Reg. No: 22 BCE2786

Final Assessment Test – November 2024

VIT
Vellore Institute of Technology

Course: BCSE308L - Computer Networks
Class NBR(s): 1967/1974/1977/1979/1983/1985/1987/
1990/1993/1995/1997/2000/2003/2007/2010/2012/
2014/2017/2020/2022/2026/4742

Slot: D1+TD1

Time: Three Hours   Max. Marks: 100

➢ KEEPING MOBILE PHONE/ELECTRONIC GADGETS, EVEN IN 'OFF' POSITION IS TREATED AS EXAM MALPRACTICE
DON'T WRITE ANYTHING ON THE QUESTION PAPER

Answer ALL Questions
(10 X 10 = 100 Marks)

1. a) In a university campus, there are three departments and each department   [8]
    is going to establish a computer lab. The requirements of each lab are listed
    below. Your task is to suggest the topology and give justification for
    selecting the topology in the view of cost-effectiveness, reliability and
    accessibility. Also discuss the challenges present in the topology.

    Department 1: Totally 50 computers have to be connected. Each computer
    is connected to two others, forming a closed loop. Data has to travel in one
    direction.

    Department 2: The lab is situated in a narrow room space, so the network
    setup has to be with a single central cable running along the length of the
    lab, with each student's workstation connected to this cable via a short
    cable.

    Department 3: This is a research project lab with high end computers and
    printer, the data are so precious. So, if one device fails or a cable is
    damaged, the rest of the network should remain unaffected, ensuring
    uninterrupted service for other users. The financial implications are not a
    primary concern in this decision-making process.

    b) Discuss the need for protocols and standards.   [2]

2. a) Stored on a flash memory device is a 200 megabyte (MB) message to be
    transmitted by an e-mail from one server to another, passing three nodes of
    a connectionless network. This network forces packets to be of size 10KB,
    excluding a packet header of 40 bytes. Nodes are 400 miles apart, and servers
    are 50 miles away from their corresponding nodes. All transmission links are
    of type 100Mb/s. The processing time at each node is 0.2 seconds.

    i. Find the propagation delays per packet between a server and a node and   [3]
       between nodes.

    ii. Find the total time required to send this message.   [3]

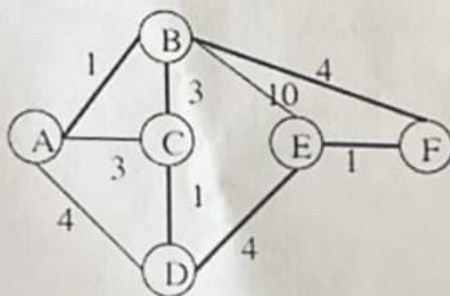   b) Compare and contrast Circuit switching and Packet Switching.   [4]

3. Distinguish between CSMA/CD and CSMA/CA. With flowchart elucidate the working scenario of CSMA/CA and Pure ALOHA. [10]

4. A midsized organization is granted with 190.168.0.0/16, design a subnetting scheme that supports 8 subnets, with each subnet capable of supporting up to 400 hosts.

   a) What is the subnet mask? [3]
   b) What is the range of valid host address (Usable address), network address, and broadcast address in each subnet? [4]
   c) What is the total number of usable IP addresses in this scheme? [3]

5. a) Illustrate the differences between IPv4 and IPv6 protocols header. [6]
   b) What is NAT? What are the situations where Network Address Translations is required? [4]

6. a) Examine the network diagram provided. Demonstrate the process of the Distance Vector Routing algorithm to determine the minimum cost paths from Node F (located at the far right of the diagram) to all other nodes. Also explicitly list all the shortest path routes from F to all destinations that are the result of the algorithm's computation. Illustrate each step of the process using diagrams. [7]

   b) How the count to infinity problem is solved in Distance Vector Routing? What are limitations in this? [3]

7. Explain the congestion control techniques used to improve QoS of the computer network. [10]

8. a) List out the types of DNS messages. With a neat frame format enumerate DNS messages with its header. [5]
   b) Name the categories of HTTP header. Write short notes on each header with its descriptions. [5]

9.a) Suppose we want to transmit the message 1011 0010 0100 1011 and protect it from errors using the CRC polynomial $x^8 + x^2 + x^1 + 1$.

   i. Use polynomial long division to determine the message that should be transmitted. **[5]**

   ii. Suppose the leftmost bit of the message is inverted due to noise on the transmission link. What is the result of the receiver's CRC calculation? How does the receiver know that an error has occurred? **[5]**

OR

9.b) Two hosts are in a CSMA/CD network and the medium has a data transfer capacity of 1Gbps. The minimum frame length is fixed to 1,000 bits and the propagation speed is 2×10^8 m/s.

   i) What will be the distance between the hosts? **[4]**

   ii) If it is an Ethernet network, what is the efficiency when the hosts have a maximum distance between them? If the distance is reduced to 1 m, does it impact the efficiency? **[6]**

10.a) After you finish the router prototype, you need to test it with different packet switching technologies, which may have different MTU. In a test, your router has 3 links with MTU as below:

Link	MTU(in bytes)
1	60
2	420
3	1000

   i) The router receives a 600-byte IPv4 packet from link 3, and it needs to send it to link 2. What will happen? Which header fields need to be updated? **[3]**

   ii) If the 600-byte IPv4 packet from link 3 has 20 bytes header, at least how many packets need to be sent over link 2? Write down the value of total length, flag and fragmentation offset fields of each outgoing packet. **[4]**

   iii) The router receives 20 fragmented packets from link 1, and needs to send them to link 3. How many packets will be sent over link 3? **[3]**

OR

10.b) Use link state routing algorithm to find the shortest path from node E to all the other nodes and show the forwarding table at node E. Analyse the challenges in link state routing. **[10]**

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