JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY

SCHOOL OF INFORMATICS AND INNOVATIVE SYSTEMS

DEPARTMENT OF COMPUTER SCIENCE & SOFTWARE ENGINEERING

UNIVERSITY EXAMINATION FOR THE DEGREE OF MASTERS IN INFORMATION SECURITY AND AUDIT

1st YEAR 1st SEMESTER 2024/2025 ACADEMIC YEAR

KISUMU CAMPUS

COURSE CODE: ICM 1103

COURSE TITLE: TCP/IP ARCHITECTURE AND ENTERPRISE NETWORK

EXAM VENUE: STREAM: MASTERS IN INFORMATION SECURITY AND AUDIT

DATE: 24/4/2025 EXAM SESSION: 9.00-12.00

TIME: 3HOURS

INSTRUCTIONS:

Answer QUESTION ONE and ANY other TWO questions

QUESTION ONE (20 Marks)

a) Describe the following concepts as used in TCP/IP:
   i) Segmentation (1 mks)
   ii) Routing (2 mks)
   iii) Address resolution (2 mks)

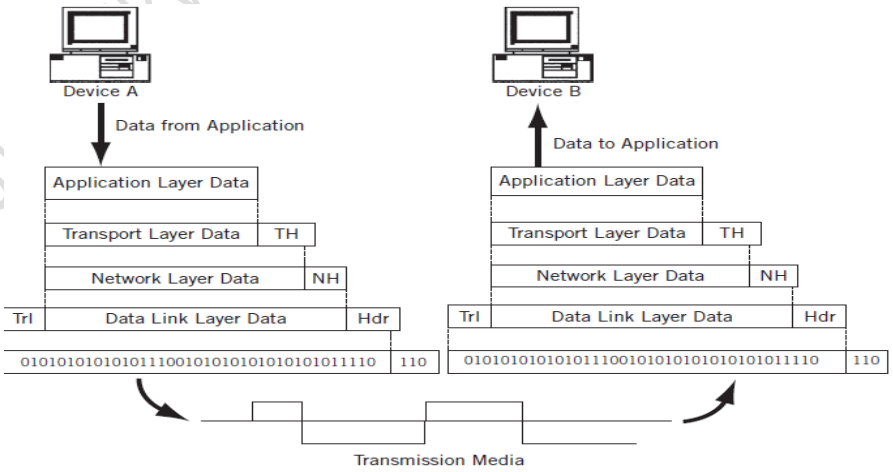
b) It is possible to translate between private and public addresses, using Network Address Translation (NAT). NAT allows a host configured with a private address to be stamped with a public address, thus allowing that host to communicate across the Internet. Discuss the following types of NAT:
   i) Static NAT (2 mks)
   ii) Dynamic NAT (2 mks)
   iii) NAT Overload/Port Address Translation (PAT) (2 mks)

c) A virtual private network (VPN) allows the provisioning of private network services for an organization or organizations over a public or shared infrastructure such as the Internet or service provider backbone network. Discuss the following protocols and technologies used to enable site-to-site VPNs:
   i) IP Security (IPsec) (2 mks)
   ii) Generic Routing Encapsulation (GRE) (2 mks)
   iii) Layer Two Tunneling Protocol version 3 (L2TPv3) (2 mks)

d) Bootstrap Protocol (BOOTP) is used to establish a network connection during a computer's initial boot up during the bootstrap process. Originally, the protocol used floppy disks, but it was soon integrated into computer hardware in motherboards and network adapters, so that no external drive is needed. Briefly describe the operation of BOOTP. (3 mks)

QUESTION TWO (20 Marks)

The diagram below shows TCP/IP encapsulation and headers. The unstructured stream of bits represents frames with distinct content.

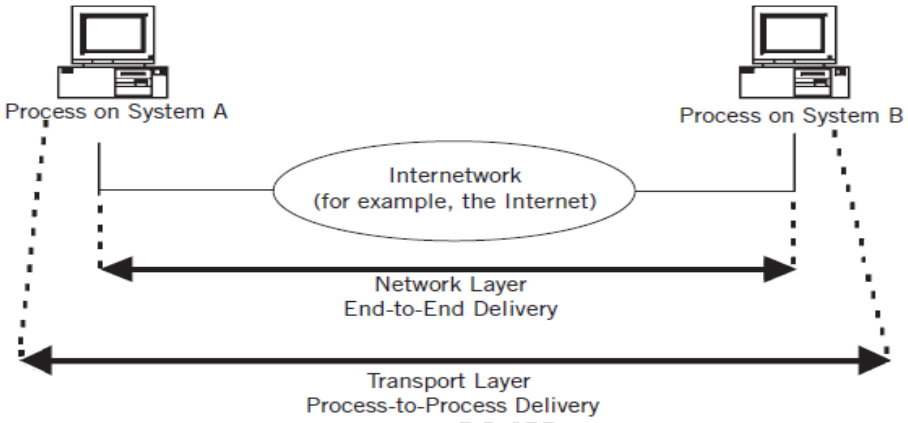


Discuss the roles played by the following layers during the transfer of data from *Device A* towards *Device B.*

i) Physical layer (4 mks)
ii) Data link layer (4 mks)
iii) Network layer (4 mks)
iv) Transport layer (4 mks)
v) Application layer (4 mks)

QUESTION THREE (20 Marks)

Study the diagram below carefully and use it to answer the questions that follow.



In TCP/IP, it is often said that the network layer (IP itself) offers an "unreliable" or "best effort" service, while the transport layer adds "reliability" in the form of flow and error control. Using the diagram above as a reference, describe the following procedures:

i) Connection control (8 mks)

ii) Flow control (6 mks)

iii) Error control (6 mks)

QUESTION FOUR (20 Marks)

Network monitoring is the use of logging and analysis tools to accurately determine trafc fows, utilization, and other performance indicators on a network. Good monitoring tools give you both hard numbers and graphical aggregate representations of the state of the network. This helps you to visualize precisely what is happening, so you know where adjustments may be needed.

a) Discuss other benefits for implementing a good monitoring system for your network (10 mks)

b) Describe some of the tools that can aid you in network monitoring. (10 mks)

QUESTION FIVE (20 Marks)

In order to create IP subnets, host bits are changed to network bits. This is often called borrowing bits. It is also often referred to as taking host bits and giving them to the network. By borrowing host bits, more IP subnets are created, but each subnet can support fewer hosts.

a) Discuss some of the reasons for IP subnetting (10 mks)
b) Describe the steps followed when calculating subnets (10 mks)