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Final Assessment Test (FAT) - May 2024

Programme	B.Tech.	Semester	WINTER SEMESTER 2023 - 24
Course Title	COMPUTER COMMUNICATIONS AND NETWORKS	Course Code	BECE401L
Faculty Name	Prof. Nitish Katal	Slot	D1+TD1
		Class Nbr	CH2023240502631
Time	3 Hours	Max. Marks	100

General Instructions:

- Write only Register Number in the Question Paper where space is provided (right-side at the top) & do not write any other details.

Section - I
Answer all questions (2 X 5 Marks = 10 Marks)

01. TCP opens a connection using an Initial Sequence Number (ISN) of 10,001. The other party opened the connection with an ISN of 7,001. Illustrate the TCP handshakes between the two parties during the connection establishment. **[5]**

02. Imagine a scenario where a user wants to visit a website with the domain name 'www.compnetwork.com'. **[5]**
(i) Can you explain the process of how the Domain Name System (DNS) would resolve this domain name into an IP address? [3]
(ii) What would happen if the DNS server initially contacted does not have the IP address for 'www.compnetwork.com' in its records? [2]

Section - II
Answer all questions (9 X 10 Marks = 90 Marks)

03. (a) Analyze the connection and transmission mechanisms of the network topology given in Fig.1 and hence answer the following questions. **[10]**
(i) Compare and contrast the characteristics of different line configurations and hence categorize the topologies in the Fig.1. based on their line configuration. [2]
(ii) Explain the transmission mechanism of the given topology when Node 2 transfers data to Node 3. [2]
(iii) In an organization, if there is a frequent addition and deletion of devices, which topology would you prefer in that case? Justify your answer. [2]
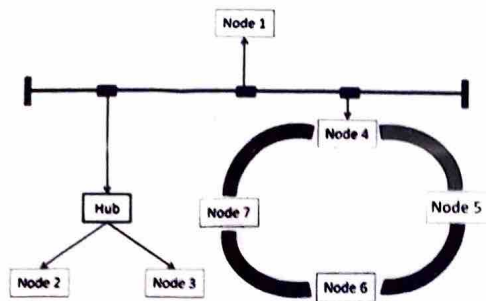
Fig. 1

(b) Discuss the features of the different switching techniques in terms of their communication delay and hence suggest a suitable switching method for data communication in disaster prevention applications. [4]

04. Fig.2 shows a LAN topology with transparent bridges to interconnect different LAN segments. **[10]** Initially, all forwarding tables are empty. The following sequence of events occurred: at first, user C attached to LAN 2 sends frame 1 to user E in LAN 3; then user A in LAN 1 sends frame 2 to user C in LAN 2; then user D in LAN 3 sends frame 3 to user C in LAN 2; finally, user B sends frame 4 to user A. Show the forwarding tables at all bridges, respectively. [8+2]
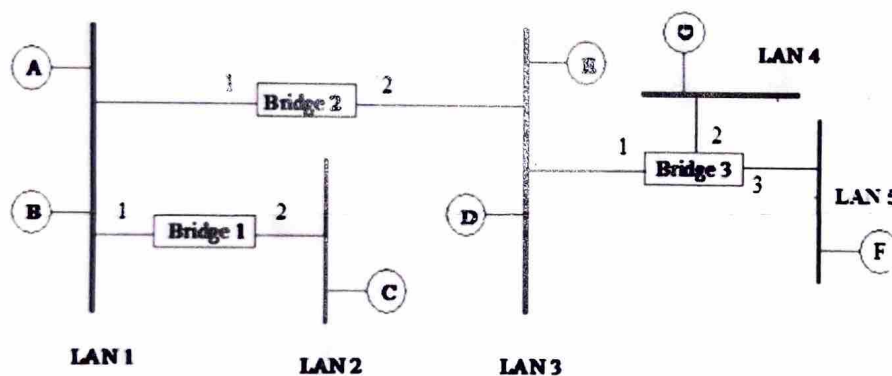

Fig. 2

05. (a) Using 5-bit sequence numbers, what is the maximum size of the send and receive windows **[10]** for each of the following protocols?
(i) Stop-and-Wait
(ii) Go-Back-N
(iii) Selective-Repeat
[1+2+2]

(b) A sender sends a series of packets to the same destination using 5-bit sequence numbers. If the sequence numbers start with 0, what is the sequence number of the 100th packet? [3]
(c) In the Stop-and-Wait protocol, show the case in which the receiver receives a duplicate packet (which is also out of order). What is the reaction of the receiver to this event? [2]

06. System-X wants to send a 24 bit data block 10101111 10000111 11010101 to System-Y and **[10]** System-X splits the data blocks into 3 segments and each segment consists of 8 bits. Find the checksum and give a comment on the received data sequence 10111111 10000111 11010101.
[6+4]

07. In a bus network there are two stations A and B that use 1-persistent CSMA/CD MAC protocol **[10]** and want to transmit frames to each other. What would happen for the following three cases ?

