COMPUTER SCIENCE

Group "A" [10 Marks]

1. **Answer the following questions in one sentence:** (6 * 1 = 6)

    - Computer Fundamentals * 2
    - Database * 2
    - Q BASIC Programming * 1
    - C Programming * 1

2. **Technical Terms:** (2 * 1 = 2)

    - Computer Fundamentals * 2

3. **Full forms:** (2 * 1 = 2)

    - Computer Fundamentals * 2

Group "B" [24 Marks]

4. **Answer the following questions:** (9 * 2 = 18)

    - Computer Fundamentals * 5
    - Database * 4

5. **QBasic - OUTPUT:** (2)

6. **QBASIC - DEBUGGING:** (2)

7. **QBASIC - ANALYTICAL QUESTIONS:** (2)

Group "C" [16 Marks]

8. **Number System:** (4 * 1 = 4)

9. **QBASIC:** (2 * 4 = 8)

    - Modular Programming
    - File Handling

10. **C Programming:** (4)

Recommended Reading Order

- Number System
- C Programming
- QBASIC
- Database Management System (DBMS)
- Theory

Networking and Telecommunication

Telecommunication is the exchange of data or instruction over a distance using signals or electromagnetic waves.

- Devices used in telecommunication systems are known as nodes.

Data communication is the telecommunication which involves computers and computer network.

Data Transmission/Communication Mode:

Transmission mode refers to way in which data communication occurs based on direction of transfer.

- There are three modes:
  - Simplex: Transmission of data takes place in a single direction. E.g: Radios, Televisions etc.
  - Half Duplex: Transmission of data takes place in both directions but only one direction at a time.
  - Full Duplex: Transmission of data can take place in both direction simultaneously.

Components of data communication:

- Message: Data/information that is to be communicated
- Sender: Computer/Computing device that creates and sends the message
- Receiver: Computer/Computing device that receives the message
- Medium: Channel/path through which message is transferred
- Protocol: Set of rules followed by sender and receiver.

Communicaton/Transmission Media

A channel or path through which data and information are transmitted between connected devices in a network environment is called communication media.

- Two types:
  - Guided / Wired / Bounded
  - Unguided / Wireless / Unbounded

Guided Transmission Media

Guided transmission media uses cable or wire to transfer data and information among computers.

- Types:
  - Co-axial (BNC connector)
  - Twisted pair (RJ-45 connector)
  - Fiber Optics (ST, SMA, SC connectors)

Co-Axial Cable

> Consists of a inner conductor surrounded by an insulating layer and again surrounded by conducting shield.

- Advantages:
    - Higher bandwidth as compared to twisted pair
    - Better shielding
    - Good noise resistance
    - Lower error rates
- Disadvantages:
    - More expensive than twisted pair

Twisted Pair Cable

> Consists of multiple pair of copper wires twisted together and insulated with plasic.

- Types:

    - Unshielded Twisted Pair: These don't have a metallic shield/sheath.
    - Unshielded Twisted Pair: These have a metallic shield/sheath.

- Advantages:

    - Relatively easy to implement and terminate
    - Least expensive

- Disadvantages:

    - Poor noise immunity
    - High attenuation
    - Lower bandwidth

Fiber Optic Cable

> Made up of plastic or glass fiber to transmit data.

- Advantages:

    - High bandwidth and Fast
    - low power loss
    - Longer distance support
    - Good resistance
    - Low attenuation

- Disadvantages: -

    - Most Expensive
    - Difficult to join (splice)
    - Easily breakable

Unguided transmission media

Unguided transmission media doesn't use wire or cable for data transmission.

- Types:
    - Radio Wave
    - Micro Wave
    - Satellite Communication

Radio wave

High frequency wave(30MHz to 1GHz) wave that can travel long distance.

- Data is changed to signal with FM(Frequency modulation), AM(Amplitude modulation) and PM(Phase Modulation)

Microware

Super High Frequency wave(1GHz to 40GHz) wave that can travel short distance(30 to 40KHz) and need repeaters.

- Needs tall towers

Satellite Communication

Uses artificial satellite stationed in space for this specific purpose.

- Earth station communicates with the satellite.

