CPEG 572 Data and Computer Communications

ASSIGNMENT #8

Ch11:

Q.1

Byte-stuff the following frame payload in which E is the escape byte, F is the flag byte, and D is a data byte other than an escape or a flag character.

D **E** D D **F** D D **E** **E** D **F** D

D **E** **E** D D **E** **F** D D **E** **E** **E** **E** D **E** **F** D

Q.2

Unstuff the following frame payload:

0001111110000011111011101001110111111000001111

00011111100000111111110100111011111100001111

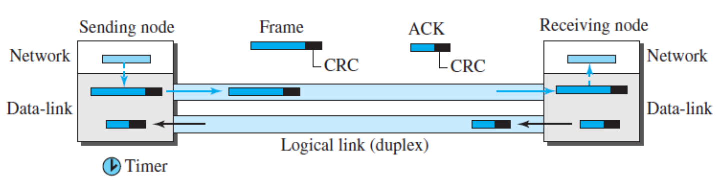
Q.3

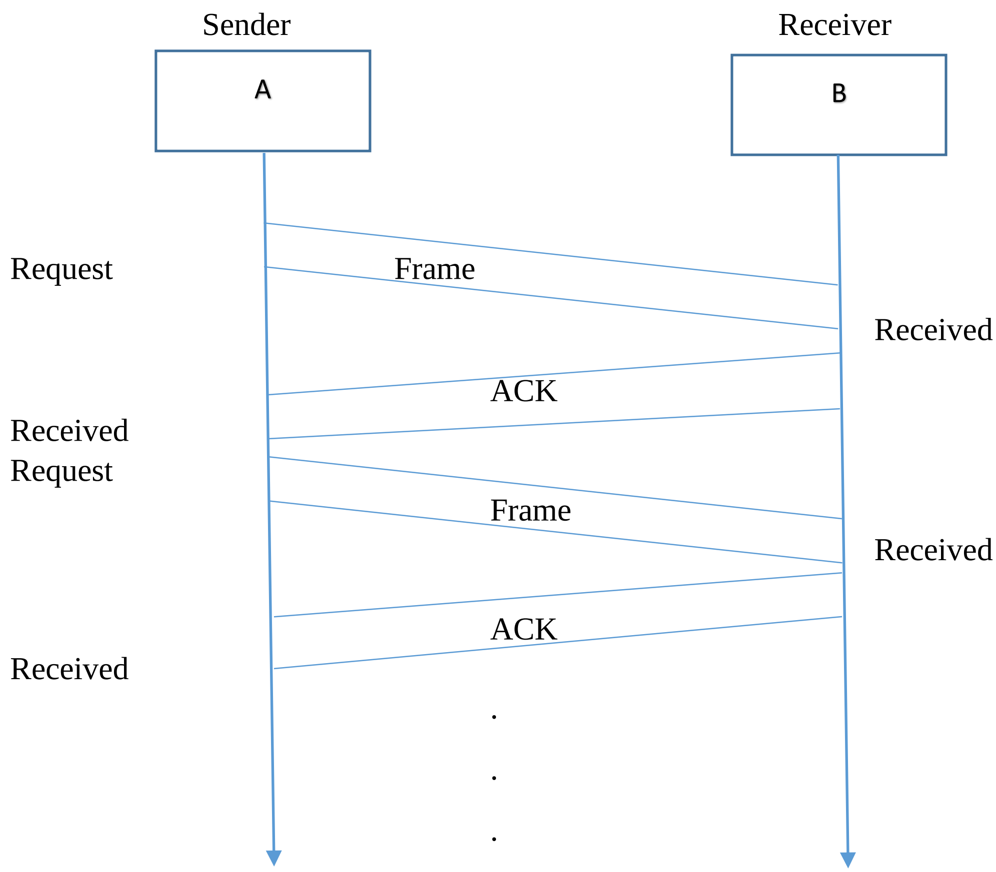
Assume the only computer in the residence uses PPP to communicate with the ISP. If the user sends 10 network-layer packets to ISP, how many frames are
exchanged in each of the following cases:
a. Using no authentication?
10 frames will be generated, one for each packet
b. Using PAP for authentication?
Since Password Authentication Protocol is involved, PAP uses REQUEST and ACK or NACK as response which are two additional frames. So total 12 frames will be generated
c. Using CHAP for authentication?
Since Challenge Handshake Authentication Protocol is involved. CHAP uses Challenge then Response then Either Success or Failure, which are three additional frames. So total 13 frames will be used

Q.4

Redraw Figure 11.10 using piggybacking.

