CMSC 5728
Date: October 9th, 2024

Programming assignment #1: Understanding Empirical Average and Hoeffding's Inequaltiy

1. You need to do the following:
    a. Generate 50 random outcomes from a **uniform distribution** between [0,1], store these 50 numbers in a file, say *input*
    b. Derive or compute the average of this distribution.
    c. For this probability distribution, calculate the average value, call this the ***empirical average***.
    d. Write a program which can use the Hoeffding's Inequality to compute the confidence interval of the average value for each of these 50 samples. In other words, find the upper/lower bounds after i samples, where $i \in \{1,2,\dots,50\}$.

2. Repeat (1), except that the 50 random outcomes are generated from a uniform distribution of [0,2].

3. Repeat (2), except the 50 random outcomes are generated from a unform distribution between [0,1] and [3,4]. In other words, we can have uniform outcomes from (0,1) and also from (3,4).

Instruction:
- You need to submit:
    o A program (with its input file) which can calculate the confidence interval of the above 3 cases
    o A written report (pdf file) which you can derive the average values of the above 3 cases, as well as 3 plots to show the shrinkage of the confidence interval. In other words, the Y-axis will be the upper/lower bound of the average value, while the X-axis will be the number of samples.
    o Put all your programs and input files and written report in a zipfile.

Submission deadline: October 21, 2024, 11:59 pm. Again, **NO LATE SUBMISSION.**