STA261: Partial Solution to Assignment 1, Question 9

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This is a partial solution to Assignment 1, Question 9.

1. *Central Limit Theorem.* Suppose we measure the heights of n randomly selected people on the University of Toronto campus at lunchtime. Let $X_1 \dots X_n$ be the random variables that represent the heights we might measure, in cm. Suppose we know from a previous experiment that these heights have a mean of $160cm$ and a standard deviation of $20cm$. And suppose one more time that we measure $n = 100$ individuals.

Approximate the probability that the sample mean height of the people measured is greater than 170cm.

Solution: the question gives you $E(X_i) = 160$ and $Var(X_i) = 20^2$, so $E(\bar{X}) = 160$ and $Var(\bar{X}) = 20^2/100 = 4$. Then

$$\begin{aligned} P(\bar{X} > 170) &= P\left(\frac{\bar{X} - 160}{\sqrt{4}} > \frac{170 - 160}{\sqrt{4}}\right) \\ &\approx P\left(Z > 5\right) \\ &\approx 0 \end{aligned}$$