Due on October 22^{nd}, 2021
M339W/389W Financial Mathematics for Actuarial Applications
Fall 2021, University of Texas at Austin
Graduate Homework
Instructor: Milica Čudina

The following problems are meant to be the extra special homework assignment for graduate students. If you are taking this course as an undergraduate course, your score on will count as extra credit. Details are below.
A part of the homework involves simulations while the rest involves calculations (and a bit of simulations). You are required to use **R** to complete this part of the assignment. Please, do not include a list of your simulated values in your final submission.
If you are a graduate student, this HW will be taken into account when your HW average is calculated (see the First-Day Handout). It will have the weight of **two** regular homework assignments. If you are taking this course as an undergraduate course and you decide to attempt this assignment, then your score will serve as extra credit toward your final score in the course. More precisely, a full score in this homework will be worth 2 points in the final score in this course.

Problem 2.1. (25 points) Let u be draws from the unit uniform distribution. Calculate $x_i = \sum_{k=1}^{12} u_k - 6$ for $i = 1, 2, \ldots, 1000$. Plot the histogram of your $x's$. Superimpose the standard normal density. What do you notice? Why?

Before attempting the following problems, the student should read and understand Chapter #3. from the SOA study note available at `https://www.soa.org/globalassets/assets/Files/Edu/2018/ifm-21-18-study-note.pdf` on *Monte Carlo simulation*.

Problem 2.2. (25 points) Let $T \sim Exponential(\lambda = 25)$. Using the *Inverse Transformation Method* draw 1000 simulated values from T. Plot the histogram of the simulated values. Superimpose the density of the exponential random variable.

Problem 2.3. (25 points) Let X be a **double exponential** random variable with parameter $\lambda = 25$. Using the *Inverse Transformation Method* draw 1000 simulated values from T. Plot the histogram of the simulated values. Superimpose the density of the exponential random variable.

Problem 2.4. (25 points) Use *Monte Carlo* to estimate the expected distance of a randomly chosen point in a square to the center of that square.