

**Instructions:** Answer question ONE and any other TWO questions

**QUESTION ONE (30 MARKS)**

- a) Define the following terms as used in computer networks:
  - i) Bandwidth
  - ii) User Account
  - iii) Frame
  - iv) Bottleneck (4 marks)
- b) Discuss briefly Wide Area Networks and Local Area Networks under the following headings:
  - i) Connectivity devices
  - ii) Data transfer and error rates
  - iii) Ownership (6 marks)
- c) Differentiate between the following:
  - i) Guided and unguided transmission media
  - ii) CSMA/CD and Token passing access methods
  - iii) Half duplex and Full duplex modes.
  - iv) Synchronous and asynchronous transmission

v) Local User Account and Domain User Account (10 marks)

- d) (i) List two key fields of an IP address (2 marks)  
(ii) Describe the key fields listed in d(i) (2 marks)
- e) Distinguish between a network logical topology from the physical topology (2 marks)
- f) List the four layers of the TCP/IP protocol suite (4 marks)

**QUESTION TWO (20 MARKS)**

- a) i) State the functions of a network interface card (NIC)/adaptor card. (4 marks)  
ii) Briefly explain three factors that will influence the choice of NIC for a particular computer. (6 marks)
- b) Briefly explain the contents of a token ring frame (8 marks)
- c) Explain the working of the following protocols as used in networking
  - (i) DNS
  - (ii) ARP (2 marks)

### QUESTION THREE (20 MARKS)

- a) As a network designer you will most likely use the following devices to enhance the performance of your network. Highlight the scenarios where you are likely to use the following devices bringing out clearly the differences between the operations of each. (8 marks)
- i) Switch
  - ii) Router
  - iii) Gateway
  - iv) Repeater
- b) Explain the factors that influence the choice of a network topology (5 marks)
- c) Describe the three classes of IP addresses (6 marks)
- d) Differentiate an Active hub from a Passive hub (1 mark)

### QUESTION FOUR (20 MARKS)

- a) Differentiate between the following
- i) Parallel transmission and Serial transmission
  - ii) Modulation and Demodulation
  - iii) Peer to peer network and Server based network
  - iv) Broadband signaling and Baseband Signaling (8 marks)
- b) With the aid of a sketch explain the operation of a hub-based network topology (3 marks)

- c) Briefly list and explain the three types of unbounded data transfer technologies (3 marks)
- d) Describe the functions of the last three layers of the OSI reference model (6 marks)

### QUESTION FIVE (20 MARKS)

- a) State three factors to put into consideration in selecting Cable type to be used in implementing a network (3 marks)
- b) Show diagrammatically and explain the layers that specify IEEE 802 standards (4 marks)
- c) With the aid of diagrams, explain the following transmissions
- i) Asynchronous
  - ii) Synchronous (4 marks)
- d) Explain three types of Access Methods (6 marks)
- e) Explain three functions of protocols at the sending (source) computer (3 marks)



**INSTRUCTIONS:**

- Answer Question ONE and Any other TWO from Section B.
- Write your registration number on all sheets of the answer book used

**SECTION A****QUESTION 1**

- ✓ a. A network must be able to meet a certain number of criteria. Explain the TWO important factors to be considered (2 marks)
- b. Explain any TWO protocols used in noisy communications channels (4 marks)
- c. Explain the difference between physical and logical topology (4 marks)
- d. Distinguish between the logical link control (LLC) sub-layer and the media access control (MAC) sub-layer of the data link layer (4 marks)
- e. Describe the THREE types of addresses in IPv4 Network (6 marks)
- f. Discuss the differences between distance vector routing and link state routing and give an example protocol for each case (6 marks)
- g. Distinguish between static and dynamic routing (4 marks)

**SECTION B****QUESTION 2**

As a network administrator in Kenyatta University, you have been requested to design and configure network for four departments. You are required to allocate 30, 24, 25 and 12 IP addresses to four departments with minimum wastage.