Other unguided mediums

- Infrared: short range, used in remotes
- Bluetooth: short range, used for short range communication (mostly to connect peripherals). (2.4GHz)

Computer Network

> Computer network is a group of two or more computers and devices connected to each other through wired or wireless media to share resources.

- Advantages:

    - Can be used to share hardware(printer, storage devices etc.).
    - Can be used to share data and software.
    - Can be used to communicate.
    - Supports central control and administration.

- Disadvantages:

    - Malware can be transferred.
    - Skilled manpower is required to setup and manage.
    - Initial setup cost is high.
    - Cybercrimes can occur and need to be handled.

Elements/Componentts of Computer Network

- Hardware Components:
    - Computer System:
        - Server: Provides service/resources and controls and manages other computers on the network
            - File Server
            - Database Server
            - Print Server
            - Network Server
            - Mail Server etc.
        - Workstation: Uses resources of the network
    - Network Adapter/NIC card: Network Interface card provides ports to connect computer to network. In can come built-in or needs to be placed on expansion slot on motherboard.
    - Connectors: Used to connect communication media with network devices.(BNC, RJ-45, ST)
    - Network devices: Devices used for setting up network like hub, switch etc.

Network Devices

Hub

Networking device with multiple port that transmits received data to all connected computers including sender. - Passive hub: No electricity and no amplification. - Active hub: Requires electricity and amplifies signal

Switch

Networking device with multiple port that can determine source and destination of data packets.

- Switch is upgrade of hub.

Hub is cheaper but it is less efficient and slower as it broadcasts packets to all connected computers and is half duplex.

Bridge

Bridge connects two networks with similar/same protocol.

- Bridge inspects incoming signals (MAC address) and decides whether to forward or discard it making it efficient.

Gateway

Gateway connects two networks having different protocol.

- It is like a dedicated server that acts as protocol converter.

Router

Router joins multiple wired or wireless networks together and routes(determine path and send) data based on IP address.

Repeater

Repeater is a network connectivity device that regenerates/amplifies weak signals.

MODEM

Modulator Demodulator is a network device that transfers data through telephone wire.

- Modulation: Conversion of digital signals to analog signals.

- Demodulation: Conversion of analog signal to digital signal.

- Modulation is required as telephone wire can only transfer analog signal and demodulation is required as computers understand digital signal.

Network Topology

Network topology is the inter-connection pattern of network components.

- Types:
    - Bus topology
    - Ring Topology
    - Star Topology
    - Mesh Topology

Bus Topology

This topology uses a segmeent of single cable to connect nodes. This cable is called bus.

- Terminators are attached at start and end.

- Advantages:

    - Easy to setup
    - Easy to expand
    - Cheap
    - Easy to understand

- Disadvantages:

    - Single point of failure(If main cable breaks, whole network malfunctions)
    - Network performance degrades with heavy traffic.

Ring/Loop Topology

In this topology, a closed loop is formed by computers.

- Data is transmitted in one direction(clockwise or anticlockwise).

- Advantages:

    - Cheap to install and expand.
    - Each computer acts as client or server.

- Disadvantage:

    - If a node fails, whole network is disturbed.
    - Difficult to troubleshoot.
    - Adding or removing node disturbs the network.

Star Topology

Type of topology in which all nodes are connected to a central device (hub/switch) through a cable.

- Advantage:

    - Fast
    - Easy to troubleshoot
    - Easy to setup and modify
    - Node failure doesn't disturb network

- Disadvantages:

    - Initial cost is high due to hub/switch.
    - If hub/switch fails, network fails.

Mesh Topology

In this each computer is connected to every other computer.

- Advantage:

    - Fast
    - Privacy is maintained

- Disadvantages:

    - Requires lot of wires
    - Not practical for large number of devices.

Hybrid topology can be made by combining different topology.

Types of Computer Network(Based on size)

- Three types:
    - Local Area Network: Small network limited within a small area like a room, a building, school, college etc. Eg. A buildings CCTV network.
    - Metropolitan Area Network: Network mostly within cities and is used for sharing of regional resources. Eg. Traffic light network of a city.
    - Wide Area Network: Very large network that covers country, countries or even the world. Eg. Internet.