(i) Both stations start sending frames to each other at the same time. If the propagation delay T_p = 100 μs in the bus and frame transmission time T_{fr} = 240 μs, Will the frame send by Station A and Station B collide? Justify [3]

(ii) Will Station A and Station B detect Collision? Justify. [3]

(iii) If Station A and Station B try to retransmit frames, what happens in the Best case and Worst case? Also, draw a time-line diagram to prove your claim and ignore any other delay including sending jamming signal. [4]

08. Given a classless IPv4 Block **11.10.10.0/23**. Design and apply subnetting scheme for the topology shown in Fig 3. You must subnet the block as specified in Table 1 since each LAN or WAN requires enough IP addresses to support the number of hosts. [10]
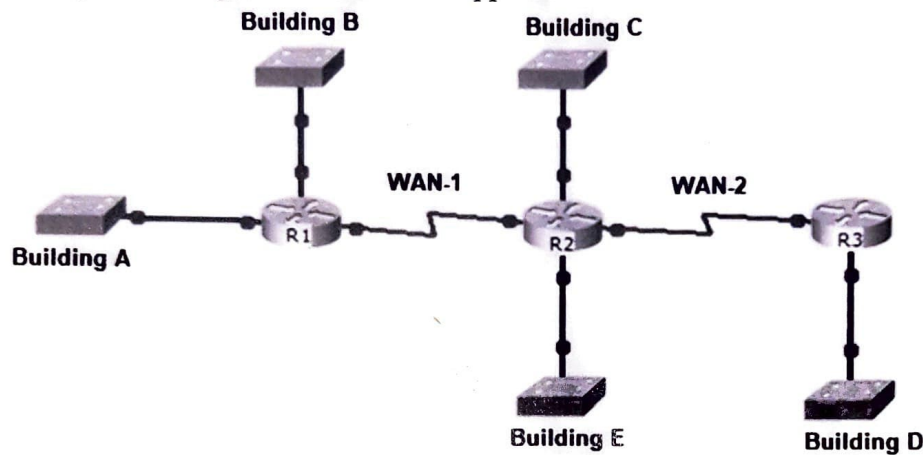

Fig. 3

Table 1 : Requirement of Number of Address

Building	Number of Addresses
Building A	100
Building B	100
Building C	100
Building D	50
Building E	30
WAN-1	2
WAN-2	2

Present the solutions in the form of table showing each subnet block, the subnet prefix, the range of addresses in that subnet block and the number of addresses wasted in that subnet block. [8+2]

09. Apply suitable algorithm to find the shortest path tree for the following graph with link costs shown in Fig 4. (Let the Root Node for this computation be A) [2+8] [10]
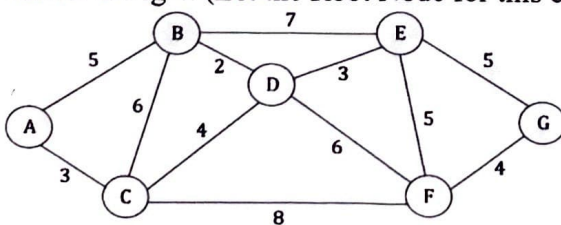

Fig. 4

10. Discuss the significance of a connection-oriented protocol that uses flow control and error control mechanisms at the transport level. Illustrate the three phases of the TCP congestion control process by drawing the cwnd (congestion window) graph and discuss the congestion avoidance measures. [4+4+2] [10]

11. Suppose you're working as a cybersecurity consultant. You're testing the RSA cryptosystem of a client. The system uses two prime numbers, 3 and 11, to generate the private key, which is 7. You're given a plaintext message of 5. Determine the cipher text and describe the RSA encryption process. [5+5] [10]

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