Tribhuwan University
Institute of Science and Technology
Model Question

Bachelor Level / First Semester / Science — Full marks: 60
Computer Science and Information Technology (CSC109) — Pass marks: 24 ((TU CSIT) Introduction to Information Technology)
Time: 3 hours

Candidates are required to give their answers in their own words as far as practicable. The figures in the margin indicate full marks.

Section A
Attempt any two questions. (2 x 10 = 20)

1. **What is an operating system? Discuss the different functions of the operating system in detail. (2 + 8)**
   An operating system, sometimes known as an OS, is a type of computer software programme that is responsible for managing a computer's resources, including software and hardware. It is the connection point between the physical components of the computer and the software that is used to operate it.

   The following are some of the primary tasks performed by an operating system:

   Management of resources:
   Management of resources: It makes certain that the programmes currently being executed on the computer make efficient and effective use of the resources that are available to them.

   Memory management : it refers to the process in which the operating system is responsible for managing the distribution of memory to various processes and programmes. It also manages virtual memory, which enables a computer to use more memory than it actually possesses by temporarily storing data on the hard drive. This is accomplished through the use of virtualization technology.

   Process management:

   Process management: A programme that is being run by the central processing unit is referred to as a process. The operating system is responsible for selecting which processes should run, determining when those processes should run, and determining how long they should run for.

   Input/output (I/O) management:

   Input/output (I/O) management: Its primary function is to facilitate the transfer of data between these devices and the memory of the computer.

   File Management:

File Management: In addition to this, it regulates who can access which data and ensures that appropriate precautions are taken to prevent illegal access.

Network management:

The operating system is in charge of controlling the communication between the computer and other devices connected to a network. This responsibility falls under the category of "network management." It manages the sending and receiving of data across the network and provides protection against unauthorised access by implementing security measures.

2. **Why do we need a computer network? Discuss different types of network topologies along with their merits and demerits. (3+7)**

A computer network is a group of connected computers and other devices that share resources and send and receive data. There are a few reasons why you might need a computer network:

Sharing resources: A computer network lets users share things like printers, scanners, and devices that store data. This can be more efficient and save money than giving each user their own set of resources.

Data exchange: A computer network lets its users share information and talk to each other. This can help people work together, share files, and share information.

Increased productivity:Productivity can go up with a computer network because it lets users access shared resources and talk to each other more efficiently.

Better security: A computer network can make security better by giving a single point of control over who can use what resources and data. This can help protect against data breaches and access by people who shouldn't be there.

There are different kinds of network topologies, which describe how a network is set up physically.

Bus topology: In a bus topology, all of the devices are connected to a central cable, or bus. This topology is simple and cheap, but it can fail if the cable in the middle gets broken.

Ring topology: In a ring topology, devices are connected in a circle, and data moves around the ring in one direction. This topology is more reliable than a bus topology, but it can be slower because data has to go through each device on the ring.

Star topology: All devices are connected to a central hub in a star topology. This topology is more reliable than a bus topology, but because it needs a central hub, it costs more.

Mesh topology: Each device on the network is connected to every other device on the network in a mesh topology. This topology is the most reliable, but setting it up is the most expensive and difficult.

Hybrid topology: A hybrid topology takes parts of more than one topology, like a star topology and a bus topology, and puts them together. This can take advantage of the good things about different topologies while also fixing their problems.

3. **What are the benefits of storing data using databases? Discuss three levels of database system architecture in detail. (3+7)**

Using databases to store information has several advantages:

Data organisation: Databases make it possible to organise and structure data in a way that makes sense and is consistent. This makes it easier to find and get the information you need when you need it.

Data security: Security measures are often built into databases to prevent unauthorised access and data breaches. This can help make sure that the data is kept private and is correct.

Data integrity: Databases keep data from being entered in the wrong format or in a format that doesn't make sense. This can help make sure that the data is correct and reliable.

Access to data: Databases let multiple users access and retrieve data at the same time. This makes it easier for teams to work together and share information.

Backup and recovery of data: Databases usually have backup and recovery systems to make sure that data can be retrieved in case of a problem or disaster.

There are three levels to the architecture of a database system:

External level: The interface between the database and the users or application programmes that access the database is the external level. It describes how users or application programmes can talk to the database.

Conceptual level: This is the logical view of the database, which shows how the data in the database is structured and put together. It has nothing to do with how the data is physically stored and is the level where users and application programmes talk to the database.

Internal level: The internal level is where the data is physically stored and how the database management system can get to it and change it. It shows how the data is organised physically and how to get to it.

Section B Attempt any eight questions. (8x5=40)

4. **Discuss the characteristics of third-generation of computers. Compare it with the fourth generation.** (3+2)
   In the 1950s and 1960s, the third generation of computers, also called mainframe computers, came on the scene. They had the following things in common:

   Use of transistors: Transistors replaced vacuum tubes as the main electronic part in the third generation of computers. Vacuum tubes were faster, smaller, and more reliable, but transistors were faster, smaller, and more reliable still. This made third-generation computers more powerful and efficient.

