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** 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 learn independently about an important topic
* to answer questions about the independently studied topic
* to empower you: you can learn any networking topic on your own
* to learn independently new concepts

What you need to do:

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

KEEP THE GRADING GUIDELINES ABOVE TO REMEMBER THE DIRECTIONS AND HOW THE HOMEWORK IS GRADED.

Objective: The objective of this assignment is explore the relationship between the packet size and the efficiency and show how a software engineering can determine the optimal packet size to tune the Stop-And-Wait protocol to maximize the efficiency over a noisy channel.

Resources:

1. **Basic math**
2. Your instructor

**Exercise**

We derived in the lecture the expression of the efficiency of the Stop-And-Protocol as a function of the bit rate *br*, the propagation time *Tp*, and the bit error rate *ber*:

Suppose the bit rate *br*, the propagation time *Tp*, and the bit error rate *ber* are given (known).

1) (80 points) Derive the expression of the optimal packet size Smax that maximizes the efficiency. Express Smax as a function of the bit rate *br*, the propagation time *Tp*, and the bit error rate *ber*.

(**Hint**: a function f(x) is optimal for some value x0 if and only if f'(x)=. In other words, derive the function f(x) and solve f'(x0) = 0.

**Tr = S / Br**

= 0

2) (2.5 points) Suppose br = 1.5 Mbps, Tp = 50ms, and ber = 5.10-6. What is the optimal packet size Smax?

3) (15 points) Suppose br = 1.5 Mbps, Tp = 50ms, and ber = 5.10-6. Plot the efficiency as a function of the packet size S from 0 to 100,000 bits.

4) (2.5 points) Using the plot, check the value of the packet size S you found in Question 3).

**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%).
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