

# Tutorial#08

## Data Link Layer [CO5]

1. A large population of ALOHA users manages to generate 50 requests/sec, including both originals and retransmissions. Time is slotted in units of 40 msec.
  - a. What is the chance of success on the first attempt?
  - b. What is the probability of exactly k collisions and then a success?
  - c. What is the expected number of transmission attempts needed?
2. Consider building a CSMA/CD network running at 1 Gbps over a 1-km cable with no repeaters. The signal speed in the cable is 200,000 km/sec. What is the minimum frame size?
3. Consider a 10-Mbps Ethernet LAN that has stations attached to a 205 km long coaxial cable. Given that the transmission speed is  $2.3 \times 10^8$  m/s in a coaxial cable, then find out the throughput of system and taking packet size as 128 bytes.
4. A bit string, 01111011110111110, needs to be transmitted at the data link layer. What is the string actually transmitted after bit stuffing?
5. Explain random access protocol. Differentiate between pure ALOHA and slotted ALOHA
6. A group of N stations share a 56-kbps pure ALOHA channel. Each station outputs a 1000-bit frame on an average of once every 100 sec, even if the previous one has not yet been sent (e.g., the stations can buffer outgoing frames). What is the maximum value of N?
7. Ten thousand airline reservation stations are competing for the use of a single slotted ALOHA channel. The average station makes 18 requests /hour. A slot is 125  $\mu$ sec. What is the approximate total channel load?
8. Suppose nodes A and B are on the same 10 Mbps Ethernet segment, and the propagation delay between the two nodes is 225 bit times. Suppose A and B send frames at the same time, the frames collide, and then A and B choose different values of K in the CSMA/CD algorithm. Assuming no other nodes are active, can the retransmissions from A and B collide? For our purposes, it suffices to work out the following example. Suppose A and B begin transmission at  $t=0$  bit times. They both detect collisions at  $t=225$  bit times. They finish transmitting jam signal at  $t= 225+48= 273$  bit times. Suppose  $K_A=0$  and  $K_B=1$ . At what time does B schedule its retransmission? At what time does A begin transmission? At what time does A's signal reach B? Does B refrain from transmitting at its scheduled time?

### **Revision Flow Control (Transport / Data link layer) [CO3]**

9. A channel has a data rate of 4 kbps and a propagation delay of 20 ms. For what range of frame sizes does stop-and-wait give an efficiency of at least 50%?
10. Consider the use of 1000-bit frames on a 1-Mbps satellite channel with a 270-ms delay. What is the maximum link utilization for
  - a. Stop-and-wait flow control?
  - b. Continuous flow control with a window size of 7?
11. Consider an error-free 64-kbps satellite channel used to send 512-byte data frames in one direction, with very short acknowledgements coming back the other way. What is the maximum throughput for window sizes of 1, 7, 15, and 127? The earth-satellite propagation time is 270 msec.