   High-level programming languages: High-level programming languages like COBOL and FORTRAN were used in third-generation computers. These languages let programmers write instructions in a way that is easier for humans to understand. This made it easier and faster to write code.

   Centralized data processing: Third-generation computers were made so that multiple users could access the computer through terminals and use it for centralised data processing. This made it easier for users to access and analyse data and made it easier to process data.

   Size and price: Third-generation computers were much bigger and more expensive than the ones that came before them. This made them harder for small businesses and individuals to use.

   In the 1970s and 1980s, microcomputers, which are also called personal computers, became the fourth generation of computers. They had the following things in common:

   Use of microprocessors: Computers of the fourth generation used microprocessors, which are small chips that hold the computer's central processing unit (CPU). This made computers of the fourth generation much smaller and easier to carry around than computers of the third generation.

   Graphical user interface (GUI): Fourth-generation computers were the first ones to have a graphical user interface (GUI), which let people use a mouse and visual icons to interact with the computer. This made it easier and more natural to use a computer.

   Personal computing: The fourth generation of computers were made to be used by one person at a time. A monitor, keyboard, and mouse are used to control the computer. This made computers easier for people to get and cheaper.

5. **Discuss the components of the CPU in brief. (5)**

   The central processing unit (CPU) is the computer's brain. It is in charge of carrying out tasks and executing instructions. It is made up of a number of parts, such as:

Arithmetic and logic unit (ALU): The arithmetic and logic unit (ALU) does math and logic operations like addition, subtraction, and comparison.

Control unit: The control unit gets instructions from memory and decodes them to figure out what operation the CPU should do. Then, it sends the right signals to the ALU and other parts of the CPU so that the instruction can be carried out.

Registers: Registers are small, fast storage units inside the CPU that temporarily store data while it is being processed. There are different kinds of registers, like the instruction register, which stores the current instruction being run, and the general-purpose register, which stores data that can be used for many different things.

Cache: Cache is a type of fast memory that is used to store data and instructions that are often used. It is on the same chip as the CPU and works much faster than the main memory. This makes it easier for the CPU to get to the data it needs.

Bus: A bus is a group of lines that connect the different parts of the CPU and let them talk to each other and to other parts of the computer. There are different kinds of buses, such as the data bus, which carries data, and the address bus, which carries the address of the data being accessed.

6. **What is primary memory? Discuss different types of primary memory. (1+4)**

A type of computer memory that is immediately accessible by the central processing unit is referred to as primary memory. This type of memory is also known as main memory or internal memory (CPU). Its primary function is to serve as a repository for the data and instructions that are being utilised by or processed by the CPU at any given moment.

The following are the two fundamental categories of primary memory:

Random access memory (RAM): Memory with random access, or RAM, is a sort of volatile memory, which means that its contents are wiped out whenever the power is switched off. Its primary function is to serve as a repository for the data and instructions that are currently being processed by the CPU. There are several distinct varieties of random-access memory (RAM), such as dynamic RAM (DRAM) and static RAM (SRAM).

Read-only memory, often known as ROM, is a form of non-volatile memory, which means that the information it stores is preserved even if the power is switched off. It is utilised for the purpose of storing instructions that are either irreversibly or semi-permanently placed into the memory of a device, such as a computer's BIOS. There are several distinct varieties of ROM, the most common of which are programmable ROM (PROM), erasable programmable ROM (EPROM), and electrically erasable programmable ROM (EEPROM) (EEPROM).

The primary memory of a computer consists of both random-access memory (RAM) and read-only memory (ROM). ROM is used to store instructions that are permanently or semi-permanently stored in the memory, whereas RAM is used to store data and instructions that are actively being utilised by the CPU. RAM is used to store data and instructions that are actively being used by the CPU.

7. **Define hard-copy and soft-copy output. Differentiate between impact and non-impact printers with examples. (2+3)**
   Physical copies of data or documents, such as a printed document or a plotter-generated map, are examples of hard-copy output. Hard-copy output is touchable and can be handled, but it cannot be edited easily.

   Soft-copy output refers to electronic copies of data or documents, such as an on-screen file or a PDF file. Soft-copy output is not tangible, but it is easily modifiable and may be electronically stored and shared.

   Impact printers leave a physical impact on the printing medium, such as paper or film. They accomplish this by striking the printing medium with an impact mechanism, such as a hammer or a pin, to generate an image or text. Dot matrix printers and line printers are types of impact printers.

   Non-impact printers are printers that leave no imprint on the printing medium. Instead, they produce an image or text using a non-impact process, such as thermal printing or inkjet printing. Thermal printers, inkjet printers, and laser printers are examples of non-impact printers.

   Impact printers are typically slower and less accurate than non-impact printers, but they are more robust and can print on a larger variety of media. Non-impact printers are faster and more accurate than impact printers, but they are typically less durable and can only print on medium types.
8. **Define IP address with an example. What are the benefits of using a domain name? (2+3)**
   Each device connected to a computer network that uses the Internet Protocol for communication is allocated an IP address. An IP address serves two primary purposes: it identifies the host or device and specifies the host's network location.