Network Architecture/Model

Network Architecture specifies how computers on the network interact and communicate with each other.

- Types:
    - **Client-Server Model**: There is at least one server that provides services and some clients/workstations that receive service from server. Servers are usually powerful computers and can administer the network and share resources.
    - **Peer to Peer Model**: There is no server that manages the network or share resources. Each computer connected is called peer and each per has equal rights.
    - **Centralized Network Model**: Here all client nodes are entirely dependent on the central server.

Peer to Peer models are easy to set up but lack security, need individual hardware and software, and have limited expansion and network performance.

Centralized Network save a lot of resource and are highly secure and administerd but have single point of failure.

Internet and its services

Internet is a WAN that connects computers all over the work based on TCP/IP protocol suite.

- Services of Internet:
    - **WWW**: Interlinked collection of hypertext documents and multimedia contents available on internet.
    - **Email**: Used to send and receive messages electronically throught the Internet.
    - **Telnet**: Allows user to use a remote computer through internet.
    - **FTP**: Protocol that lets file transmission between computers on the internet.
    - **Search Engine**: Communication program that finds documents based on keywords. Eg. Google.
    - **IRC**: Allows real time communication.
    - **Online Banking**: Financial transactions through internet.
    - **E-commerce**: Bying and Selling of products through internet.

Ethical and Social Issues in ICT

> Computer ethics is a set of moral principles or code of conducts that regulate the use of computers systematically without harming others.

Commandments of computer ethics

- Do not use a computer to harm other people.
- Do not use a computer to publish fake information.
- Do not search the file or record of other people.
- Do not destroy or delete the records of other people.
- Do not use a computer to steal someone's privacy.
- Do not interfere with other people's computer work.
- Do not snoop around in other people's files.
- Do not use or copy software for which you have not paid.
- Do not use other people's computer resources without authorization.

> Cyber Ethics is a code of behavior for using the Internet. Cyber ethics deals with Privacy, Property, Security, Accuracy, Accessibility, Censorship and Filtering.

Digital Citizenship

> Digital citizenship is the responsibilities and duties of a digital citizen in a digital community.

- Digital citizen is a person who has skills and knowledge to use digital technology to participate in society, commiunicate with others, and create and consume digital content.

Digital Footprint

> Digital footprint is the recording of interaction with the digital world. i.e. trails created when using online technology.

- Active Digital footprints are traces that are created intentionally. Eg. when creating accounts, posting, accepting cookies, etc.

- Passive Digital footprints are those tracees which are created without knowledge of a user. Eg. your likes, comments, shares etc are used to advertise.

- Protecting Digital footprint:

  - Avoid sharing too much.
  - Use privacy settings.
  - Keep track of all online accounts are delete unused ones.
  - Google yourself to see your information and reputation.
  - Keep track of passwords and don't share them.

> You can develop a positive footprint by keeping personal information to a limited, being respectful, adding positive aspects of your life online.

Social Media

> Social media refers to website and application that enable people to interact with each other by sharing contents quickly and efficiently on the internet.

- Examples:

    - Facebook
    - Instagram
    - Twitter
    - WhatsApp
    - YouTube
    - Viber etc.

- Advantages:

    - Connectivity
    - Education
    - Information and Updates
    - Business Promotion
    - Awareness
    - Building Communities

- Threats or Risks:

    - Hacking
    - Fake Accounts
    - Spam and Malware attack
    - Cyber-bullying
    - Fake news

- Disadvantages:

    - Addiction
    - Health issues(mental, physical)
    - Reputatation
    - Relationship issues

- Staying safe on social media:

    - Use strong passwords, change regularly and don't share.
    - Set up two-factor authentication whenever possible.
    - Use appropriate and respectful language.
    - Don't share personal information.
    - Log out after use.

Information Technology Policy 2072 (ICT Policy 2072)

Policy designed to guide and mainstream the use of ICTs in all sectors of Nepal.

- Goal:
    - Enhance overall ICT readiness.
    - Increase digital literacy
    - Broadband and interneet access to all people
    - E-Procurement promotion.

