

KATHMANDU UNIVERSITY
End Semester Examination
July/August, 2024

Marks Scored:

Level : B.E.
Year : III

Course : ETEG 303
Semester : II

Exam Roll No. :

Time: 30 mins.

F. M. : 10

Registration No.:

Date **05 AUG 2024**

SECTION "A"

[20 Q. × 0.5 = 10 marks]

Choose and encircle in the most appropriate option from each set of choices

- Which of the following standards organizations is known for its role in creating and maintaining standards for the physical and data link layers of the OSI model, particularly those used in local area networks (LANs)?
a. ANSI b. EIA c. IEEE d. ITU
- Model of data transmission in which entire stream of data is synchronized is called _____.
a. Synchronous b. Isochronous c. Asynchronous d. None of these
- Which of the following line coding techniques ensures a transition at the middle of each bit period, which helps in clock recovery and synchronization?
a. NRZ b. Manchester encoding
c. Bipolar encoding d. Return-to-zero
- Which technique is specifically designed to optimize bandwidth utilization by dividing the available bandwidth into discrete frequency bands, allowing multiple signals to be transmitted simultaneously?
a. TDM b. FDM c. STDM d. WDM
- Which network topology is characterized by all nodes being connected to a central hub, and what is a primary disadvantage of this topology?
a. Bus topology; limited scalability b. Star topology; single point of failure
c. Mesh topology; high cost of cabling d. Ring topology; difficult fault isolation
- IP is responsible for _____ communication while TCP is responsible for _____ communication.
a. Node-to-node, Host-to-Host b. Process-to-process, Host-to-Host
c. Socket-to-socket, Host-to-node d. Host-to-Host, Process-to-Process
- In the context of IPv4 addressing, which class of IP address is used for multicast applications and what is its leading bit pattern?
a. Class A; 0 b. Class B; 10 c. Class C; 110 d. Class D; 1110
- What is the maximum size of data that application layer can pass on to the TCP layer below?
a. Any Size b. 2^{16} bytes – the size of the TCP header
c. 2^{16} bytes d. 1500 bytes

9. In the process of encapsulation within the OSI model, which layer is responsible for adding source and destination MAC addresses to the frame header?
- Network Layer
 - Transport Layer
 - Data Link Layer
 - Physical Layer
10. Which of the following protocols is used to map an IP address to a physical machine address that is recognized in the local network, and what type of address does it resolve to?
- Domain Name System (DNS); IP address
 - Address Resolution Protocol (ARP); MAC address
 - Dynamic Host Configuration Protocol (DHCP); IP address
 - Internet Control Message Protocol (ICMP); MAC address
11. Given an IPv4 address of 192.168.1.25 with a subnet mask of 255.255.255.240, what is the subnet address and the broadcast address for this subnet?
- Subnet address: 192.168.1.16, Broadcast address: 192.168.1.31
 - Subnet address: 192.168.1.0, Broadcast address: 192.168.1.15
 - Subnet address: 192.168.1.32, Broadcast address: 192.168.1.47
 - Subnet address: 192.168.1.25, Broadcast address: 192.168.1.30
12. A network has a link with a capacity of 10 Mbps. The average packet size is 1000 bytes and the average arrival rate is 800 packets per second. What is the utilization of the link?
- 0.64
 - 0.80
 - 0.88
 - 0.90
13. A router uses the Distance Vector Routing algorithm and the following are the distance vectors received from its three neighbors A, B, and C for destination D: Distance vector from A: $D(A) = 4$, Distance vector from B: $D(B) = 2$, Distance vector from C: $D(C) = 3$. The costs to reach neighbors A, B, and C from the router are 1, 3, and 2 respectively. What is the minimum cost to reach destination D from the router?
- 4
 - 5
 - 6
 - 7
14. A company has deployed a Virtual LAN (VLAN) across its infrastructure. If a VLAN tag is 4 bytes long and the original Ethernet frame size is 1500 bytes, what will be the new size of the Ethernet frame with the VLAN tag?
- 1496 bytes
 - 1500 bytes
 - 1504 bytes
 - 1518 bytes
15. A star network has 10 nodes connected to a central hub. If the hub fails, how many nodes will be affected?
- 1
 - 5
 - 10
 - All nodes will be affected
16. In a Fiber Distributed Data Interface (FDDI) network, the theoretical maximum data transfer rate is 100 Mbps. If a device on the network is transferring data at 60% of the maximum rate, how much data (in megabytes) can it transfer in 5 minutes?
- 1800 MB
 - 2000 MB
 - 2250 MB
 - 3000 MB
17. In email security, which of the following protocols ensures end-to-end encryption by allowing users to encrypt emails with a public key and decrypt them with a private key?
- SMTP
 - POP3
 - PGP
 - IMAP