Figure 11.10 *Stop-and-Wait protocol*




Sender
Receiver
A
B
Request
Frame
Received
ACK
Received
Request
Frame
Received
ACK
Received
.
.
.

Q.5

Assume PPP is in the authentication phase, show payload exchanged between
the nodes if PPP is using

a. PAP

The authentication request packet is sent. The system will respond either by ACK or NACK

b. CHAP

The Challenge packet is sent. The user will respond with response packet. The system will send either SUCCESS or FAILURE.

Ch 12

Q.6

There are only three active stations in a slotted Aloha network: A, B, and C.Each station generates a frame in a time slot with the corresponding probabilities
$p_A = 0.2$, $p_B = 0.3$, and $p_C = 0.4$ respectively.

a. What is the throughput of each station?

Throughput is the probability that the station has frame to send and the other station have no frame to send.
So,

$$SA = pA * (1 - pB) * (1 - pC) = 0.2 * (1 - 0.3) * (1 - 0.4) = 0.084$$
$$SB = pB * (1 - pA) * (1 - pC) = 0.3 * (1 - 0.2) * (1 - 0.4) = 0.014$$
$$SC = pC * (1 - pA) * (1 - pB) = 0.4 * (1 - 0.2) * (1 - 0.3) = 0.022$$

b. What is the throughput of the network?

The throughput of network is sum of all throughputs

$$S = SA + SB + SC = 0.084 + 0.14 + 0.22 = 0.45$$

Q.7

A slotted Aloha network is working with maximum throughput.

a. What is the probability that a slot is empty?

Piosson distribution will be used here, as X = 0

$$P[0] = G^0\, e^{-1}/_{0!} = \frac{1}{e} = 0.367$$

b. How many slots, n, on average, should pass before getting an empty slot?

It can be found using the geometric distribution that tells us if probability of an even is p, the number of experiments that need to be tried before getting that event is $\frac{1}{p}$

Therefore, $n = \frac{1}{p}(empty\ slots) = \frac{1}{0.368} = 2.717$

Q.8

Another useful parameter in a LAN is the bit length of the medium (L_b),which defines the number of bits that the medium can hold at any time. Find the bit length of a LAN if the data rate is 100 Mbps and the medium length in meters (L_m) for a communication between two stations is 200 m. Assume the propagation speed in the medium is $2 \cdot 10^8$ m/s.

Let's assume the propagation speed in medium as $2 * 10^8\ m/s$
So,

$$n = \frac{bits}{Speed} = \frac{100 * 10^6}{2 * 10^8} = 0.5\ m/s$$
$$Lb = Lm * n = 200 * 0.5 = 100\ bits$$

Q.9

In a bus CSMA/CD network with a data rate of 10 Mbps, a collision occurs 20 μs after the first bit of the frame leaves the sending station. What should the length of the frame be so that the sender can detect the collision?

In order to detect collisions, the last bit of the frame should not have left the station. Which means that the transmission delay needs to be greater than $40\ usec\ (20\ usec + 20\ usec)$ or the frame length should at least be $10\ Mbps * 40\ usec$, which is 400 bits

Q.10

In a bus 1-persistence CSMA/CD with T_p = 50 μs and T_{fr} = 120 μs, there are two stations, A and B. Both stations start sending frames to each other at the same time. Since the frames collide, each station tries to retransmit. Station A comes out with $R = 0$ and station B with $R = 1$. Ignore any other delay including the delay for sending jamming signals. Do the frames collide again? Draw a time-line diagram to prove your claim. Does the generation of a random number help avoid collision in this case?

Assuming both stations starting transmission at same time t=0 us. The collision would occur at the middle of the bus at time t=25 us. Both stations hear the collision at time t=50 us.
First station senses the medium and find it free. It will retransmit the transmission at t=50 us. The frame would arrive successfully. Second station would schedule its transmission at time t=50+120 us. This means that the second station senses that channel at t=170us is busy. It would require continuous sensing of the channel. AT t=220 us, second station would find the channel as free. This shows the benefit of creating a random number to make the stations schedule at different times and avoid the collisions.