1. **(15%)** Consider the link layer control of a link. Let the length of the link be d, the length of a frame be L and the data rate be R. Let the speed of light be V. Assume that the link layer controller uses stop-and-wait protocol.

   (5%) Assuming that the link is error-free, what is the maximum utilization of the link ?

   (10%) If the probability that a frame is in error is p, what is the maximum utilization of the link ?

2. **(15%)** Under the same notations and assuming that the link layer controller uses Go-Back-N protocol, repeat the following questions.

   (5%) If the link is error-free, what is the maximum utilization of the link ?

   (10%) If the probability that a frame is in error is p, what is the maximum utilization of the link ?

3. **(5%)** Explain what virtual circuit routing is. Explain how it works.

4. **(15%)** Explain the following terms:

   (a) DQDB
   (b) Mobile IP
   (c) AAL

5. **(5%)** Let a denote the propagation delay between the farthest two nodes of an Ethernet (Fast Ethernet/Gigabit Ethernet) and L denote the minimum transmission time of a frame. Which of the following is correct ? Why ?

   (a) $L = a$,
   (b) $L \geq 2a$,
   (c) $L \leq 2a$,
   (d) $L = 4a$.

6. **(10%)** What are *carrier extension* and *frame bursting* used in Gigabit Ethernet ?

7.(5%) What is *late collision* in CSMA/CD protocol ? How this happens ? How to solve this problem ?

8.(10%) The flow control mechanism used in the Transport Control Protocol (TCP) is Credit Allocation Scheme. Please describe how this scheme works.

9. (10%) TCP uses "three-way handshaking" scheme to establish a connection. Please describe how this scheme works. Please also describe why this scheme is able to handle the (a) delayed SYN packets, (b) delayed SYN/ACK packets, from other previous connections.

10.(10%) Typically, the network configuration of a computer (for example, a PC) in the Internet includes its IP address, subnet mask, Domain Name Server (DNS) IP address and "default router" IP address. Please describe *when* and *how* the computer will transmit the packets to the default router. What happens if we set the subnet mask of the computer as

(a) 255.255.255.255,

(b) 0.0.0.0 ?