Electronic Transaction Act(ETA)

ETA deals with issues related to cybercrime and also help in making and implementing laws over cybercrime.

- This is cyber law of Nepal. House of Representative approved it on 2063 Mangsir 18.

- Offenses relating to cyber law:

    - piracy, destruction or alteration of source code
    - unauthorized access
    - damage to any computer and information system
    - publication of illegal materials in electronic form
    - disclosing confidential
    - informing false statement
    - submission or display of false license or certificates etc.

Digital Signature is the security mechanism used on the internet for digital data processing and their transaction through electronic media.

Copyright and trademark issues are handled by Intellectual Property law.

Data Protection and Privacy law deals with the protection of data or information of people.

Computer Security

> Computer Security is the protection of computer (hardware,software and data) from malicious attacks or accidental damage.

- It is also known as cyber security or IT security(rarely).

Threats to Computer System

> Anything that has potential to harm computer system.

- Physical threat: Anything that has potential to cause physical damage:

    - Fire
    - High voltage
    - Theft
    - overheating
    - water or moisture etc.

- Non-physical threats: Anything with potential to damage data, information or software of a computer system.

    - Malicious codes
    - Unauthorized access.

Non-Physical / Logical Threats

Malicious codes:

> Malicious codes are code or web script designed to create and exploit system vulnerabilities.

- It includes computer viruses, worms, trojan horses, malicious web scripts etc.

- Malware or malicious software is developed to harm the computer system in any way.

- **Computer virus** : Computer virus is man-made destructive program capable of hiding and replicating.

- Destructive task includes: (**These are also the symptoms of computer virus infection**)

    - Degradation of overall performance
    - Running of unwanted programs
    - Deletion or corruption of files
    - Unnecessary messages
    - High memory usage

- Computer virus can spread due to:

    - Sharing of portable storage device(like pendrive)
    - Downloading files from unreliable sites
    - Opening infected email attachment
    - Using pirated software

- You can stay protected from computer virus by:

    - Install and update antivirus software
    - Install firewall
    - Scan computer system periodically
    - Keep Operating system updated
    - Stop using pirated software
    - Dont open suspicious email attachments
    - Don't download from untrusted websites

- **Computer worms** : Computer worms are malware that uses network to send copies to other PCS, often without user intervention.

- **Trojan horses** : Trojan horses are destructive program that pretend to be a useful program for a user. Unlike virus and worm, it doesn't replicate.

- **Spyware** : Type of malware that secretly collects and shares information about a computer or network without the user's consent.

- **Adware** : Type of malware that displays unwanted advertisements on your computer.

- **Other non-physical(i.e. logical threats)**:

  - **Hacking** : Identifying and exploiting weakness to gain unauthorized access.

    - White hat hackers intend to fix identified weakness
    - Black hat hackers intend to exploit identified weakness for their benefit.

  - **Phishing**: Tricks individuals into providing sensitive information by pretending to be a trustworthy entity.

  - **Pharming**: Redirects website traffic to fake sites to steal personal information.

  - **Keylogger**: Records keystrokes to steal passwords and confidential information.

  - **Botnets**: Networks of infected computers used for DDoS attacks or sending spam.

  - **Rootkit**: Tools that enable unauthorized control of a computer system without detection.

Information security

Refers to protection of data and information from unauthorized accesss or alteration while it is being stored or transmitted from one machine to another.

- Concerns of information security:
  - **Confidentiality**: Only authorized users should be able to access the data and information.
  - **Integrity**: Data should be accurate and unaltered.
  - **Availability**: Data should always be available to authorized users.
  - **Non-repudiation**: Sender can't deny his involvement in data transmission.

Information security mechanisms:

- **Identification and Authentication**: Making sure the user is who he/she is claiming to be.

  - **Password**: A secret word or phrase that a user must enter to gain access to a system or service. It should be strong, combining letters, numbers, and special characters to enhance security.

  - **Biometric system**: Uses unique physical characteristics such as fingerprints, facial recognition, or iris scans to verify the identity of a user.

- **Firewall**: A network security device or software that monitors and controls incoming and outgoing network traffic based on predetermined security rules. It acts as a barrier between a trusted network and an untrusted network.

