MATH 358/658 Assignment 3

Due in class on Thursday, February 7.

1. An insurer has $n = 10,000$ automobile policies. Each files an unknown claim amount C_i, and the insurer expects that $E(C_i) = 240$ and $Var(C_i) = 800^2$. Let $S = C_1 + ...C_n$ be the sum of the $n = 10,000$ claims.

   (a) What is the probability that the sum of claims exceeds $2,600,000? While you may think this is identical to what we did in class, you will find I made a mistake and was off (by a factor of 1,000,000! Imagine that). So your job is to do it correctly. You should find the probability the losses exceed 2.6 million isn't big at all.

   (b) Briefly explain what mistake I made in class.

   (c) The insurer wants to set the premium Q to raise enough money to be profitable 95% of the time. Find Q. That is, find the value Q wuch that

   $$P(S > 10,000 \cdot Q) \leq 0.05$$

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   - Computer Problem: Look at `HW3Script.R` on Sakai, under Resources. This script helps you see how the Central Limit Theorem operates.

     1. The script involves simulating independent values X from an Exponential($\beta = .001$) density,
        $$f(x) = \beta \cdot e^{-\beta \cdot x} = 0.001 \cdot e^{-.001 \cdot x}.$$
        Show that $E(X) = 1000$ and $Var(X) = 1,000,000$.

     2. The script shows how to make a histogram of sample averages for n=1 and n=2. Copy and paste histograms for sample sizes of n=1, 5, 10, 50, 100, and 500.

     3. Show that the conditions for the Central Limit Theorem are satisfied, and describe how the CLT relates to the sequence of histograms.

     4. Show that the conditions for the Law of Large Numbers are satisfied, and describe how the LLN relates to this sequence of histograms.