B.E. COMPUTER SCIENCE & ENGINEERING 3RD YEAR 1st SEMESTER EXAM- 2024

COMPUTER NETWORKS

Time: 3 hours | Full Marks: 100

Group A (Total Marks: 10) [CO1]
Answer Question No. 1 OR Question No. 2

1. Ethernet has imposed restrictions on both the minimum and maximum length of a frame. Explain why such restrictions are required. What are the different fields of IEEE 802.3 MAC frame (give a schematic representation of the frame)? Explain their functionalities. What is the difference between a unicast, multicast and broadcast address? If an Ethernet destination address is 05:01:02:03:04:05, what is the type of the address.

4+3+3=10

OR

2. Describe the access method used by wireless LAN (with flowchart or algorithm). Explain the MAC layer frame format used in IEEE 802.11 standard (give a schematic representation). Explain how 802.11 addressing scheme handles the cases when the following subfields of frame control are: (i) To DS=0 and From DS=0 (ii) To DS=0 and From DS=1 (iii) To DS=1 and From DS=0 (iv) To DS=1 and From DS=1.

3+3+4=10

Group B (Total Marks: 30) [CO2]
Answer Question No. 3 OR Question No. 4 AND Question No. 5 (Compulsory)

3. Assume a network using ALOHA channel with an infinite number of users connected shows that 25% of slots are idle. In this network a large number of users generates 45 requests/sec, including both originals and retransmissions. Time is slotted in units of 30 msec. (i) Calculate the channel load, G (ii) Find the throughput, S and (iii) Is the channel underloaded or overloaded? iv) What is the chance of success on the first attempt? v) What is the probability of exactly k collisions and then a success? vi) What is the expected number of transmission attempts needed? vii) Justify that approx 25% of slots are idle. viii) Why does the vulnerable time in ALOHA depend on the average time required to send out a frame and CSMA depends on the maximum propagation time?

2+2+2+2+2+2+1+2=15

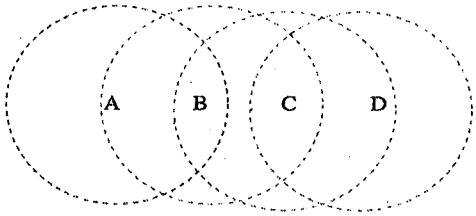
OR

4. Consider a 2-km long, 20 Mbps CSMA/CD LAN has a propagation speed of 200 m/μsec. Data frames are 256 bits long, including 32 bits of header, checksum and other overhead. The link parameter is defined as the ratio of Propagation Time and Frame Time. The first slot after successful transmission is reserved for the receiver to capture the channel in order to send a 32-bit acknowledgement frame. Before transmission of data/acknowledgement frame, the sender has to capture the channel. For capturing the channel, stations use dummy frames.

i) What is the transmission time? ii) What is the inter-frame gap here? iii) Calculate the link parameter. iv) What is the maximum possible utilization? v) What should be the slot time here? vi) What is the effective data rate for the transmission of one data frame, excluding the overhead, assuming that there are no collisions. vii) How propagation delay is linked with collisions? viii) How is the link parameter important for effective CSMA LAN?

2+2+2+2+1+2+2+2=15

5. A) Consider the following topology of wireless laptops A, B, C and D. The dotted lines indicate the range of wireless transmissions from each node. For example, B is within range of A, A & C are within range of B, B & D are within range of C and only C is within range of D. Assume that each node uses an RTS/CTS based MAC protocol



Explain your answers of the following questions with an interaction diagram showing exchange of packets.

i) If C sends B an RTS, why does A know not to transmit?
ii) If B is sending data to C, why does D know not to transmit?
iii) Using the nodes above, give an example of the exposed terminal problem.
iv) List the hidden and exposed stations for the following transmissions: (a) A→B (b) B→A and (c) D→C

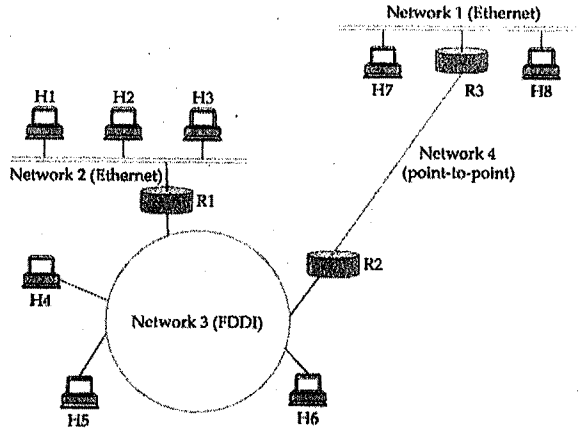
B) Suppose you want to develop a walkie-talkie service to enhance the security and monitoring of the university campus.

i) What should be the choice of protocols in MAC, Network, Transport and Application layers of the network stack. Justify your choice by explaining the main feature of that protocol in respect to the said application.
ii) What measures will you take to avoid delay and improve efficiency?
iii) Should you use RTS/CTS for this application? Justify your answer with suitable examples and schematic diagrams.

