**Questions and Exercises to work out and turn in:**

**Grading Guidelines:**

A right answer will get full credit when:

1. It is right (worth 25%)
2. It is right **AND** neatly presented making it easy and pleasant to read. (worth an **extra** 15%)
3. There is an **obvious and clear link[[1]](#footnote-0)** between 1) the information provided in the exercise and in class and 2) the final answer. A clear link is built by properly writing, justifying, and documenting an answer (worth an **extra** 60%).
4. Calculation mistakes will be minimally penalized (2 to 5% of full credit) while errors on units will be more heavily penalized.

**Late Submission** : as specified in the syllabus. Days counting starts one minute after the deadline.

**Check Your Submission:**  after submitting, download your submission to check whether it is the right version and it is complete.

You are welcome/encouraged to discuss exercises with other students or the instructor. But, ultimately, **personal** writing is expected.

* USE THIS FILE AS THE STARTING DOCUMENT YOU WILL TURN IN. **KEEP IN THE QUESTIONS** AND INSERT YOUR ANSWERS.
* IF USING HAND WRITING (STRONGLY DISCOURAGED), REWRITE THE QUESTIONS.
* FAILING TO FOLLOW TURN IN DIRECTIONS /GUIDELINES WILL COST A 30% PENALTY.

**Objectives of this assignment:**

* to understand the design issues of the medium access control.
* to understand today's medium access control protocols

**What you need to do:**

Answer the questions and/or solve the exercises described below.

**Medium Access Control (Questions)**

The objective of this exercise is to explain in your own words the evolution from Aloha to CSMA/CD. Explain how they differ and how each newer protocol improves the previous one: describe each one how it works and provide its performance, then contrast it with the protocol it improves.

a) (25 points) Briefly describe (Pure) Aloha protocol. Provide its channel utilization (efficiency) and discuss it

Pure Aloha allows for any transmission station to send packets whenever the station is ready. This allows for the station to be quick to respond to information but the likelihood of collision is high because it does not communicate that there is a station sending information at one time for a duration. Its channel efficiency is determined by the number of stations communicating on the network. The chance that a packet is successfully sent without collision is where G is the number of stations. So the maximum efficiency of a pure Aloha network is 18.4%. This is because with the addition of more stations that are independently sending information the likelihood that one station is sending information when another is rises exponentially.

b) (25 points) Briefly describe Slotted Aloha protocol. Stress on the difference from Pure Aloha. Provide its channel utilization (efficiency) and discuss it.

Slotted Aloha divides the time of any shared channels into specific time slots, thus making it less likely to have collisions as it is less likely for two or more stations to attempt to send at the same time. A station must begin its transmission at the start of a time slot, and if the station misses the beginning of a time slot it must wait for the beginning of the next time slot. The major differences that slotted aloha has compared to pure aloha is that there are specific times where a station can begin transmitting, the time slots are discrete and globally synchronized, and the time frame in which the system is vulnerable to collisions is half that of pure aloha.

The efficiency of Slotted Aloha is where G is the number of stations willing to transmit data at the beginning of the same time slot.

c) (25 points) Briefly describe CSMA. Stress on the difference from Aloha

While Aloha and CSMA are both random access protocols, CSMA unlike Aloha listens to the network before sending information to decrease the chance of collision. CSMA allows for fewer collisions for connections that are already ongoing, for example Station1 is currently sending information and Station2 is preparing a packet to send. If the network operated under pure aloha then both packets would need to be resent as they collided. CSMA Station2 would wait for Station1 to finish before attempting to transmit. CSMA also has different levels of aggressiveness when it comes to transmission algorithms. There are four levels; 1-persistent, Non-persistent, P-persistent, O-persistent. Each level allows for the network to either be more quick in transmitting data to being more efficient (Colliding less due to a more pensive approach.) information to the receiver.

Q2: (25 points) What is the purpose of collision detection in CSMA/**CD**?

CSMA/CD uses Collision Detection to stop the transmission as soon as a collision is detected, this allows for a much quicker retry time, effectively increasing the efficiency over normal CSMA by making collisions less destructive to the overall speed of the system.

**What you need to turn in**:

* Electronic copy of this file (including your answers) (standalone). Submit the file as a Microsoft Word or PDF file.
* Recall that answers must be well written, documented, justified, and presented to get full credit.
* How this assignment will be graded:
* A right answer will get full credit when:
* It is right (worth 25%)
* It is right AND neatly presented making it easy and pleasant to read. (worth 15%)
* There is an obvious and clear link between 1) the information provided in the exercise and in class and 2) the final answer. A clear link is built by properly writing, justifying, and documenting an answer (worth 60%).
* Calculation mistakes will be minimally penalized (2 to 5% of full credit) while errors on units will be more heavily penalized.
* You are welcome/encouraged to discuss exercises with other students or the instructor. But, ultimately, personal writing is expected.

**Appendix**: Grading: What is an OBVIOUS and CLEAR LINK?

Here is an example to explain what an **obvious and clear link** is and how we grade your work.

Consider the following problem:

*"(100 points) John travels from Auburn to Atlanta in his car at a speed of 50 mph. Leaving at 8am, at what time will John reach Atlanta".*

Here are the answers of three students and their scores:

**Student 1** answers: "10am". Student 1 will get 25 points.

**Student 2**answers : "John will reach Atlanta at 10am". Student 2 will get 25+15 = 40 points

**Student 3** answers: "The time t to travel a distance d at speed v is equal to d/v = d/50mph. The problem does not provide the distance d from Auburn to Atlanta. Based on Google, the distance from Auburn to Atlanta is approximately 100 miles (**document is here**). Therefore, the time t = 100 miles/50mph = 2 hours. Since John left at 8am, he will then reach Atlanta at 8am + 2 hours = 10 am".

**Student 3** will get 25 + 15 + 60 = 100 points

Do you see the **direct** **link** going from the data provided in the question to the final answer, using general knowledge/formula and documents?.... Can you now solve the following problem and get 100 points?

*"(100 points) Alice travels from Auburn to Atlanta in her car at a speed of 50 mph. Leaving at 8am, at what time will Alice reach Atlanta assuming that she had a flat tire that delayed her 30 minutes*".

1. Check the appendix about what an obvious and clear link is. [↑](#footnote-ref-0)