National University of Computer and Emerging Sciences, Lahore Campus

Quiz ……6 [BS(CS): Section A] Fall 2024

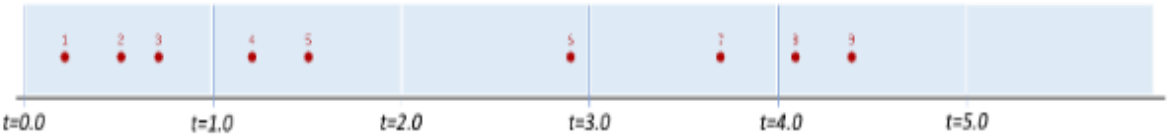
Computer Networks (Code: CS3001) **Quiz Date: December 5, 2024**

Total Marks: 20 **CLO 3** **Duration: 20 -Minutes**

Name ---------- Roll #---------- Section --------

Instructions: Answer the question(s) on this sheet. You can make use of rough sheet (not to be attached).

Q1: Consider the figure below, which shows the arrival of 9 messages for transmission at different multiple access wireless nodes at times
t = <0.2, 0.5, 0.7, 1.2, 1.5, 2.9, 3.7, 4.1, 4.4> and each transmission requires exactly one time unit.
[10 Marks]



For part a) and b), suppose all nodes are implementing the Slotted Aloha protocol.

a) For each message, indicate the time at which each transmission begins. Separate each value with a comma and no spaces.

Answer: **Answer:** 1,1,1,2,2,3,4,5,5

b) Which messages transmit successfully assuming that messages are never retransmitted after the occurrence of collision (if any)? Write your answer as a comma separated list with no spaces using the messages' numbers

Answer: 6,7 (as no message will be transmitted successfully

For part c), d) and e), suppose all nodes are implementing Carrier Sense Multiple Access (CSMA), with collision detection (CSMA/CD).

c) Suppose that the time from when a message transmission begins until it is beginning to be received at other nodes is 0.4 time units, and assume that a node can stop transmission instantaneously when a message collision is detected. (Thus if a node begins transmitting a message at t=2.0 and transmits that message until t=3.0, then any node performing carrier sensing in the interval [2.4, 3.4] will sense the channel busy.) For each message, indicate the time at which each message transmission begins, or indicate that message transmission does not begin due to a channel that is sensed busy when that message arrives. Separate each value with a comma and no spaces, and if the channel is sensed busy, substitute it with 's'

Answer: 0.2,0.5,s,s,1.5,2.9,s,s,4.4

d) Which messages transmit successfully assuming that messages are never retransmitted after the occurrence of collision (if any)? Write your answer as a comma separated list with no spaces using the messages' numbers

Answer: **Answer:** 6,9

e) At what time did each message stop transmitting due to a collision. Write your answer as a comma separated list with no spaces using the messages' numbers in order, and if a message didn't stop, write 'x' for that message.

Answer: **Answer:** 0.9,0.6,x,x,x,x,x,x,x

Q2: Assume that there are 3 active nodes, each of which has an infinite supply of frames they want to transmit, and these frames have a constant size of L bits. If two or more frames collide, then all nodes will detect the collision.

There are two versions of the Aloha protocol: Slotted and Pure. In the case of Slotted Aloha, frames will be sent only at the beginning of a time slot, frames take an entire time slot to send, and the clocks of all nodes are synchronized. Efficiency of pure Aloha is equal to $Np\ (1 - p)^{\wedge 2(N - 1)}$, while the same for slotted Aloha is equal to $Np\ (1 - p)^{\wedge (N - 1)}$. For each of these protocols answer the following questions: [10 Marks]

a) Given a probability of transmission p = 0.34, what is the maximum efficiency?
b) Given a probability of transmission p = 0.68, what is the maximum efficiency?

Answer Q2:

a) For Pure Aloha, the efficiency given p = 0.34 is $Np(1 - p)^{\wedge 2(N - 1)} = 3 * 0.34 * (1 - 0.34)^{\wedge 2(3 - 1)} = 0.19$ or 19% efficiency.
   For Slotted Aloha, the efficiency given p = 0.34 is $Np(1 - p)^{\wedge (N - 1)} = 3 * 0.34 * (1 - 0.34)^{\wedge (3 - 1)} = 0.44$ or 44% efficiency.

b) For Pure Aloha, the efficiency given p = 0.68 is $Np(1 - p)^{\wedge 2(N - 1)} = 3 * 0.68 * (1 - 0.68)^{\wedge 2(3 - 1)} = 0.02$ or 2% efficiency.
   For Slotted Aloha, the efficiency given p = 0.68 is $Np(1 - p)^{\wedge (N - 1)} = 3 * 0.68 * (1 – 0.68)^{\wedge (3 - 1)} = 0.21$ or 21% efficiency.