- **Cryptography**: The practice of securing information by transforming it into an unreadable format, only accessible to those possessing a secret key.

  - **Encryption**: The process of converting plain text into ciphertext using an algorithm and a key, making it unreadable to unauthorized users.

  - **Decryption**: The process of converting ciphertext back into plain text using an algorithm and a key, making it readable to authorized users.

- **Antivirus**: Software designed to detect, prevent, and remove malware from a computer system. It scans files and programs for known threats and monitors the system for suspicious activity.

- **Backup System**: A process of copying and storing data to ensure it can be restored in case of data loss or corruption. Regular backups are essential for data recovery.

- **Updating System Software**: Regularly installing updates and patches for the operating system and applications to fix security vulnerabilities, improve performance, and add new features.

Hardware Security

> Refers to the protection of hardware(physical component of computer) from damage.

Hardware Security Mechanisms:

- **Regular Maintenance**: Routine checks and servicing to ensure hardware components are functioning correctly and to prevent potential failures.

- **Insurance**: Financial protection against loss or damage to hardware due to unforeseen events like theft, fire, or natural disasters.

- **Security from theft or harm**: Measures such as physical locks, security cameras, and restricted access areas to prevent unauthorized access or damage to hardware.

- **Protection from fire**: Installation of fire alarms, fire extinguishers, and fire suppression systems to protect hardware from fire damage.

- **Air conditioning**: Maintaining optimal temperature and humidity levels to prevent overheating and moisture damage to hardware components.

- **Power protection devices**: Devices that protect hardware from power-related issues.

    - **Spike guard**: Protects hardware from voltage spikes and surges.
    - **UPS (Uninterruptible Power Supply)**: Provides backup power during outages and protects against power fluctuations.
    - **Voltguard**: Regulates voltage to ensure a stable power supply to hardware.
    - **Surge protector**: Shields hardware from sudden voltage spikes.
    - **Power conditioner**: Improves power quality by filtering out noise and regulating voltage.

Contemporary Technology

Contemporary technology refers to the current state of technological advancements and innovations that are prevalent in today's society.

Cloud Computing

`Cloud computing` is the network of large groups of servers that provides storage and computing resources to organizations, institutions, offices and people.

- Some cloud providers are:

    - Amazon AWS
    - Microsoft Azure
    - Google Cloud
    - IBM Cloud
    - VMWare Cloud
    - Oracle Cloud
    - Alibaba Cloud

- Public Cloud provides storage and application services to the public via the internet.

- Private Cloud is cloud computing that is owned by a single organization.

- Types of cloud computing services:

    - Infrastructure as a Service (IaaS): Provides computing resources including servers, networking, storage, and data center space to run their software system. Customers pay according to usage. (E.g. Amazon AWS EC2)
    - Platform as a Service (PaaS): Provides infrastructure and tools required to develop their own application. (E.g. Microsoft Azure)
    - Software as a Service (SaaS): Provides software applications over the internet. (E.g. Google Drive)

Cloud Computing has high performance, scalability and availability.

Companies that offer computing services are called cloud providers.

Artificial Intelligence(AI)

Artificial Intelligence(AI) refers to simulation/mimicking of human intelligence using computer system.

- AI systems are capable of performing tasks and can iteratively improve themself.

- Example: Siri, Cortana, Alexa, ChatGPT etc.

Virtual Reality(VR)

> VR is an artificial environment created with the computer hardware and software and presented to the user in such a way that it appears real.

- They can be used to control drones, fly aeroplanes, play games, watch movies and even use it as computer.

- Example: Oculus Rift, PlayStation VR, Apple Glass, Meta Glass etc.

E-Governance

> E-Governance is a set of services provided by the government to public via electronic media especially using Internet

- Types(Modes) of E-Governance:
    - Government to Citizen(G2G): License renewal, notices etc.
    - Government to Business(G2B): Registration, tax payment etc.
    - Government to Government(G2G): Interpol interaction, local level coordination etc.
    - Government to Employee(G2E): Online interaction between goverment agencies and government employees.

Mobile Computing

> Mobile computing refers to accessing of computing resourcees using mobile devices like smartphones, tablets, e-readers, wearable devices.

