DCCN - SAMPLE PROBLEMS

MODULE I

1. What are the propagation time and the transmission time for a 2.5-kbyte message (an e-mail) if the bandwidth of the network is 1 Gbps? Assume that the distance between the sender and the receiver is 12,000 km and that light travels at 2.4×10^8 m/s.

2. In a digital transmission, the receiver clock is 0.1 percent faster than the sender clock. How many extra bits per second does the receiver receive if the data rate is 1 kbps and 1Mbps?

3. Find the Minimum Hamming distance between pair of words :
   d(000, 011) , d(10101, 11110) and d(11011 , 01001)

4. In the Hamming code, for a data unit of m, justify how you compute the code. Assume the data taken is 1001101.

5. Suppose the message 1001 1100 1010 0011 is transmitted using checksum (4 bit word). Compute the value of the checksum and check whether the message is accepted by the receiver or not.

6. The message 1101011011 is to be transmitted using CRC error detection algorithm. Assuming the CRC polynomial to be $x^4 + x + 1$, determine the message that should be transmitted.

MODULE II

7. Find the class of each address.

   a. 00000001 00001011 00001011 11101111
   b. 0100001 10000011 00011011 11111111
   c. 14.23.120.8
   d. 227.2.15.3.

   Also, Find the number of network address and host address (OR) How many bits are allocated for network id (NID) and host id(HID).

8. A block of addresses is granted to a small organization. We know that one of the addresses is 205.16.37.39/28. What is the first address , last address in the block and calculate the total number of addresses?

9. With reference to question no. 8, IP address 205.16.37.39/28 can be represented as : 11111111 11111111 11111111 11110000 (twenty-eight 1s and four 0s). Find :
   a. The first address
   b. The last address and
   c. The number of addresses.

10. Convert IP address whose hexa decimal representation is C22F1582 to dotted decimal notation. Find the class of IP address.

11. Expand the address 0:15::1:12:1213 to its original.

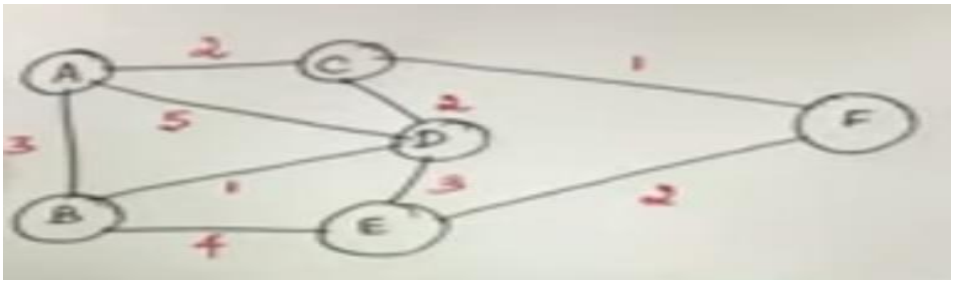
12. An ISP is granted a block of addresses starting with 190.100.0.0/16 (65,536 addresses). The ISP needs to distribute these addresses to three groups of customers as follows:
    a. The first group has 64 customers; each needs 256 addresses.
    b. The second group has 128 customers; each needs 128 addresses.
    c. The third group has 128 customers; each needs 64 addresses.

    Design the sub-blocks and find out how many addresses are still available after these allocations.

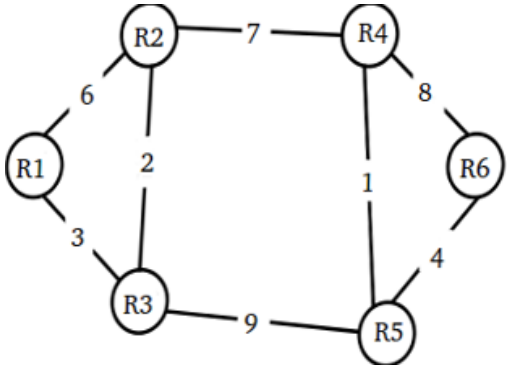
13. A slotted ALOHA network transmits 200-bit frames on a shared channel of 200 kbps. What is the throughput if the system (all stations together) produces?

    a. 1000 frames per second b. 500 frames per second c. 250 frames per second.

14. Find the shortest path from source node 'A' to all other nodes in the given network using OSPF protocol (Link state routing)



15. Consider a network with 6 routers R1 to R6 connected with links having weights as shown in the following diagram.



All the routers use the distance vector based routing algorithm (RIP Protocol) to update their routing tables. Each router starts with its routing table initialized to contain an entry for each neighbor with the weight of the respective connecting link. After all the routing tables stabilize, how many links in the network will never be used for carrying any data?

MODULE III

16. Consider the effect of using slow start on a line with a 10 msec RTT and no congestion. The receiver window is 24 KB and the maximum segment size (MSS) is 2 KB. How long does it take before the first full window can be sent?

Solution

Given-

Receiver window size = 24 KB
Maximum Segment Size(MSS) = 2 KB
RTT = 10 msec

Receiver Window Size-

Receiver window size in terms of MSS

= Receiver window size / Size of MSS

= 24 KB / 2 KB

= 12 MSS

Slow Start Threshold-

Slow start Threshold

= Receiver window size / 2

= 12 MSS / 2

= 6 MSS

Slow Start Phase- In TCP Slow start congestion control, initially the rate of transmission is 1MSS. Then doubled for every RTT and done by incrementing for every ACK received until threshold is reached.

Window size at the start of 1st transmission = 1 MSS
Window size at the start of 2nd transmission = 2 MSS
Window size at the start of 3rd transmission = 4 MSS
Window size at the start of 4th transmission = 6 MSS

Since the threshold is reached, so it marks the end of slow start phase.

Now, congestion avoidance phase begins.

Congestion Avoidance Phase- After reaching the threshold, rate of transmission is cut sending rate in half at each loss event ie. 2MSS/2 = 1MSS,

Window size at the start of 5th transmission = 7 MSS
Window size at the start of 6th transmission = 8 MSS
Window size at the start of 7th transmission = 9 MSS
Window size at the start of 8th transmission = 10 MSS
Window size at the start of 9th transmission = 11 MSS
Window size at the start of 10th transmission = 12 MSS

From here,

Window size at the end of 9th transmission or at the start of 10th transmission is 12 MSS.
Thus, 9 RTT's will be taken before the first full window can be sent.

So,

Time taken before the first full window is sent

= 9 RTT's

= 9 x 10 ms

= 90 ms