- a. Compute the range of IP address, broadcast address, network address and subnet mask for each department from address pool 202.77.19.0/24. (12 marks)
- b. Discuss the difference between routed and routing protocol and give examples for each case. (4 marks)



- c. Flag byte with byte stuffing is one of the methods used to make it easy for the receiver to find the start of new frames while using little of the channel bandwidth. Describe how byte-stuffing algorithm operates. (4 marks)

### QUESTION 3

- a. Discuss how the following techniques are used to detect errors in a computer network (8 marks)
- i) Simple Parity check
  - ii) Two-dimensional Parity check
  - iii) Checksum
  - iv) Cyclic redundancy check
- b. Discuss the difference between congestion control and flow control (4 marks)
- c. Describe the operation of the following application layer protocols that provide IP addressing services. (8 marks)
- i) DNS
  - ii) DHCP

### QUESTION 4

- a. Flag byte with byte stuffing is one of the methods used to make it easy for the receiver to find the start of new frames while using little of the channel bandwidth.
- i) The following data fragment occurs in the middle of a data stream for which the byte stuffing algorithm described in the text is used: A B ESC C ESC FLAG FLAG D. Compute the output after stuffing. (4 marks)
  - ii) Explain when maximum overhead in byte-stuffing algorithm occurs. (2 marks)
- b. Explain two advantages and two disadvantages of having international standards for network protocols. (4 marks)
- c. Compare TCP and UDP and give an example where they can be applied (6 marks)
- d. When a file is transferred between two computers, two acknowledgement strategies are possible. In the first one, the file is chopped up into packets, which are individually acknowledged by the receiver, but the file transfer as a whole is not acknowledged. In the second one, the packets are not acknowledged individually, but the entire file is acknowledged when it arrives. Discuss these two approaches. (4 marks)

### QUESTION 5

- a. Explain FOUR advantages of fiber optics over copper as a transmission medium (4 marks)
- b. By using an illustration, compare the OSI reference model and TCP/IP model (8 marks)
- c. Explain the IEEE 802.3 frame format (8 marks)

### QUESTION ONE (30 MARKS)

- a) Define the following terms as used in computer networks:
- i. Bandwidth
  - ii. Bottleneck (2 marks)
- b) Describe the arrangement of wires on:
- i. A straight through cable (4 marks)
  - ii. A crossover cable (4 marks)
- c) Describe the encapsulation and de-capsulation process with the aid of a well labelled diagram. (5 marks)
- d) Distinguish between a network logical topology from the physical topology. (2 marks)
- e) Using a well labelled diagram, describe the components of a frame format. (4 marks)
- f) i Convert the following IP Address 172.168.1.7, to its equivalent binary form. (2 marks)
- ii Explain the class to which the IP Address in f)i) belongs (1 mark)
  - iii Explain the key fields of the IP Address in f)i) (2 marks)
- g) Differentiate between the following terms:
- i Packet switching vs. circuit switching. (2 marks)

- ii Peer to peer network vs. client server network. (2 marks)

### QUESTION TWO (20 MARKS)

- a) Discuss the following protocols (8 marks)
- i. NAT
  - ii. DHCP
  - iii. TCP
  - iv. UDP
- b) Explain four threats to the Machakos University network. Explain **four** counter-measures to the threats. (4 marks)
- c) With the aid of well labelled diagrams, distinguish between the following LAN technologies - Token ring and FDDI. (6 marks)
- d) Describe attenuation and how it can be managed in a network. (2 marks)

### Question Three

**Total – 20 Marks**

- (a) As a network designer, you need to identify and plan for three main domains in a network. List and briefly discuss these domains. **[6 Marks]**
- (b) Availability of a network is a measure that focuses on the usefulness of the network. Explain the issues that affect availability of a network. **[6 Marks]**
- (c) An operating system that provides the connectivity among a number of autonomous computers is called a network operating system. Compare a Windows-based Server OS and UNIX/Linux-based OS in terms of security. **[3 Marks]**



- c) List the **three** types of unbounded data transfer technologies (3 marks)
- d) Describe the **three** methods of transmission of frames within a local network. (6 marks)

### QUESTION FIVE (20 MARKS)

- a) State **two** factors to put into consideration in selecting Cable type to be used in implementing a network (2 marks)
- b) Show diagrammatically and explain the **two** layers that specify IEEE 802 standards (4 marks)
- c) With the aid of diagrams, explain the following transmissions
  - i. Asynchronous and Synchronous (4 marks)
  - ii. Full Duplex and Half Duplex (4 marks)
- d) Explain **three** types of Access Methods in networking (6 marks)



