Assignment 1

Due Date

Create a matlab script and change the filename to F7xxxxxx_hw1.m. Link all the programs to solve following problems to this script. Make sure once type the filename' F7xxxxxx_hw1', the results of the following problems will pop-up automatically in order. Remember not to type any 'clear all ' command in any of the codes.

Problems

Prob1. (No m-file is needed. Write down the answers on the PDF file)

IEEE754 standard defines the bit representation of double precision floating point as follows.
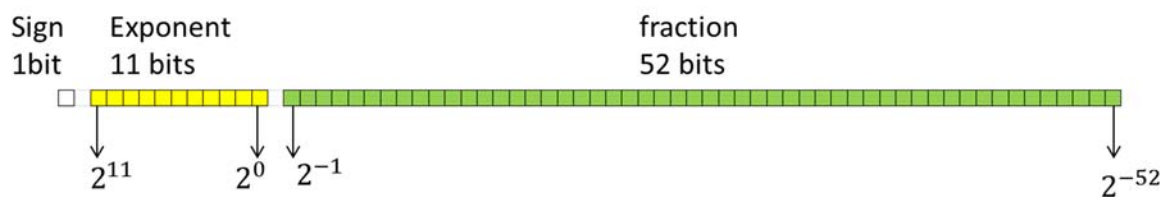
The number in the decimal format can be represented by

$$(-1)^{sign} * 2^{Exponent-1023} * (1 + fraction)$$

(1) Find the decimal equivalent of the following floating numbers

a.

0 10001001001 1001001001000000000000000000000000000000000000000000

b.

1 01111111001 0001001001000000000000000000000000000000000000001001

(2) Find the next largest machine numbers in decimal form of the two numbers in (1). (i.e. the next largest number will be larger than the given number by an increment which is just large enough to change the binary representation).

(3) Calculate the relative differences for each number in (1) and its next largest machine number. What is the limit of significant digits for the numbers representing by 64-bit real format?

Prob2. [F7xxxxxxx_hw1_prob2.m]

~~Suppose that a unit charge Q = 1C is placed at the origin (0,0,0).~~

(a) Given the following configuration, the two charges have +1C and -1C respectively.
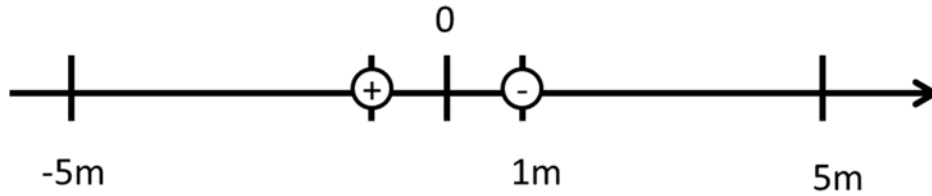
Generate a plot ,V(x)-x to demonstrate the electric potential from -5m to 5m except for the locations closed to the two charges.

(b) Generate a plot for the electric field E(x)-x by using the values and the locations from V(x)-x. Note: the precision should contain at least 6 significant digits. Explain how do you generate E(x)-x from V(x)-x in detail including the method, the algorithm and the critical parameters chosen.

Prob3. [F7xxxxxxx_hw1_prob3.m]

A 5-kg brick undergoes a damped oscillation. The velocity of the brick can be expressed by

$$\vec{v}(t) = -20e^{-0.01t^2}\sin\left(20\pi t + \frac{2\pi}{5}\right)\frac{m}{s}\,\hat{x} \quad \text{for} \quad t \geq 0$$

(a) Draw the v-t plot of the object and include appropriate axis labels on the plot.

(b) Plot the temporal changes of the net force on the object, an F-t plot.
    (put on appropriate axis label on the figure)

(c) Find $\vec{F}(8)$. The precision should be up to 6 significant digits and print the result on the console window.

Contents to submit

1. All the m-files should include proper COMMENTS.
   (No comment, no score)
2. A PDF [F7xxxxxxx_hw1.pdf] includes Your Name, Your Student ID Number, written answers to the question, and introduction to your program, such as What your program can do, How do you finish this homework, and the test result that convinced you that your program is correct.

Notice

1. DO NOT PLAGIARIZE. You are encouraged to ask and to discuss the homework content with your fellow classmates, the TAs and the instructor. But identical core program wording is NEVER ACCEPTABLE.
2. Upload all the files without archiving (Do Not ZIP, tar, 7z or RAR). Do not upload files that don't work. Any missing file or function that leads to fail of the execution will be regarded as a program that does not work.