- Advantages: Allows computing from any location with wireless connection.

- Disadvantages: Security threats, needs battery and wireless connection.

- Principles:

    - Portability
    - Connectivity
    - Interactivity
    - Individuality

Internet of things(IOT)

> Internet of things is a system that connects computing devices and objects that have ability to transfer data over a network without requiring human-to-human or human-to-computer interaction.

- Example: Smart home system.

E-Commerce

E-Commerce refers to electronic transactions such as buying, selling and exchanging of goods, services and information over computer network.

Technology used in E-commerce

- E-mail, Fax
- Online catalogues(website)
- Online Payment Gateway
- Online Security Tool etc.

Traditional Commerce vs E-Commerce

- Similarities:

    - Both want to make profit
    - Both deliver product/service
    - Both want to serve large number of customer
    - Both try to deliver quickly

- Difference:

    - E-commerce customer expect shorter fulfilment time.
    - E-commerce customers must know how to use web-based technologies.
    - E-commerce provides a global audience.
    - Orders processing can be automated in E-commerce.

- Eg: Daraz, hamrobazar, pathao foods, sastodeal etc.

Advantage of E-Commerce

- Faster transactions
- No geographical limitation
- Doesn't require physical stores
- Lower operation cost
- Review system

Limitations/Disadvantages of E-Commerce

- Lack of physical inspection
- Not feasible for all products and services
- Security issues of customer information
- Potential scams
- Requires internet access
- Technical failures can result in unpredictable effects

Types/Models of E-Commerce

- **Business-to-Consumer (B2C)**: This model involves transactions between businesses and individual consumers. Examples include online retailers like Amazon, daraz and eBay.

- **Business-to-Business (B2B)**: This model involves transactions between businesses. Examples include companies like Alibaba and AliExpress.

- **Consumer-to-Consumer (C2C)**: This model involves transactions between consumers, usually facilitated by a third-party platform. Examples include eBay, hamrobazar and Craigslist.

> M-Commerce is the extended version of e-commerce which is done through wireless handheld devices such as smartphones.

> Online payment refers to payment for buying goods or services through the Interneet using different online payment gateway.

DataBase Management System

> Data refers to raw facts and figures.

- **Information** refers to processed form of data.

> Database is an organized collection of inter-related data.

- Types of database:
    - Manual database
    - Electronic database

> Database management system is a digital system that allows you to create, modify, process, store, and retrieve information in an organized form.

- Examples of DBMS:

    - Ms-Access
    - MySQL
    - MongoDB etc.

- Features of DBMS:

    - Provides security and integrity
    - Reduces redundancy
    - Organization of large volume of data can be done easily
    - Provides data sharing facility

Components of Database

- **Table**: A table is a collection of rows and columns that builds the database.
- **Record**: A record, or row, consists of information about a single item in the database. A record is also called a tuple.
- **Field**: A field, or column, contains information about a specific attribute for all records.

MS Access

Ms-Access is a relational database management system developed by Microsoft Corporation. (which is distributed along with the Ms Office application package)

Features of Ms-Access:

- Easy to create complex databases
- Data can be analyzed and modified using queries with ease
- Creates elaborate reports from your data
- Makes customized data entry forms
- Presents your data dynamically on the WWW (World Wide Web)

Major objects of Ms-Access

- Tables : Building block of database that holds data in form of row and column.
- Queries : Request to DBMS to access and modify data.
- Forms : Graphical interface to enter and also display information.
- Reports : Presentation of information in desired format.