   A typical default IP address for a home router is "192.168.1.1", which is an example of an IP address.

   There are numerous advantages to utilising a domain name:

   Domain names are simpler for humans to memorise and type than IP addresses, which consist of lengthy sequences of numbers. This facilitates the accessibility of webpages and other online resources for users.

Domain names can be utilised to establish a distinct and distinctive brand identity for a website or business. This can assist in establishing credibility and enhancing the customer experience.

Search engine optimisation (SEO): Domain names containing keywords relevant to a website's content can boost its ranking in search engine results, hence increasing its traffic and visibility.

Domain names can be used to secure websites with SSL certificates, which encrypt data passed between the user's device and the website. This can aid in preventing cyber assaults and protecting user privacy.

Portability: Domain names can be transferred simply from one hosting provider to another, allowing websites to switch hosting providers without changing their URL. This is important for firms who must switch hosting providers for whatever reason.

9. **What are the characteristics of multimedia? Discuss. (5**)
Multimedia refers to the use of numerous forms of media to convey information or tell a story, such as text, audio, video, photos, and animation. The following are characteristics of multimedia:

Interactivity: Multimedia enables users to engage with the content, for instance by clicking on links or buttons to get further information or by using controls to pause or play music or video.

Engagement: Multimedia is intended to catch and hold consumers' attention, frequently using visual or aural stimuli. This can help maintain user interest in the content.

Versatility: Multimedia can be utilised in numerous contexts, such as education, entertainment, advertising, and more. It is accessible via a variety of platforms, such as PCs, cell phones, and tablets.

Accessibility: Multimedia is accessible to people with varying abilities and preferences, such as those with visual or auditory impairments. Additionally, it can be used to translate content into multiple languages, making it more accessible to an international audience.

Collaboration: Multimedia can be utilised to facilitate user collaboration using video conferencing and online collaboration tools, for example.

The characteristics of multimedia make it a potent tool for conveying information and engaging people in a variety of settings.

10. **Define cryptography. Discuss public key cryptography in detail. (1+4)**
Cryptography is the process of protecting information against unwanted access or modification via the use of codes or algorithms. Cryptography is utilised to safeguard

sensitive data, such as financial transactions, military communications, and personal information.

Public key cryptography is a form of cryptography that encrypts and decrypts communications using a pair of keys, a public key and a private key. The public key encrypts the communication, while the private key decrypts it.

The operation of public-key cryptography is as follows:

A sender produces a pair of keys, consisting of a public and private key. The public key is made available to everyone who wishes to send a message to the sender, whilst the private key is kept confidential.

The sender encrypts the message using the recipient's public key before sending it to the recipient. This produces a message that can only be decoded by the recipient's private key.

The receiver receives the encrypted communication and uses their private key to decode it. No one else has access to the recipient's private key, thus only they can see the message.

The recipient can then reply to the sender using the sender's public key to encrypt their message. This assures that only the sender, who possesses the private key corresponding to the reply, may read it.

Public key cryptography is frequently used to protect internet communications, including email and online transactions. It is regarded to be more secure than other forms of cryptography since it employs two keys instead of one and the keys are never shared. This makes it far more challenging for an adversary to intercept and decrypt the communication.

11. Write short notes on:(2 x 2. 5 = 5)

a. BigData

Big data refers to enormous datasets that cannot be handled and evaluated using conventional data processing tools and methods. These datasets can comprise structured, semi-structured, and unstructured data from many sources, including social media, sensors, and transactional systems.

Big data is difficult to store, handle, and analyse using conventional methods due to its volume, diversity, and velocity. To overcome these obstacles, businesses and organisations utilise big data technologies, such as Hadoop and Spark, to store and process massive amounts of data in distributed systems spanning several computers. These technologies let organisations to handle and analyse large amounts of data rapidly and at scale, enabling them to make better and quicker decisions based on the data's insights.

There are several uses for big data, including marketing, finance, healthcare, and more. By giving insights about customer behaviour, market trends, and other areas

of interest, it may assist businesses and organisations increase efficiency, cut costs, and gain a competitive edge.

b. E-governance

E-governance, also known as electronic governance or digital governance, is the use of information and communication technology (ICT) to enhance the effectiveness, openness, and accountability of government operations and services. It entails the incorporation of ICT into all facets of government, such as policymaking, service delivery, and decision-making.

E-governance may entail the use of internet portals, mobile applications, and other digital platforms to give citizens access to government services and information. It may also entail the use of digital tools and technology to enhance the efficacy and efficiency of government procedures, such as through automating activities and simplifying workflow.

Among the advantages of e-government are:

E-governance enables individuals to access government services and information online, hence decreasing the need to visit government offices in person.

E-governance may enhance the openness and accountability of government operations by providing public access to information and data regarding government decisions and actions.

E-governance may increase the productivity of government procedures by automating jobs and optimising workflow.

By removing the requirement for paper-based operations and lowering the necessity for in-person visits to government offices, e-governance can help governments save money.