

Name: _____
MAT 222
Spring 2019
Homework 3

“Blackmail is such an ugly word. I prefer extortion. The ‘x’ makes it sound cool.”
–Bender, Futurama

Problem: A education policy maker is interested in how NYS High School students performed on the SAT Mathematics portion. She decides to take a SRS of 400 students. In order to see if the mean SAT Mathematics score has increased from the mean score of 502 in 2009, she tests

$$\begin{cases} H_0 : \mu = 502 \\ H_a : \mu > 502. \end{cases}$$

Assuming the population standard deviation is $\sigma = 100$ (based on information from the SAT Board), she decides to use a significance level of 0.01 that rejects H_0 if $\frac{\bar{x}-502}{100/\sqrt{400}} \geq 2.326$, or equivalently if $\bar{x} \geq 513.63$.

- Find $P(\text{Type I error})$.
- Find the probability of failing to reject the null hypothesis, if the null hypothesis is consistent with the data.
- Find the probability of a Type II error if $\mu = 512$.
- Is this test sufficiently sensitive to detect an increase of 10 points in the population mean of the SAT Mathematics score?