ME 2450 Assignment 1

Name:	______________________
Due:	January 24th, 2019
Collaborators:	______________________
	______________________

I declare that the assignment here submitted is original except for source material explicitly acknowledged.

I also acknowledge that I am aware of University policy and regulations on honesty in academic work, and of the disciplinary guidelines and procedures applicable to breaches of such policy and regulations, as contained in the University website.

Name	Date
Signature	Student ID

Score

Exercise Graded:	______
Presentation:	/2
Technical Content:	/8
Total:	/10

Exercise 1

Express the *signed* binary number 11101101 in base-10. (Show your work)

1 bonus point: Write a fully commented computer code that takes as input a base-2 integer and prints its base-10 representation. Prove that it's working by running 3 other (not 11101101) base-2 numbers as input and showing printed output. Add to the pdf upon submission as part of Exercise 1.

Exercise 2

Express the base-10 number 420 as a *signed* binary number. How many bits are required to do so? (Show your work)

1 bonus point: Write a fully commented computer code that takes as input a base-10 integer and prints its base-2 representation. Prove that it's working by running 3 other (not 420) base-10 numbers as input and showing printed output. Add to the pdf upon submission as part of Exercise 2.

Exercise 3

Consider the function

$$f\left(x\right) = \frac{5x}{\left(1 - 2x^2\right)^2}$$

a) Evaluate the function at x = 0.423 using 3-digit arithmetic with chopping. Report the value obtained and the true relative error. (Turn in hand calculations only. No computer code is required.)

b) Repeat part (a) except using 4-digit arithmetic with chopping.

   HINT: Consider each arithmetic operation separately. First, calculate the numerator, i.e., $5x = (5) * (0.423)$and chop the answer to specified number of significant digits. Then, calculate $x^2 = (0.423) * (0.423)$and chop the answer to the specific number of significant digits, and so forth. After each operation, the resulting answer can only have 3 significant digits for part (a), and 4 significant digits for part (b).

Exercise 4

The quantity e^{-5} may be determined using the following two different formulas

$$\text{Formula 1 :} e^{-x} = 1 - x + \frac{x^2}{2!} - \frac{x^3}{3!} + \ldots$$
$$\text{Formula 2 :} e^{-x} = \frac{1}{e^x} = \frac{1}{1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \ldots}$$

a) Write a *fully commented* computer code to evaluate formulas 1 and 2 using 1–20 terms.

b) In your code, calculate the true relative error (ϵ_t) and *approximate* relative error (ϵ_a) of each calculation.

c) Report your results in a table that looks something like the one shown below. (Be sure to clearly label the columns of the table)

	Formula 1			Formula 2		
terms	value	ϵ_t (%)	ϵ_a (%)	value	ϵ_t (%)	ϵ_a (%)
1						
.						
.						
.						
20						

a) Comment on which formula has the least error.