MS-Access Data type:

Data Type	Description	Max Space
Short Text	Alphanumeric data	255 characters
Long Text	Large amounts of alphanumeric data	Up to 64,000 characters
Number (Byte)	Numeric data	1 byte
Number (Integer)	Numeric data	2 bytes
Number (Long Integer)	Numeric data	4 bytes
Number (Single)	Numeric data	4 bytes
Number (Double)	Numeric data	8 bytes
Date/Time	Dates and times	8 bytes
Currency	Monetary data, stored with 4 decimal places of precision	8 bytes
AutoNumber	Unique value generated by Access for each new record	4 bytes (default)
Yes/No	Boolean data, true/false values	1 bit
OLE Object	Objects (such as Word documents, Excel spreadsheets, pictures, etc.)	Up to about 2 GB

Data Type	Description	Max Space
Hyperlink	Links to other files, including web pages	Up to 2048 characters
Attachment	Files attached to the records	Up to 2 GB
Calculated	Results of a calculation based on other fields in the same table	Dependent on result type
Lookup Wizard	Creates a field that allows you to choose a value from another table or list	Dependent on source type

Field description column can be used to help you remember the use and purpose of a particular field. (Optional)

Field Properties Pane

Field properties pane displays list of properties associated with each field data type.

- It has:
    - Field size
    - Caption: Alternative name given for any field.
    - Default value
    - Format: Allows displaying in different format(g. for date)
    - Input mask: Specifies pattern of data
    - Validation rule: Specifies criteria that data entered into the field must meet.
    - Validation text: The message displayed when data entered does not meet the validation rule.
    - Required
    - Indexed: Speeds up searching

Primary Key

Primary key is the special field or group of field in the table that uniquely identifies each record from the database. Primary keys are unique and not null.

- Importance of primary key:
    - To identify each record uniquely
    - To reduce and control duplication of records
    - To set relationships between tables (foreign key is also required for this)

In Design view, click on field you want to apply primary key to, click on primary key button from tools group in design tab.

Foreign Key

A foreign key is a field (or collection of fields) in one table that uniquely identifies a row of another table. The foreign key establishes a link between the data in the two tables.

- It ensures referential integrity of the data.
- It helps maintain the consistency and accuracy of the data.
- It allows you to create a relationship between tables, enabling complex queries and data analysis.

Views in Ms-Access

- Design view: Related with table structure. You can add, edit, or delete fields and their properties.
- Datasheet view: Related with records. You can add, modify, search or delete records.

You can switch view using view dropdown button from tools group in design tab.

Query

Query is the question or request for the database.

- Types of query:
    - Select Query: Used to select and display relevant information.
    - Action Query: Used to make changes to or remove many records in just one operation.
        - Update Query
        - Delete Query
        - Insertion can be done using SQL statement too.

Forms

Form is Ms-Access database objects that is primarily used to create an interface for entering data in a table or multiple linked tables.

- Form wizard can be used from forms group in create tab.
- The Form Wizard enables you to select the fields from a table or multiple linked tables, layout, and user interface for the form.

Report

Report is Ms-Access database objects used to present information in an effective and organized format that is ready for printing.

- The Report Wizard provides you with more flexibility such as you can choose the tables and fields, group the data, sort the data, summarize the data, choose a layout and orientation, apply a style, and title your report.

Programming

QBASIC

- **Local Variable**: A variable declared within a subroutine or function, accessible only within that block.
- **Global Variable**: A variable declared outside any subroutine or function, accessible throughout the program.
- **Library Function**: Predefined functions provided by QBASIC to perform common tasks.
- **User Defined Function**: Functions created by the user to perform specific tasks.
- **File Handling**: Operations for reading from and writing to files.
- **Modular Programming**: Dividing a program into separate sub-programs or modules.
- **Sub Procedure**: A block of code that performs a specific task, called using the `CALL` statement.
- **Function**: A block of code that performs a specific task and can return a value.

C

- **Definition**: C is a general-purpose, procedural programming language.
- **Keywords**: Reserved words in C that have special meaning, such as `int`, `return`, `if`, etc.
- **Features of C**: Includes simplicity, efficiency, portability, and flexibility.
- **Loops in C**: Constructs like `for`, `while`, and `do-while` used to repeat a block of code.
- **Conditionals in C**: Statements like `if`, `else if`, `else`, and `switch` used for decision making.
- **Elements of C**: Basic components such as variables, data types, operators, and expressions.
- **Format Specifier**: Symbols used in `printf` and `scanf` to specify data types, such as `%d`, `%s`, `%f`.
- **Header File**: Files containing C declarations and macro definitions to be shared between several source files.
- **Why is C Called Structural**: C is called structural because it allows the use of functions and control structures to create a structured and organized codebase.