(2+2+2+2)+(3+2+2)=15

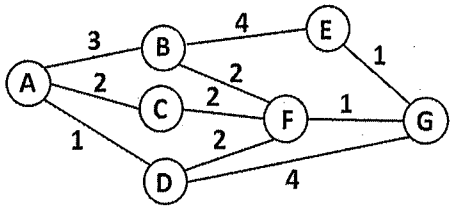
Group C (Total Marks: 30) [CO3]
Answer Question No. 6 (Compulsory) and Question No. 7 OR Question No. 8

6. Consider the following heterogeneous networking environment. Assume that the IP header is 20 bytes long. The MTU of Ethernet is 1500 bytes. Note the relation of MTU of PPP < MTU of Ethernet < MTU of FDDI. Suppose H1 sends an eBook of size 4.7 kB to H8.
i) What are the MTUs of Ethernet, FDDI and PPP (Point-to-Point)? ii) Which fields in the IP header are involved in fragmentation? Explain with a schematic diagram of IP header format. iii) How many times has fragmentation done and where in this case? iv) Where is reassembly done in this case? v) Determine the length of fragments in R1, R2 and R3. vi) What are fragment offset values for divided packets in these routers? Show the calculation and schematic diagram(s) for (v) and (vi).



2+2+2+1+4+4=15

7. Consider a network as shown in the figure below. A, B, C, D, E, F and G are the nodes. Link costs are provided along the edges. Explain the Link State Routing protocol with this example network. Contrast and compare link state routing with distance vector routing. Discuss the instability issue of distance vector routing. What strategies can be used to solve the two-node and three node loop instability issues?



7+4+4=15

OR

8. Why is dynamic address configuration required? Explain how DHCP dynamically assigns IP addresses with suitable interaction diagrams. Explain different error reporting messages of ICMP. Why is the IGMP message encapsulated in an IP datagram?
2+7+4+2=15

Group D (Total Marks: 30) [CO4 and CO5]
Answer Question No. 9 OR Question No 10 and Question No 11 OR Question No. 12

9. A) How are sending and receiving buffers used in stream delivery service by TCP? Explain with a suitable example and schematic diagram.
B) Suppose, a TCP header consists of 160 bits.
Equivalent Hexadecimal number of first 80 bits: 15006E000000090000
Equivalent Octal of remaining bits: 20500020157740000000000

Find the value and meaning of the following attributes: i) Window size and Header length ii) Control flags and Urgent pointers iii) Source port and Destination port iv) Source process and Destination process v) Acknowledgement number and Sequence number vi) Segment type vii) Calculate the Checksum. viii) If the application protocol is DNS at the source then what will be the modified header? ix) Considering that an IP packet can have a maximum total length of 65 535 bytes, what is the maximum length of the data in a TCP segment? x) Calculate the efficiency of this transmission at the TCP level if the data are 32 bytes.

5+10=15

OR

10. A) How are ports implemented in UDP? Explain the background processes for port unreachable messages in this context.
B) Suppose, a UDP header consists of 64 bits. If we consider that 64-bit header as a binary number and convert it to its octal equivalent, then we get the following octal value.
1457260006701ab72cdefg

Here, a, b, c, d, e, f and g denote the missing octal digits. Length of the data part is 0D74 in Hexadecimal. Suppose, the sender chooses to calculate the checksum. Find the following attributes: i) Total length of the UDP ii) Length of the data iii) Source port and application process iv) Destination port and application process v) Value of a, b, c, d, e, f and g vi) Calculate the checksum vii) Is the packet directed from a application server process to a client process? Justify viii) If the protocol is DNS, what will be the modified header? ix) Considering that an IP packet can have a maximum total length of 65 535 bytes, what is the maximum length of the data in a UDP datagram? x) Calculate the efficiency of this transmission at the UDP level if the data are 16 bytes.

5+10=15

11. Explain different techniques of name-address resolution. DNS can use either UDP or TCP. Explain when to use UDP and when to employ TCP in DNS. Write the pseudo code for DNS implementation using Socket so that it can justify your explanation.

3+2+10=15

OR

12. What are the different interpretations about the structure of the data used to transfer a file across the data connection of FTP? What are the different FTP transmission modes? Explain. How are control and data characters distinguished in NVT? What is the difference between local and remote login in TELNET? Explain the architecture of e-mail in respect to SMTP, POP3 and IMAP4 and HTTP.

3+2+2+3+5=15