request for resources.
 - C the server computer makes request for resources.
 - D the client computer provides needed resources.
-
29. The abbreviation FTP stands for:
- A File Transfer Protection.
 - B File Transfer Protocol.
 - C File Transmission protection.
 - D File Transferable Protocol.
-
30. One of the functions of an operating system in a computer is to manage processes. The term process refers to a:
- A program stored in the hard disk.
 - B program loaded in main memory.
 - C program executing in the CPU.
 - D compiled program ready for running.
-

31. The HTML open and close tags ` --- ` are used to generate:
- A Numbered list.
 - B Bulleted list.
 - C Underlined text.
 - D Unified list of numbers.
-
32. The abbreviation USB stands for:
- A Unit Storage Bus.
 - B Universal Standard Bus
 - C Unified storage Bus.
 - D Universal Serial Bus.
-
33. A system designed to track daily sales and purchases of a company is a(n) _____ system.
- A transaction processing
 - B management information
 - C decision support
 - D Executive information
-
34. Which of the following is true about user name and passwords in an information system?
- A Users can have the same user name, but their passwords must be different.
 - B Users can have the same password, but their user names must be different.
 - C Users are able to change their user names and still have access to their account.
 - D When users change their passwords, they must also change their user names.
-
35. Which one of the following is **NOT** a component of an information system?
- A User.
 - B Data.
 - C Computer table.
 - D Computer hardware
-
36. _____ is a programming paradigm that specifies a problem to be solved but does not specify how to solve it.
- A Object-oriented
 - B Declarative
 - C Procedural
 - D Imperative
-
37. _____ is usually described as a knowledge-based system
- A Control system
 - B Monitoring system
 - C Expert system
 - D Management information system
-
38. In system implementation, parallel conversion means:
- A running the new system alongside the old system.
 - B running some parts of the new system alongside the old system.
 - C replacing parts of the old system with parts of the new system.
 - D running the new system while the old one is shut down.
-
39. When an email message is sent from John to Mary, copies of the message are found in:
- A John's sent folder and Mary's inbox folder.
 - B John's sent folder and his inbox to Mary on a server.
 - C Mary's sent folder and John's inbox folder.
 - D a folder's inbox folder and Mary sent folder on a server.
-
40. The file extension **.pdf** stands for:
- A Printable document format.
 - B Popular document format.
 - C Portable document format.
 - D Picture document format.
-
41. Flash memory is an example of a(n) _____ storage device.
- A Optical
 - B solid state
 - C chip
 - D magnetic
-
42. Disk compression software is a type of:
- A application software.
 - B server software.
 - C utility software.
 - D device driver software.
-
43. Which of the following is **NOT** an example of a storage devices
- A Flash memory
 - B ROM chip
 - C Hard disk
 - D CPU.
-
44. Software that enables an operating system to communicate effectively with a given peripheral device is known as:
- A Firewall.
 - B Driver.
 - C Bespoke.
 - D Widget.
-

45. _____ system enables people who are geographically dispersed to have an online meeting that looks like a real life situation.
- A Electronic Marketing
 - B Videoconferencing
 - C Multimedia Message Service
 - D Teleworking
-
46. In project management, lag time means a delay between:
- A a predecessor and a successor task
 - B two predecessor tasks.
 - C two successor tasks.
 - D two dummy tasks.
-
47. _____ is a class of computers that is most suitable for weaponry and weather forecasting.
- A Minicomputer
 - B Microcomputer
 - C Supercomputer
 - D Laptop computer
-
48. Communication between a hand held remote controller and a television set is an example of _____ communication.
- A radio wave
 - B bluetooth
 - C microwave
 - D infared
-
49. Convert 2 seconds to microseconds
- A 2000 Microseconds.
 - B 2000 000 Microseconds.
 - C 0.002 Microseconds.
 - D 0.000002 Microseconds.
-
50. Ergonomics is concerned about:
- A the economies of writing and displaying characters.
 - B the design of pictures and word art
 - C the design and placement of equipment in a computer workplace.
 - D speed and accuracy of a computer user.
-

