B.Sc. (Honours) Examination 2018
Semester-III
Computer Science
Course : CC-7
(Computer Network)

Time : 3 Hours **Full Marks : 40**

Questions are of value as indicated in the margin

Answer **any five** questions.

1. a) Among NRZ-L and NRZ-I line coding schemes, which one would you prefer to encode a bitstream if long sequences of 1's is more likely than long sequence of 0's? Why? 2
   b) If 1 and 0 are equally likely in the transmitted bitstream, which among NRZ-L and NRZ-I would you prefer? Why? 2
   c) Show the Manchester and Differential Manchester coded waveforms for bit-stream 11100101. 4

2. a) Why line coding cannot be used for wireless systems? 1
   b) If baud rate of an wireless channel is 2 Msps, what are the achieved bit-rates for QPSK, 8-PSK, 16-QAM and 64-QAM over that channel? 2
   c) If 11000010 is transmitted using QPSK, how many times would the phase of modulated signal change during transmission?
   d) If all symbols are equally likely, and average transmission power is same for a 16-PSK and 16-QAM systems, comment on their relative bit detection performances from their signal-space diagrams. Assume same AWGN noise level for both. 4

   [Hint: $s(t) = A \cos(2\pi ft + \varphi)$ and find the values of A for each symbol. Transmitted power during each symbol = $A^2/2$ for that symbol. As all symbols are equally likely, equate the average transmitted power of all symbols for 16 PSK and 16-QAM to derive respective A_c and A_s values. Draw the signal space diagram and interpret.]

3. a) A Go-Back-N ARQ with modulo-16 sequence numbers has RTT = 20 ms, frame transmission time =4 ms, window size = 8. Transmission starts from sequence number 0. Receiver has buffer to store out-of-sequence packets, and transmits ACK each time a packet is received correctly or a missing packet is detected. ACK contains the next expected in-sequence number. Transmitter detects loss of packet through duplicate ACKs. Show how transmission error in packet with sequence number 2 is recovered through re-transmissions. 5
   b) Briefly describe flag-based framing with a suitable example. 3

4. a) Transmission by each host in a 8-persistent slotted-ALOHA system has slot duration = 10 ms, bit-rate of the medium = 4 Mbps. Find the average latency for transmission of a frame when it suffers 3 collisions before getting successfully transmitted. 3
   b) If BE backoff is used instead of 8-persistency in the above system, find the average latency value for successful transmission after suffering 3 collisions. 5

   [Hint: Recollect the static persistency based mechanism. p-persistent means static persistency based backoff with persistency value p. Here p = 8. Average dealy in terms of frames for re-attempt after each of the three collisions = (min dealy + max delay)/2. Assume average initial latency (delay between the freame being ready and first transmission attempt) = ½ slot. Find the total average latency between the frame being ready for transmission and successful completion. Do the same exercise for Binary Exponential backoff (BE backoff).]

P.T.O.

5. a) A TDMA system has 8 slots per frame. Capacity of the link = 10 Mbps. If at most one slot is allotted per frame for each host, what is the maximum data rate permissible for each host? 2

   b) Find a possible allocation to accommodate 20 active hosts in this system using the full system capacity. Assume no host has any specific data rate requirement. 3

   [Hint: As no host has any specific data rate requirement, you can choose lower data rate allocations for some of them. Total allocation should exhaust all slots.]

   c) A CSMA-CD bus network has bus length = 100 m, speed of signal in the medium = 10^8 m/sec, link capacity = 100 Mbps, packet length = 1500 bytes. Find the minimum latency of transferring a 100 MB stream over the network without any collision. 3

   [Hint: Find the number of frames required to be transmitted. For each frame, find minimum carrier sense duration and CD preamble time from propagation dealy of signal in the medium, and add frame transmission time.]

6. a) An organization has 5 departments and each department has provision for connecting upto 1000 devices to internet. The organization has a single class B address 150.116.0.0. Find subnet id's and range of IP addresses of hosts in each department. 3

   [Hint: Need to create 5 subnet addresses from the single lass-B address using subnet masks. Number of host id bits are derived from the provisioned number of hosts in each subnet.]

   b) The organization has a central gateway and each department has its own gateway. Department 1 and 3 are directly connected to the central gateway, department 2 and 5 are connected through department 1, department 4 is connected through department 3. Find the routing table entries in the gateways within the organization. 3

   [Hint: Connectivity is given. Find the routing table entries to facilitate packet forwarding the central gateway and individual subnet gateways.]

   c) If NAT is used to hide individual hosts of the organization from outside IP networks, find a possible IP address allocation within the organization having provisions to add new departments in future. 2

   [Hint: Local Ib addresses are used within the network Class A local address start with 10.0.0.0, class B – 172.16.0.0 class C – 192.168.1.0. Use the subnet masks derived in 6(a). Allocate local addresses so that new subnets can be added in future.

7. a) Illustrate active open and passive open for TCP. 2

   b) How does TCP achieve end-to-end flow control? 2

   c) Explain if it is justified to say that the receiver side does not play any specific role in TCP congestion control. 2

   d) What is meant by slow start?

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