**Question Three****Total – 20 Marks**

- (a) As a network designer, you need to identify and plan for three main domains in a network. List and briefly discuss these domains. **[6 Marks]**
- (b) Availability of a network is a measure that focuses on the usefulness of the network. Explain the issues that affect availability of a network. **[6 Marks]**
- (c) An operating system that provides the connectivity among a number of autonomous computers is called a network operating system. Compare a Windows-based Server OS and UNIX/Linux-based OS in terms of security. **[3 Marks]**
- (d)
  - (i) Define the term convergences used in Computer networks **[1 Mark]**
  - (ii) Converged networks have existed for a while now, but were only feasible in large enterprise organizations. Why? **[4 Marks]**

**Question Four****Total – 20 Marks**

- (a) Explain three functions that CSMA/CD uses in Ethernet **[3 Marks]**
- (b) You are performing network troubleshooting and you notice that there are a high number of FCS errors from a single station. Explain what this indicates **[4 Marks]**
- (c) State any four functions of a Web browser **[4 Marks]**
- (d) List five major components that make up a LAN **[5 Marks]**
- (e) Explain briefly what WANs are designed to do **[4 Marks]**

**Question Five****Total – 20 Marks**

- (a) Which of the following are private IP addresses? 10.1.1.1, 172.32.20.55, 192.167.10.10, 172.25.197.250, 224.6.6.6, 192.168.5.5 **[3 Marks]**
- (b) State the classes to which IP addresses can be grouped and give the ranges for the first octet decimal values. **[5 Marks]**
- (c) Calculate the number of networks that can be found in Class A, Class B and Class C. **[3 Marks]**
- (d) Calculate the number of hosts in each Class A network, Class B network. **[4 Marks]**
- (e) Write the network and broadcast addresses for the IP Address 210.189.137.100 with Subnet Mask – 255.255.255.240 **[2 Marks]**
- (f) State the ranges of private addresses for Class A, Class B and Class C. **[3 Marks]**

## QUESTION ONE [30 MARKS]

- a) Discuss in detail the following concepts as used in hierarchical network designs:
- (i) User community analysis **4 Marks**
  - (ii) Data stores and data server analysis **4 Marks**
- b) A company has considered creating a network for their complex that has just been completed. The building is composed of six floors including the ground floor. You have been tasked to be the designer of this network which will later be connected to the rest of the company network. It is assumed that you will base your design on Ethernet and all the floors will be cabled. It is further assumed that each floor will have approximately 380 computers. On each floor, there will be administrative computers which must be separated from the student computers.
- (i) What four critical goals would inform your network design? **4 Marks**
  - (ii) What is the minimum number of wiring closets you would create for this particular network? **1 Mark**
  - (iii) Where would you place your MDF and why? **3 Marks**
  - (iv) Assuming that the average UTP cable run for each computer is 50 metres. How many reels of UTP cable would you require for wiring the whole building?  
Show your working. **4 Marks**

- c) A wide variety of software and hardware tools are available to make troubleshooting easier. These tools may be used to gather and analyze symptoms of network problems and often provide monitoring and reporting functions that can be used to establish the network baseline. Explain any three of these tools **6 Marks**
- d) (i) Two buildings on the Ruaraka campus of KCA University must be connected to use Ethernet with a bandwidth of at least 100 Mbps. Our main concern is about possible problems from voltage potential differences between the two buildings. Explain which media type should be used for the connection **2 Marks**
- (ii) You are installing IP phones in a new office. The phones and office computers connect to the same device. To ensure maximum throughput for the phone data sessions, the company needs to make sure that the phone traffic is on a different network from that of the office computer data traffic. What is the best network device to which to directly connect the phones and computers and what technology should be implemented on this device? **2 Marks**



## QUESTION TWO [20 MARKS]

- a) Your company has a class C network address of 200.10.57.0. You want to subdivide your physical network into 5 subnets (A, B, C, D and E). You will need at least 20 hosts per subnet. Based on the given information, fill in the table below. **12 Marks**

<i>Subnet Number</i>	<b>Subnet mask</b>	<b>Subnetwork Address</b>	<b>Range of possible IP Addresses</b>	<b>Range of possible Host IP Addresses</b>
<b>2</b>				
<b>3</b>				
<b>4</b>				

- b) Explain how the following diagrams help in troubleshooting a network.
- (i) Physical Network Diagram **4 Marks**
- (ii) Logical Network Diagram **4 Marks**