GCE 2020 PAPER 2

1. (a) (i) Give the role of each of the following types of system buses:
 - (ii) Address bus (2 marks)
 - (iii) Control bus (2 marks)
 - (iv) Data bus (2 marks)
 - (b) Briefly describe the characteristics of a compact disc (CD) in terms of:
 - (i) How data is stored (3 marks)
 - (ii) The physical layout of tracks and sectors on the CD. (2 marks)
 - (c) (i) Sketch and label a block diagram of a simplified computer system, that shows the stages of information processing. (3 marks)
 - (ii) Describe the main activity of each stage and give one example of a device used. (6 marks)
-
2. (a) State the main difference between
 - (i) A Server and a Client in a Client-Server network. (2 marks)
 - (ii) Synchronous and asynchronous data transmission. (2 marks)
 - (iii) Parallel and serial data transmission. (2 marks)
 - (c) Give the main role of the following network devices:
 - (i) Repeater (2 marks)
 - (ii) Bridge (2 marks)
 - (iii) Router (2 marks)
 - (iv) Modem (2 marks)
 - (d) Convert the following numbers to the indicated bases showing clearly the steps involved:
 - (i) FD_{16} to binary (3 marks)
 - (ii) 395_8 to hexadecimal (3 marks)
-
3. (a) Differentiate between system software and application software. Name an example in each case. (4 marks)
 - (b) Explain the following features of a word processor:
 - (i) Editing
 - (ii) Mail merging
 - (iii) Cropping
 - (iv) Formatting (4 marks)
 - (c) (i) Briefly describe the differences between Manual Information System and an Automated Information System. (4 marks)
 - (ii) Give two examples of Computerised Information Systems. (2 marks)
 - (d) (i) Name any four components of a Data Transmission System. (4 marks)
 - (ii) Briefly describe the role of any two of the components listed above. (2 marks)
-
4. (a) Study the line of codes written in HTML below and answer the question that follow:
 1. <html>
 2. <head>
 3. <title> Computer Science </title> </head>
 4. <body>
 5. <marquee><q><u> THANK YOU
</u></q></marquee>
 6.

 7. <hr size = 16 width "50%" align = "center" color = "blue">
 8. <ol type = "I" start = "3">
 9. English Language
 10. Computer Science
 11. Arithmetic
 12.
 13. </body>
 14. </html>

- (i) State the role of the HTML code in relation to the webpage **(2 marks)**
 (ii) Give the general name of software commonly used to interpret codes written in HTML. **(1 mark)**

Briefly explain the output

- (iii) In lines 8 to 12 **(4 marks)**
 (iv) In line 7 **(5 marks)**
 (v) Write HTML code that will generate a hyperlink to a web page called CSC595. **(3 marks)**
- (b) Evaluate the following in binary arithmetic:
- (i) $1101011_2 + 10111_2$ **(2 marks)**
 (ii) $101100_2 - 111_2$ **(3 marks)**

5. (a) Table 1 is used to register student's information in a certain school.

Table 1

ADMISSION NUMBER	NAME OF STUDENT	DATE OF BIRTH	CLASS	FEES PAID

- (i) What do you understand by the term key field? **(2 marks)**
 (ii) Which of the fields in Table 1 is suitable to used as a key field? Give a reason for your answer. **(2 marks)**
 (iii) Give appropriate data types for the entries in the following fields: ADMISSION NUMBER, NAME OF STUDENT, DATE OF BIRTH, CLASS. **(4 marks)**
- (b) Briefly explain what you understand by each of the following:
- (i) Bootstrap **(2 marks)**
 (ii) Ergonomics **(2 marks)**
 (iii) A milestone in project management **(2 marks)**
 (iv) A biometric system **(2 marks)**
- (c) Distinguish briefly between data verification and data validation. **(4 marks)**

6. (a) (i) What do you understand by the term social media? **(2 marks)**
 (ii) Briefly explain one positive and one negative impact of social media in the Cameroon Education sector. **(4 marks)**
 (iii) Give two examples of social media platforms. **(2 marks)**

- (b) Briefly explain two ways by which
- (i) a computer can be affected by a virus
 (ii) a computer can be protected against viruses
 (iii) a computer system that may malfunction when infected by a virus **(6 marks)**
- (c) Determine the logic expression that corresponds to the output P, R and Q, in terms of A and B, on the logic circuit in Figure 1:

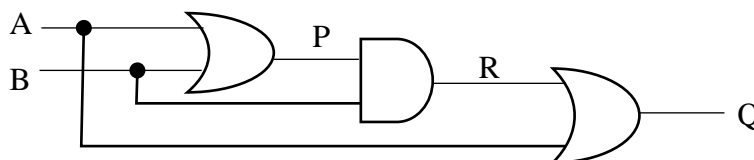


Figure 1

(6 marks)

8. (a) You are requested by a Principal to make recommendations for types and specifications of computers for the school computer laboratory
- (i) Name three characteristics of system unit you will recommend and say how these are important for proper functioning of the library. **(6 marks)**
 - (ii) Name one characteristic of the monitor you will recommend and say how this is important for the laboratory. **(2 marks)**
- (b) A student gets up a 5:30 AM and performs the following activities shown in Table 2 within the indicated duration, in order to get to school.

Table 2

No.	Activity	Duration In Minutes
1.	Facial clean-up	10
2.	Heat water for shower	15
3.	Prepare breakfast	10
4.	Take a shower	15
5.	Clean shoes	5
6.	Dress up	15
7.	Take breakfast	10
8.	Walk to school	15

Assuming that activities 2 and 3 can start at the same time, as well as activities 5 and 6,

- (i) Draw a Gantt chart for the above activities. **(6 marks)**
 - (ii) What do you understand by the terms:
 - Critical path
 - Slack time**(4 marks)**
 - (iii) Determine the critical path for these activities. **(2 marks)**
-

GCE PAPER 3 2020

Do all tasks (Task 1, Task 2 and Task 3) specified in this question paper.

TASK 1 (20 marks)

Figure 1 shows a story typed and enclosed in a frame. Your task is to type, edit and format the text as requested.

