**Project 1 Simulating Slotted ALOHA, CSMA/CD and CSMA/CA**

**This project will be completed in groups of two**

**Due Oct 2nd**

Implement in any programming language a simulation of collision protocols used by data link layer: Slotted ALOHA, CSMA/CD and CSMA/CA.

The simulation will simulate a number of hosts within a LAN using a shared simulated physical medium communicating with a single destination node. The simulation will run in time slots.

The following actions are allowed during each time slots:

1. Sensing medium availability – takes 0 time slots. In the same slot a host can do action 3 and 4, but cannot do action 2.
2. Detect collision, send jam signal and stop transmitting – takes 1 time slots.
3. Send ACK, RTS, CTS or any control related frames – takes 2 time slots.
4. Send data frames – takes 2 or more time slots
5. Receive data frames – takes same time slots as sending frames. Meaning as soon as data frame is sent, it is received.

Each host has the following assumptions:

1. Each host can both sense medium availability and detect collision when simulating Slotted ALOHA, CSMA/CD, but cannot detect collision in CSMA/CA.
2. Each host can detect collision in the next time slot after transmission start. It means that after sensing the medium is free to send, if two or more hosts decide to send at the same time, they can detect collision, send jam signal and stop transmitting at the next time slot.
3. Number of time slots required to complete sending each data frame is a randomly generated number in a certain range.

The destination node has the following assumptions:

1. The destination node performs all necessary function needed to keep Slotted ALOHA, CSMA/CD and CSMA/CA working.
2. The destination node can sense medium availability and detect collision in all three protocol simulations.
3. The destination node receives data in the same time slot as the sender. Meaning when sender finish transmitting, the destination node can assume all data is received during the same time slot and can choose an action in the next time slot.

Your Tasks:

1. Implement simulations of Slotted ALOHA, CSMA/CD, CSMA/CA using the above assumptions. It is up to you to use the ACK version of CSMA/CA or RTS-CTS version of CSMA/CA
2. Make [8, 16] to be the range for randomly generating number of time slots required to complete a data frame. Simulate all three protocols with 5 hosts, 10 hosts, 15 hosts, 20 hosts and 25 hosts, with each host sending 1000 frames. Chart the curve of “# of hosts” in x axis and “total time slots used” in y axis for each protocol.
3. Fixing # of host to be 16, vary the range of time slots required to complete a data frame using the following ranges: [5, 10], [10, 15], [15, 20], [20, 25]. Chart the curve of “data frame range” in x axis and “total time slots used” in y axis for each protocol.
4. Compile the charts in a short report (less than 2 pages + charts) that include the following discussions:
5. Discuss what you expect what your charts should look like among three protocols.
6. Discuss what you observed on your charts.
7. Discuss any unexpected results from your charts, if any.
8. Discuss the difference of the three protocols’ performance based on your charts.
   1. Does number of host impact performance? Is the relationship linear? Which protocols are impacted more? Why?
   2. Does increase in frame length impact performance? Is the relationship linear? Which protocols are impacted more? Why?
9. Instruction on how to run your code (input, output, hard coded value change, etc).