## QUESTION THREE [20 MARKS]

- a) Describe the procedure you would follow in isolating problems at the physical layer. **6 Marks**
- b) With the aid of a well-labelled diagram, describe in detail the procedure you would follow in laying your cabling between the work areas and the wiring closets. **6 Marks**
- c) To efficiently diagnose and correct network problems, a network engineer needs to know network baseline. This information is captured in documentation. Network documentation include 3 components: Network configuration table, End-system configuration table and Network topology diagram. Discuss briefly the contents of each of these three documents. **6 Marks**
- d) What is port security in relation to switches? **2 Marks**



## QUESTION FOUR [20 MARKS]

- a)
  - (i) What does a switch do if a frame arrives and the destination MAC address is not in its MAC address table? **1 Mark**
  - (ii) What does a switch do with a broadcast frame? **1 Mark**
  - (iii) You replace a hub with a layer 2 switch. How does this affect collision domains? **1 Mark**
  - (iv) You replace a hub with a layer 2 switch. How does this affect broadcast domains? **1 Mark**
  - (v) Why do routers typically add more latency than switches? **2 Marks**
- b) Describe any three rules will help ensure that the structured cabling design projects are both effective and efficient. **6 Marks**
- c) Discuss the three most common causes of network congestion. **6 Marks**
- d) Differentiate between a server-based and client/server network. **2 Marks**

## QUESTION FIVE [20 MARKS]

- a) Briefly describe five factors that must be taken into account when deciding what type of Network Operating System to install on a network. **5 Marks**
- b) What three goals does a security policy meet? **3 Marks**
- c) State any five benefits of a security policy to an organization **5 Marks**
- d) Describe **four** guidelines for creating effective network documentation **4 Marks**
- e) There are three key factors that influence network uptime/availability. State these three factors and illustrate how they affect availability. **3 Marks**

## QUESTION ONE [30 MARKS]

- a) Study the diagram below.



- (i) Based on the diagram shown above, what kind of cable should be used to make each connection that is identified by the numbers shown? Explain **4 Marks**
- (ii) What kind of cable should be used to establish a trunked line between two Catalyst switches? **1 Mark**

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- b) The convergence of the many different communication media onto a single network platform is fueling exponential growth in network capabilities. There are three major trends that are contributing to the future shape of complex information networks. Discuss. **6 Marks**

- c) Discuss the stages involved when gathering symptoms for a network problem.

**5 Marks**

- d) The KCAU corporate LAN consists of one large flat network. You decide to segment this LAN into two separate networks with a router.

- (i) What will be the affect of this change? **2 Marks**
- (ii) If a host on a network has the address 192.168.10.40/28, what is the address of the subnetwork to which this host belongs? **2 Marks**
- (iii) How many hosts per subnet have been created by the addressing scheme above? **2 Marks**

- e) When planning the installation of LAN cabling, there are physical areas to consider. Discuss each of the following areas:

- (i) Work Areas **4 Marks**
- (ii) Telecommunications Room **4 Mark**

### QUESTION THREE [20 MARKS]

- a) Describe any four major benefits associated with hierarchical network designs. **8 Marks**
- b) Explain any **six** ways that network managers can enhance availability and reliability of their networks. **6 Marks**
- c) Explain any three costs that can be attributed to poor cabling **6 Marks**

### QUESTION FOUR [20 MARKS]

- a) Discuss the guidelines for choosing the right troubleshooting methodology. **4 Marks**
- b) Discuss the following in relation to switches:
  - (i) Port security **2 Marks**
  - (ii) Power over Ethernet (PoE) **2 Marks**
  - (iii) Link aggregation **2 Marks**
- c) WANs are groups of LANs connected together with communications links from a service provider. Because the communications links cannot plug directly into the LAN, it is necessary to identify the various pieces of interfacing equipment. Describe the functions of the following WAN devices:
  - (i) Router **2 Marks**
  - (ii) CSU/DSU **2 Marks**
  - (iii) Modem **2 Marks**
  - (iv) Communication server **2 Marks**
- d) Differentiate between cut-through switching and store-and-forward switching. **2 Marks**



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### QUESTION FIVE [20 MARKS]

- a) A network may require an upgrade to one of the faster Ethernet topologies. Most Ethernet networks support speeds of 10 Mbps and 100 Mbps. The new generation of multimedia, imaging, and database products can easily overwhelm a network that operates at traditional Ethernet speeds of 10 and 100 Mbps. Network administrators may choose to provide Gigabit Ethernet from the backbone to the end user. Describe how Ethernet technologies can be used economically in a campus network. **6 Marks**