The Cunning Fox and the Clever Stock

Once upon a time, there lived a very cunning and mischievous fox. He used to speak to other animals sweetly and gain their trust, before playing tricks on them. One day the fox met a stork. He befriended the stork and acted like a very good friend. Soon, he invited the stork to have a feast with him.

The stork happily accepted the invitation.

The day of the feast came, and the stork went to the fox's house. To her surprise and disappointment, the fox said that he could not make a big feast as promised, and just offered some soup. When he brought the soup out of the kitchen, the stork saw that it was in a shallow bowl ! The poor stork could not have any soup with its long bill, but the fox easily licked the soup from the plate ...

The day arrived and the fox reached the stork's place. After exchanging pleasantries, the stork served soup for both of them, in a narrow jar with a long neck. She was able to have the soup very easily with her long bill, but the fox obviously could not. After finishing hers, the stork asked the fox if he was enjoying the soup. The fox remembered the feast he himself had given

Figure 1

1. State the name(s) of the word processor(s) installed in your PC. **(1 mark)**

2. Launch a word processor program from your PC and type the text of Figure 1. Justify the three paragraphs. **(10 marks)**
3. For the title, Bold, Center, underline, and apply a font size of 16. **(1 mark)**
4. Add a light blue background colour to the title. **(1 mark)**
5. Select the body text and apply a serif font of size 12. **(2 marks)**
6. Insert the image called 'foxandstork' (found on the desktop) at the left of the first paragraph and wrap text to its light. **(2 marks)**
7. Insert page number as header. **(2 marks)**
8. Insert a footer with the text 'One bad turn begets another' at bottom left. **(1 mark)**
9. Save your work as Task 1 in your working directory.
10. Print copy of task 1.

TASK 2 (20 marks)

An excerpt of a worksheet in Figure 2 shows mock examination results of 10 students in Form 5. All marks on 20

	A	B	C	D	E	F	G	H	I
1	Mock Exam Result - 2009								
2	S/n	Students Names	Sex	Eng	Fre	Mat	His	Geo	Econs
3	1	Njie Fabian	M	12	9	11.5		13	13.5
4	2	Tatah Ami	F	7	12	10	14	9	11
5	3	Verla Jones	M	13.5	11		16	14	10.5
6	4	Mvogo Cliff	M	5	11	13	12.5	10	15.5
7	5	Mary Tita	F	11	9	14	16	11	16
8	6	Tataw Princewill	M	8	10	13.5	13	10	11
9	7	Akemjia Leonard	M	9.5	11	12		11	13.5
10	8	Full Saradia	F	13	11.5	10	16.5	13.5	10.5
11	9	Ngemoussi Juliet	F	14	12.5	15	13.5	11	14.5
12	10	Kinah Queenta	F	10.5	14	13.5	12	9	11.5

Figure 2

1.	Create a workbook called Task 2 and enter the worksheet data exactly as provided.	(5 marks)
2.	a) Use a bold font size 14 for the title. b) Use a bold font of size 12 for column headers. c) Auto fit all data columns. d) Merge cells A1 to I1 and center the title.	(1 mark) (1 mark) (1 mark) (1 mark)
3.	Add the following three column headers to the right of column I : SubSat, Avge and Rank.	(1 mark)
4.	For the first student Njie Fabian, use the suitable spreadsheet functions (or formulas) to calculate: a) number of subjects sat, b) average (correct to 2 decimal places) and c) rank d) Hence, calculate similar values for the other students.	(2 marks) (2 marks) (2 marks) (2 marks)
5.	Save your work as Task 2 in your working directory.	
6.	Print a copy of Task 2.	

TASK 3 (10 marks)

The C and Pascal programs below perform the same task. Select any one of them and answer the questions that follow

C Program

```
#include <stdio.h>
int main (void) {
    int num ;
    printf ( "Enter a number : " );
    scanf ("%d", &num) ;
    while (num < 5 ) {
        printf ( "%d  ", num) ;
        num = num+1 ;
    }
    getchar( ) ;
}
```

Pascal program

```
program Numbers ;
var num : integer ;
BEGIN
    write ( 'Enter a number:  ' ) ;
    readln (num) ;
    while num < 5 do
        begin
            write( num, '  ' ) ;
            num := num + 1 ;
        end ;
    ..
end ;
```

1. Launch either a C or Pascal program development environment, and key in the corresponding programs, compile the program. If any errors, keep correcting and compiling until all the errors are corrected. **(2 marks)**
2. Run the program and enter -2 when prompted for a number. Write the output you observe in the space below. Write NONE if there is no output. **(1 mark)**

3. Run the program again but this time, enter 10 when prompted for a number. Write the output you observe in the space below. Write NONE if there is no output. **(1 mark)**

4. Explain what the program is designed to do.

(3 marks)

5. The keyword “while”, which is used in the program is the program is an example of which programming construct? Explain how the stated programming construct works.

(3 marks)

(a) Programming construct _____

(b) Explantation : _____

6. Save your work as Task 3.

7. Print your work.

