KIBABII UNIVERSITY COLLEGE

(A Constituent College of Masinde Muliro University of Science and Technology)

UNIVERSITY EXAMINATIONS
2013/2014 ACADEMIC YEAR

FOR THE CERTIFICATE IN INFORMATION TECHNOLOGY

COURSE CODE: DIT 069 – MARKING SCHEME

COURSE TITLE: DATA COMMUNICATION AND NETWORKS II

DATE: December, 2014   **TIME: 2 Hrs**

INSTRUCTIONS

ANSWER QURSTION **ONE** and **ANY TWO** QUESTIONS

Q1

a) Define the following as used in data communications

i) Networking – *Networking is the technology that facilitates computing devices communicate. It includes the underlying protocols, interlinking gadgets, etc.*

ii) Computer Networks – *A network is a set of devices (often referred to as nodes) connected by communication links that are built using different physical media.*

iii) Multiplexing – *refers to the ability of a number of devices to share a transmission facility*

iv) Compression – *involves squeezing the data down so that a lower-capacity, cheaper transmission facility can be used to meet a given demand.*

(8 Marks)

b) Differentiate between the following

i) LAN and WAN – *The scope of the LAN is small, typically a single building or a cluster of buildings. This difference in geographic scope leads to different technical solutions, as we shall see. It is usually the case that the LAN is owned by the same organization that owns the attached devices. For WANs, this is less often the case,*

or at least a significant fraction of the network assets is not owned. This has two implications. First, care must be taken in the choice of LAN, because there may be a substantial capital investment (compared to dial-up or leased charges for WANs) for both purchase and maintenance. Second, the network management responsibility for a LAN falls solely on the user. The internal data rates of LANs are typically much greater than those of WANs.

ii) UDP and TCP – While TCP provides a reliable connection for the transfer of data between applications, UDP does not guarantee delivery, preservation of sequence, or protection against duplication.

iii) Circuit switching and packet switching. – In a circuit-switching network, a dedicated communications path is established between two stations through the nodes of the network while in packet switching data are sent out in a sequence of small chunks, called packets with each packet passed through the network from node to node along some path leading from source to destination.

iv) Frame relay and ATM – difference between frame relay and ATM is that frame relay uses variable-length packets, called frames, and ATM uses fixed-length packets, called cells.

v) WIFI and WIMax   (10 Marks)

c) Two armies, amisom troops and KDF troops are each poised on opposite hills preparing to attack on an Al Shabaab target in the valley. The Al Shabaab can defeat either of the armies separately but will fail to defeat both armies if they attack simultaneously. The armies communicate via an unreliable communications system (a foot soldier). The commander with the KDF troops would like to attack at midnight. His problem is this: If he sends a message to the Amisom troops ordering the attack, he cannot be sure it will get through. He could ask for acknowledgment, but that might not get through. Is there a protocol that the armies can use to avoid defeat? Explain.

(6 Marks)

Yes. They could easily employ the TCP protocol because that protocol provides a reliable connection for the transfer of data between applications unlike the foot solder use which is equal to using the UDP that has limitations in guaranteeing delivery, preservation of sequence, or protection against duplication

Q2.

Define any four network interlinking devices   (2 Marks)

- Routers   - Hub   - Brouter

- Bridges   - Switch   - Repeater

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Describe any four technologies widely used to implement WANs.   (8 Marks)

Circuit Switching In a circuit-switching network, a dedicated communications path is established between two stations through the nodes of the network. That path is a connected sequence of physical links between nodes. On each link, a logical channel is dedicated to the connection. Data generated by the source station are transmitted along the dedicated path as rapidly as possible. At each node, incoming data are routed or switched to the appropriate outgoing channel without delay. The most common example of circuit switching is the telephone network.

