CSE 330 (Summer 2024)
Assignment 1

1. In the classes, we discussed three forms of floating number representations as given below,
(1) Standard/General Form, (2) Normalized Form, (3) Denormalized Form.
Now, let's take, **$\beta = 2$, $m = 3$, $e_{min} = -2$ and $e_{max} = 3$.** Based on these, answer the following:

(a) (2 marks) What are the **maximum/largest** numbers that can be stored in the system by these three forms defined above? (express your answer in decimal values)
(b) (2 marks) What are the **non-negative minimum/smallest** numbers that can be stored in the system by the **denormalized form**? (express your answer in decimal values)
(c) (2 marks) How many numbers (**both non-negative and negative)** can be represented in the above mentioned system using the **general form**? Explain your answer.
(d) (4 marks) Find all the decimal numbers for **e = 3** and **e = 2** in **denormalized form**, plot them on a real line and prove that all the numbers are not equally spaced. Write **the equally spaced sets** for the number line you drew.

2. Let **$\beta = 2$, $m = 6$, $e_{min} = -3$ and $e_{max} = 3$**. Answer the following questions:

(a) (2 marks) Compute the minimum of |x| for **General** and **Denormalized form**.
(b) (2 marks) Compute the Machine Epsilon value for the **General** and **Normalized** form.
(c) (3 marks) If we change the value of e_{max} to 6 then how will it affect the value of maximum scale invariant error for the case of **Denormalized** form? Explain your answer.

3. Consider the **real number $x = (3.395)_{10}$**

(a) (2 marks) Convert the decimal number x into **binary format** up to 7 binary places (7 binary digits after decimal)

(b) (3 marks) Convert the calculated value into **normalized form** and calculate **fl(x)** for **m=4**

4. Consider the quadratic equation, **$5\square^{2} - 70x + 4 = 0$**. Consider **up to 5 significant figures** when performing calculations.

(a) (4 marks) Calculate the roots of the quadratic equation and find out where **the loss of significance** occurs when you calculate the roots?
(b) (4 marks) Evaluate the correct roots such that loss of significance does not occur.