

1. A communication channel has a bandwidth of 6000 Hz and a signal to noise ratio of 20 dB. Calculate the capacity (in bits per second) of this channel.
2. Briefly explain the following terms:
  - a) Time Division Multiplexing
  - b) Frequency Division Multiplexing
  - c) Code Division Multiple Access
  - d) Message Switching
  - e) Packet Switching
3. Compare and contrast Dial-up, Cable and DSL Internet services on the basis of bandwidth sharing between hosts utilizing the medium, and contention for medium access. Clearly differentiate between uplink and downlink channels.
4.  $N$  stations share a 100 Mbs Ethernet cable of length 250m. Assume that the velocity of propagation of electromagnetic waves in the Ethernet cable is  $2.3 \times 10^8$  m/s.
  - a) What is the maximum propagation delay  $\tau$  ?
  - b) What is duration of each contention slot?
  - c) What is the minimum packet size (in bits)?
  - d) If all packets have a duration of  $P$ , the efficiency of the Ethernet is given by  $P/(P + 2\tau e)$  where  $e = 2.7813$ . Explain.
  - e) What is the efficiency (and hence the average capacity) of the shared medium if the packet size is 1500 bytes?
  - f) What is the efficiency (and average capacity) of the shared medium if the packet size is 1500 bytes, but if the 100 Mbs Ethernet line is replaced by a 10 Mbps Ethernet line?
5. Explain the differences between flooding, distance vector, and link state routing, clearly elucidating the information exchanged between nodes; the nodes involved in the information exchange; the knowledge of the network topology gained by each node (after successful execution of the routing algorithms).
6. Discuss the advantages and disadvantages of the following approaches for congestion control in the network layer
  - a) Warning bit
  - b) Choke Packets
  - c) Hop-by-hop choke packets
7. Briefly explain (not more than 3 lines) the following
  - a) ARP
  - b) DHCP
  - c) DNS
  - d) POP3
  - e) IMAP
8. The output of a communication channel employing (4,7) Hamming code is 1011001. Given that you do not know what parity was used (odd or even) and the convention used for representing the position of the bits (the LSB position could be referred to as 1 and MSB 7 or vice-versa), what are the four possible 4 bit messages that could have been sent?