Department of Computer Science
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CS 326: Computational Methods for Data Science

February – June 2022

Assignment II (**due 6 March 2022**)

Full Marks: 30

1. [15 marks] Write Python codes to verify that the compensated summation algorithm and the sorted sum, where at first the numbers are sorted using quicksort and then summed, are **numerically equivalent algorithms**. Compare the errors obtained in these two methods with the vanilla iterative summation method. [Hint: generate an array of floating point numbers by first generating n random integers between a and b then adding an integer multiple of the machine epsilon to each number to make those floating point numbers. Vary n to see the effect on error]
2. [15 marks] Refer to slides 25,26 of "CDS Preliminaries: Error Analysis". Write Python codes to verify that the compound interest calculated by $c[(1 + x)^n - 1]/x$, $x = i/n$, $i \ll n$, $n = 365$ is erroneous because the main problem is computing $(1 + x)^n$. Noting that $(1 + x)^n = \exp(n \log(1 + x))$, use Maclaurin series for $\log(1 + x)$ and also use $\log(1 + x) = x \log(1 + x))/((1 + x) - 1)$ to find the compound interest. Show that the later two ways are **numerically equivalent algorithms**

Instructions:

1. Submit two files in LMS – (i) the code files and (ii) a pdf file with the report showing graphs, tables, comparative analysis etc.
2. How to save your file : **YourName_CDS_Assignement_1.pdf. and YourName_CDS_Assignement_1.ipynb**