18. In classful addressing, what is the maximum number of hosts that can be addressed in a single network segment in a Class C address?
- a. 254 b. 65534 c. 65536 d. 4096
19. Which of the following IP address ranges is reserved for multicast and is not used for standard host addressing in classful addressing?
- a. 128.0.0.0 to 191.255.255.255 b. 224.0.0.0 to 239.255.255.255
c. 192.0.0.0 to 223.255.255.255 d. 240.0.0.0 to 255.255.255.255
20. If a network administrator wants to create subnets with a maximum of 50 hosts each from the network 172.16.0.0/16, what is the minimum subnet mask that will be used?
- a. /24 b. /25 c. /26 d. /27

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SECTION "B"

[4 Q. × 10 = 40 marks]

Attempt *ANY FOUR* questions. Assume any suitable data if necessary. Figures in margin indicate full marks for each question.

1.
 - a. Explain various physical topologies in networks with advantages and disadvantages. [3]
 - b. Distinguish between the communication at the network layer and communication at data link layer. [3]
 - c. Four channels, two with a bit rate of 200 kbps and two with a bit rate of 150 kbps are multiplexed using multiple-slot TDM with no synchronization bits. [4]
 - i. What is the size of the frame in bits?
 - ii. What is the frame rate?
 - iii. What is the duration of the frame?
 - iv. What is the data rate?

2.
 - a. Explain why there is no need for CRC in simple protocol? [2]
 - b. Explain the working principle of STOP and WAIT protocol and draw flow diagram using following scenario. [5]
 - i. Frame first is sent and acknowledged.
 - ii. Frame second is sent and acknowledged, but acknowledgement is lost.
 - iii. The second frame is resent but is timed-out.
 - iv. The second frame is resent and acknowledged.Is there any issue in the above frame timeline exchange, if yes provide answer with reasoning.
 - c. Assume PPP is in authentication phase, show payload exchanged between the nodes if PPP is using [3]
 - i. PAP
 - ii. CHAP

3.
 - a. A pure ALOHA network transmits 200-bit frames on a shared channel of 200kbps. What is the throughput if the system produces [3]
 - i. 1000 frames per second
 - ii. 500 frames per second
 - iii. 250 frames per second
 - b. There is no acknowledgement mechanism in CSMA/CD, but we need this mechanism in CSMA/CA. Explain the reason. What is the purpose of NAV in CSMA/CA? [4]
 - c. What are the parameters needed to measure the network layer performance? Explain. [3]

P.T.O.

4.

- a. An ISP is granted a block of addresses starting with 190.100.0.0/16. The ISP needs to distribute these addresses to three group of customers as follows: [6]
- i. The first group has 64 customers and each need 256 addresses.
 - ii. The second group has 128 customers and each need 64 addresses
 - iii. The third group has 64 customers and each need 32 addresses
- Design the sub blocks and give the slash notation for each sub block. Find out how many addresses are still available after these allocations.
- b. Explain how DHCP can be used when the size of the block assigned to an organization is less than the number of hosts in the organization. [4]

5.

- a. Point out the differences between TCP and UDP protocol. [3]
- b. Compare and contrast a circuit-switched network and a packet-switched network. [4]
- c. List out the characteristics of a line coding technique. [3]