Homework 11
Experiment Design and Analysis

Option A: Assume that the one-way commute time of an U student from his or her home to their class at the U is a normally distributed random variable that we will call X. Furthermore, assume that the population standard deviation of X is $\sigma_0 = 10$ minutes. Let μ be the unknown population mean for X. In part (g), you will use $\mu_0 = 20$ minutes.

Option B: Come up with your own random variable X. For example, it could be the resistance of a resistor, or the run time of a particular executable. State an initial assumption for the population standard deviation of X, which you will call σ_0. State an initial hypothesis for the mean of X, calling it μ_0. Note that your assumed values may or may not be correct – they are a good guess and a starting point for this assignment. These values, σ_0 and μ_0, could be a from a data sheet, or from an expert's opinion (it may be that you are the expert). Note: If your random variable is anything asked of a person, please do not ask any private or sensitive information, and ask your instructor if there is any possibility for concern.

1. State which option you are doing (A or B, not both). If B, state what your random variable X is, and state your assumptions for the population standard deviation and population mean, σ_0 and μ_0.

2. Experimental design: Determine a minimum sample size such that we will be 95% confi- dent that the error will not exceed $\sigma_0/2$ when the sample average $\bar{X}$ is used to estimate the population mean μ. Let n denote this sample size.

3. Population: From what population are you sampling? For Option A, the population might be: U of U students in the class, or your U of U student friends on Facebook, for example. Describe how you collect the data – make sure this samples from your chosen population.

4. Data Collection: Collect a sample of size n from among your chosen population, and record their answers.

5. Mean Estimation I: Based on your sample, and your assumed known standard deviation σ_0, find a 95% confidence interval for μ. (Assume the central limit theorem applies.)

6. Mean Estimation II: Now assume that you don't know the population standard deviation, and use the t-distribution and the sample standard deviation S to find a 95% confidence interval for μ.

7. Test Hypothesis: Test the null hypothesis that the mean of X is μ_0 at the significance level $\alpha = 0.01$. The alternate hypothesis is that the mean commute time is not μ_0. You may assume that the standard deviation of X is known to be σ_0.