CS 323 Homework 1

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You can discuss questions with others, but the solutions/codes you submit must be entirely your own work, and please mention who you collaborated with in your homework.

Software: MATLAB/ C++ /Python (or any language that you are familiar)

Due date: Rutgers time: Wed Feb 10 2021 23:59 pm

Theoretical Assignment 1: Suppose we have a decimal number $(-28.91)_{10}$

1. Convert it to binary number, show the specific procedures, and truncate the result with accuracy to 4 decimal places. (Points: 25)

2. Convert your binary number back to its corresponding decimal number, show the specific procedures, and evaluate the relative error. (Points: 15)

3. Use online calculator[1] to present the floating point representation of $(-28.91)_{10}$ in a 32-bit computer. Show the specific sign(s) (1-digit), exponent(n) (8-digit), and Mantissa (f) (23-digit). (Points: 10)

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[1]see a useful website: https://www.h-schmidt.net/FloatConverter/IEEE754.html

Theoretical Assignment 2:   Suppose we have a matrix $\mathbf{A}$:

$$\mathbf{A} = \begin{bmatrix} 2 & 1 & 0 \\ 1 & 4 & 0 \\ 0 & 3 & 10 \end{bmatrix} \tag{1}$$

1. Find the L_1 and L_∞ norms of $\mathbf{A}$ (Points: 15)

2. Show the details of evaluating eigenvalues of $\mathbf{A}_2$, the L_2 norms of $\mathbf{A}$ and $\mathbf{A}^{-1}$. Numbers you would need: $\sqrt{2} \approx 1.414$ and $\sqrt{8} \approx 2.828$.

   Note: use pre-programmed functions such as 'eig' in MATLAB, 'eigenvalues()' in C++, and 'eigvals' in Python would get few credits. (Point: 25)

3. Evaluate the condition number of matrix $\mathbf{A}$ based on the resulting L_2 norms of $\mathbf{A}$ and $\mathbf{A}^{-1}$ (Point: 10)

   Note: use pre-programmed functions, such as 'cond' in MATLAB and the like, would get few credits.