Packet Switching A quite different approach is used in a packet-switching network. In this case, it is not necessary to dedicate transmission capacity along a path through the network. Rather, data are sent out in a sequence of small chunks, called packets. Each packet is passed through the network from node to node along some path leading from source to destination. At each node, the entire packet is received, stored briefly, and then transmitted to the next node. Packet-switching networks are commonly used for terminal-to-computer and computer-to-computer communications.

Frame Relay Packet switching was developed at a time when digital long distance transmission facilities exhibited a relatively high error rate compared to today's facilities. As a result, there is a considerable amount of overhead built into packet-switching schemes to compensate for errors.

Frame relay was developed to take advantage of these high data rates and low error rates. Whereas the original packet-switching networks were designed with a data rate to the end user of about 64 kbps, frame relay networks are designed to operate efficiently at user data rates of up to 2 Mbps. The key to achieving these high data rates is to strip out most of the overhead involved with error control.

ATM Asynchronous transfer mode (ATM), sometimes referred to as cell relay, is a culmination of developments in circuit switching and packet switching. ATM can be viewed as an evolution from frame relay. The most obvious difference between frame relay and ATM is that frame relay uses variable-length packets, called frames, and ATM uses fixed-length packets, called cells. As with frame relay, ATM provides little overhead for error control, depending on the inherent reliability of the transmission system and on higher layers of logic in the end systems to catch and correct errors

Briefly describe any four types of networks   (8 Marks)

Local Area Networks (LAN)

- A LAN is a communications network that interconnects a variety of devices and provides a means for information exchange among those devices. LANS are

usually privately owned. The owning organization usually owns all the attached devices.

- They are widely used to connect Personal computers and workstations in <u>offices</u> to share resources and exchange information

- The management responsibilities of a LAN are carried out solely by the owning organization

- LANs can be distinguished from other kinds of networks by their

  - Size

  - Transmission technology

  - Topology

Metropolitan area networks (MANs)

- A MAN covers a medium-size geographic region (e.g. entire town or city).

- A MAN is larger than a LAN and smaller than a WAN and is constrained to a defined geographical area.

- A MAN may be controlled by an organization, or by a Telecommunications provider or may be a regional resource.

- Best known example of a MAN is the cable television network

- This type of network is based on high bandwidth copper wire and/or fiber optic cabling installed in towns and cities for the transmission of television programming and other services directly to peoples homes over distances of up to 50 kilometers .

- Characteristics

  - Geographical scope

  - Ownership

  - Transmission Technology

Wide Area Networks (WANs)

- A WAN covers a large geographical area (e.g a country or continent).

  - Typically a WAN is a geographically-dispersed collection of LANs.

  - Connects multiple LANs to one another over great geographic distances, the size of a country or continent.

- The type of WAN can be Enterprise wide Private network (leased circuits) or simply use Public carrier networks.

- Most organizations do not build their own WANs by laying cables, building Microwave towers or sending up satellites.

- Instead most organizations lease circuits from Public communication providers and use those to transmit their data.

- They require crossing of public right-of-ways. Hence WANs depend on telecommunication providers for actual data transmission when communicating computers are located in different sites.

- WANs operate using an interconnection of <u>routers</u> which can "choose" the most appropriate path for data to take to reach a network node

Internetworks

- An internetwork is a collection of networks that are interconnected together

- People connected to one type of network often want to communicate with people attached to a different one. This requires incompatible networks to be connected. E.g.

  - LAN and WAN or

  - LAN and LAN

- Internetworking means connecting **different types** of networks that use different technologies such as Ethernet, ATM, FDDI.

- An internetwork is therefore a logical network built around multiple separate physical networks.

- These different networks are connected, sometimes by means of machines called gateways to make connections and provide the necessary translation in terms of both hardware and software

- A common form of internet is a collection of LANs connected by a WAN

  - LAN-WAN-LAN

- The world wide Internet is the most widely used interconnection of networks to which a large number of networks are connected.

- The Internet is an internetwork of widely used networks.

