

7. (a) Design various subnetworks for the following private class C network (192.168.12.0).

Subnet A	30 hosts
Subnet B	45 hosts
Subnet C	28 hosts

In particular show the subnet mask, starting and ending addresses for each subnet preferably in a table form.

- (b) Why is Longest Prefix matching required in CIDR? How can the address "193.16.12.0" be shared by more than 255 hosts (say 400 hosts) in CIDR?
- (c) Explain why the destination field generally precedes the source field in Link layer but generally the opposite is true for Network layer.

$$5 + 4 + 3 = 12$$

Group - E

8. (a) Write down the differences between UDP and TCP.
- (b) A computer on a 10Mbps network is regulated by a token bucket. The token bucket is filled at a rate of 2Mbps. It is initially filled to capacity with 16 Mega bits. What is the maximum duration for which the computer can transmit at the full 10Mbps?
- (c) Define congestion. What is the difference between flow control and congestion control?
- (d) A TCP connection has Threshold set to 32 KB. The congestion window starts from the initial size of 1 KB. Describe the behaviour of the congestion window under the following conditions: (you may draw a suitable graph to explain your answer).
- (i) Time out occurs at the 8th transmission
- (ii) After that 4 more transmissions are performed.
- $$3 + 3 + (1.5 + 1.5) + (1.5 + 1.5) = 12$$
9. (a) What attributes can be used to describe a flow of data? What are the four general techniques to improve QoS?
- (b) Explain with diagram how TCP establish connection using three way handshaking.
- (c) What is the hidden station problem in Wireless LAN?
- (d) Explain token bucket algorithm.

$$(2 + 2) + 3 + 2 + 3 = 12$$

COMPUTER NETWORKS (CSEN 3201)

Time Allotted : 3 hrs

Full Marks : 70

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.

Candidates are required to give answer in their own words as far as practicable.

Group - A (Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1 = 10**
- (i) Which routing algorithm requires more traffic between routers for set up and updating?
 (a) Distance vector (b) Link State
 (c) Dijkstra (d) Vector link.
- (ii) Which of the following protocols use TCP as the transport layer protocol?
 (a) HTTP (b) DNS (c) SMTP (d) TELNET.
- (iii) The maximum frame length of an Ethernet frame is ___ bytes and minimum frame length is ___ bytes.
 (a) 1500, 128 (b) 1500, 64 (c) 4500, 64 (d) Infinity, 64.
- (iv) There are 4 voltage levels and 4 phases in a modem transmission. The bandwidth of the channel is 8 KHz. What is the maximum data rate supported in the channel?
 (a) 64 Kbps (b) 256 Kbps (c) 16 Kbps (d) None of the above.
- (v) Which transmission is highly susceptible to noise interference?
 (a) ASK (b) FSK (c) PSK (d) QAM.
- (vi) State which of the following is correct: [More than one choice could be correct, you will get marks only when you mark all correct answers]
 (a) The Bandwidth requirement of a baseband transmission is reduced in broadband transmission.
 (b) Data rate of a channel can be manipulated by changing the number of signal levels present in the channel.
 (c) Packet switching has the advantage of pipelining as compared to message switching.
 (d) All the above.

(vii) A small organization is given a block of addresses and one of the addresses is 167.199.170.82/27 (in slash notation). What is the network address of the block?

- (a) 167.199.170.64 (b) 167.199.170.0
(c) 167.199.0.64 (d) 167.199.0.0.

(viii) Which channel access method is used in Ethernet networks?

- (a) Pure ALOHA (b) CSMA/CD
(c) CSMA/CA (d) Slotted ALOHA.

(ix) In CSMA/CD the minimum size of the frame is:

- (a) $2 \times \text{propagation time} \times \text{bandwidth}$
(b) $\text{Transmission time} \times \text{bandwidth}$
(c) $2 \times \text{transmission time} \times \text{bandwidth}$
(d) $2 \times \text{propagation time}$.

(x) In the slow start phase of the TCP congestion control algorithm, the size of the congestion window

- (a) does not increase (b) increases linearly
(c) increases quadratically (d) increases exponentially.

Group - B

2. (a) What is PCM (Pulse Coded Modulation)?
(b) Consider a channel with bandwidth 1 MHz and SNR 63. What is the maximum data rate supported by this channel? If the channel is noiseless and the above data rate has to be supported, how many signal levels are needed?
(c) What is the difference between a hub and a switch?
(d) What is the main strategy followed behind designing high speed modems?

$$2 + (2 + 2) + 3 + 3 = 12$$

3. (a) Prove that $2^r \geq m + r + 1$, where m is the no. of data bits and r is the no. of redundancy bits required to correct the single bit error using Hamming code.
(b) Applying CRC algorithm, determine the checksum and the transmitted frame for the bit stream 1010011110 and for the generator polynomial $x^3 + x + 1$.
(c) Design a three stage, 15×15 switch ($N = 15, k = 2, n = 5$). What would be the number of crosspoints in the above mentioned switch? Redesign the previous three stage, 15×15 switch, using the Clos criteria with a minimum number of crosspoints.

$$3 + 4 + (2 + 3) = 12$$

Group - C

4. (a) An error correcting code has the following code words: 00000000, 00001111, 01010101, 10101010, 11110000. What is the maximum number of bit errors that can be corrected?

- (b) How can you get twice the efficiency in Slotted ALOHA protocol compared to the Pure ALOHA protocol? Show your analysis.
(c) What is the necessity of the Padding field in an Ethernet frame?
(d) What is transparent bridge? Explain the backward learning algorithm used by transparent bridge.

$$2 + 4 + 2 + (1 + 3) = 12$$

5. (a) The sender has a sliding window size=3. Go-back-N ARQ protocol is used. Discuss the behaviour of receiver sliding window under the following two cases:

Case 1 : Frame 2 is lost in transition

Case 2 : Frame no. 2 is received by the receiver correctly but ACK is lost.

- (b) A network using CSMA/CD has a bandwidth of 10Mbps. If the maximum propagation time is $25.6 \mu\text{s}$, what is the minimum size of the frame?
(c) If $a = \text{propagation delay/transmission delay}$ and P is the probability of frame error then prove that channel utilization in the case of stop and wait protocol is $(1-P)/(1+2a)$. Assume negligible sender, receiver processing time, transmission time and acknowledgement time.
(d) In selective repeat ARQ the size of the send window must be less than 2^{m-1} , where m is the number of bits used to represent the sequence number. Justify your answer with suitable example.

$$3 + 2 + 4 + 3 = 12$$

Group - D

6. (a) Distinguish between adaptive routing and fixed routing. Why adaptive routing is preferred over fixed routing?
(b) Explain count to infinity problem in distance vector routing. How does split horizon handle the slow convergence problem faced in distance vector routing?
(c) A block of addresses are assigned to an organization. One of the addresses is 205.16.39.40/28. What are the first and the last address of the block? Also find the total number of addresses in the block.

$$(2 + 2) + (3 + 2) + 3 = 12$$