**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.

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)**

Q1: (75 points) 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.

The first algorithm for allocating a multiple access channel is Pure Aloha, It was created to let users transmit whenever they had data to send, but when collisions occur both frames are damaged. If the frames are damaged, the sender waits a random amount of time and sends it again. The wait times are random so that the same frames aren’t resent at the same time again over and over again. Soon after, the next algorithm, Slotted Aloha was created to increase the capacity of the system by dividing the time into *slots* that all of the frames must correspond with. Each sender must wait for the beginning of the next slot, which decreases the risk of multiple frames overlapping and getting damaged. Pure Aloha and Slotted Aloha’s main difference is that Pure Aloha’s time is continuous and Slotted Aloha’s time is divided into discrete intervals. The third algorithm, Carrier Sense Multiple Access (CSMA), makes the stations listen to the channel before sending, and if the channel is busy they must wait until it becomes idle, however a collision can still occur. CSMA allows the networks to achieve much better channel utilization than the best one they can achieve with Slotted Aloha (). CSMA can be separated into two carrier sense protocols: persistent and nonpersistent. Persistent CSMA will continuously try to send their frame if the channel is not idle, causing the likelihood of a collision from two waiting senders to be more likely. Nonpersistent CSMA will wait a random amount of time to try and send again if the channel is not idle. An improvement to CSMA is to add Collision Detection, which creates CSMA/CD, so that if the frames do collide the stations can detect the collision and stop transmitting abruptly. This keeps the stations from finishing the frames they are transmitting since they are already ruined by the collision. One main difference of CSMA/CD is that the senders must listen to the medium *while transmitting*, which they do not have to do with any of the others.

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

When collision detection is used with CSMA a transmitting station detects collisions by sensing transmissions from other stations while it is transmitting a frame. When this collision condition is detected, the station stops transmitting that frame and transmits a jam signal. After this happens the station waits a random time interval before trying to resend the frame.

**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)