Q3

a) Explain the importance of the network protocol architecture   (4 Marks)

- *The importance of network protocol architecture is to streamline the communication tasks into standardized subroutine tasks that are easy to manage and control between two or more communicating terminals.*

b) With regards to network configurations

    i)   Briefly discuss the two types of Network Configurations   (4 Marks)

- *Peer-to-peer networks are more commonly implemented where less then ten computers are involved and where strict security is not necessary. All computers have the same status, hence the term 'peer', and they communicate with each other on an equal footing. Files, such as word processing or spreadsheet documents, can be shared across the network and all the computers on the network can share devices, such as printers or scanners, which are connected to any one computer.*

- *Client/server networks are more suitable for larger networks. A central computer, or 'server', acts as the storage location for files and applications shared on the network. Usually the server is a higher than average performance computer. The server also controls the network access of the other computers which are referred to as the 'client' computers.*

    ii)   Compare and Contrast between the two types of configurations   (10 Marks)

Peer-to-Peer Networks vs Client/Server Networks	
Peer-to-Peer Networks	*Client/Server Networks*
Easy to set up	*More difficult to set up*
Less expensive to install	*More expensive to install*
Can be implemented on a wide range of operating systems	*A variety of operating systems can be supported on the client computers, but the server needs to run an operating system that supports*

More time consuming to maintain the software being used (as computers must be managed individually)	Less time consuming to maintain the software being used (as most of the maintenance is managed from the server)
Very low levels of security supported or none at all. These can be very cumbersome to set up, depending on the operating system being used	High levels of security are supported, all of which are controlled from the server. Such measures prevent the deletion of essential system files or the changing of settings
Ideal for networks with less than 10 computers	No limit to the number of computers that can be supported by the network
Does not require a server	Requires a server running a server operating system
Demands a moderate level of skill to administer the network	Demands that the network administrator has a high level of IT skills with a good working knowledge of a server operating system

Similarities

– Both are effective network support configurations

– They both require similar communication media

Q4.

a) Describe the key elements of a general communication model   (6 Marks)

- *Source. This device generates the data to be transmitted; examples are telephones and personal computers.*

- *Transmitter: Usually, the data generated by a source system are not transmitted directly in the form in which they were generated. Rather, a transmitter transforms and encodes the information in such a way as to produce electromagnetic signals that can be transmitted across some sort of transmission system. For example, a modem takes a digital bit stream from an attached device such as a personal computer and transforms that bit stream into an analog signal that can be handled by the telephone network.*

- *Transmission system: This can be a single transmission line or a complex network connecting source and destination.*

- *Receiver: The receiver accepts the signal from the transmission system and converts it into a form that can be handled by the destination device. For example, a modem will accept an analog signal coming from a network or transmission line and convert it into a digital bit stream.*

- *Destination: Takes the incoming data from the receiver.*

b) What are the advantages of layering in TCP/IP architecture?   (4 Marks)

- *The importance of Layering is to streamline the communication tasks into standardized subroutine tasks that are easy to manage and control between two or more communicating terminals.*

c) A broadcast network is one in which a transmission from any one attached station is received by all other attached stations over a shared medium. Examples are a bus-topology local area network, such as Ethernet, and a wireless radio network. Explain the need or the lack of a network layer in such a broadcast network.   (5 Marks)

d) Briefly discuss the origin and development of the Internet.   (3 Marks)

Q5.

a) The Ugandan and Tanzanian presidents need to come to an agreement by telephone, but neither speaks the other's language. Further, neither has on hand a translator that can translate to the language of the other. However, both presidents have English and Swahili translators in their ministerial staffs. Draw a diagram to depict the communication situation in the 7-Layer OSI architecture, and describe the interaction and each level.   (14 Marks)

b) Differentiate between the following as used in the TCP protocol suite

    i)   IPV4 and IPV6

    ii)   UDP and TCP   (4 Marks)