Assignment #1

IE 208: Applied Statistics

Due date: October 21, 2021 at 4:30 pm

Please note:

- You will receive no points for answers without explanation.
- Late submission is not allowed.
- You must submit your work through E-campus: no email submission.
- Prepare your answers in an Excel file and then submit the Excel file.
- 20 points for each question.
- Assume central limit theorem holds for even small sample sizes.

1. A sample of 30 data observations has a sample mean $\bar{x} = 14.4$ and a sample standard deviation of $s = 2.98$. Is it plausible that $\mu \geq 15$?

(a) Use a 95% one-sided confidence interval to show if $\mu \geq 15$ is plausible.

(b) Use a hypothesis test with a significance level of 5% to show if $H_0: \mu \geq 15$ is plausible.

(c) What is the acceptance region of the hypothesis test $H_0: \mu \geq 15$?

2. An engineer selects a sample dataset of 100 components at random and measures their strengths. It is reported that the average strength of the components is between 72.3 and 74.5 with a 99% confidence level.

(a) What is the sample standard deviation of the sample dataset?

(b) If a 99% two-sided confidence interval is desired with a length no longer than 2.0, about how many more components (in addition to the current 100 components) would you recommend be tested?

3. A random sample of 10 items gives $\bar{x} = 614.5$ and $s = 42.9$.

(a) Use a hypothesis test to determine whether there is sufficient evidence for the experimenter to conclude that the population average is not 600, when the significance level is 0.01.

(b) Construct a 99% two-sided confidence interval for the population average.

(c) If a 99% two-sided confidence interval for the population average is required with a total length no larger than 30, approximately how many additional items do you think need to be sampled?

4. A pizza store recently upgraded its delivery system. Two samples of delivery times in minutes were recorded before and after the upgrade as summarized below (all 80 delivery locations are randomly chosen). Use a significant level of 0.05 in the below tests.

Before	
n	40
$\bar{x}$	18.4
s_x	6.7

After	
m	40
$\bar{y}$	20.2
s_y	4.1

(a) Please perform a hypothesis test to show whether there is strong evidence that the average delivery time before and after the upgrade are different.

(b) Please perform a hypothesis test to show whether there is strong evidence that the upgrade was a success.

5. A restaurant recently upgraded its cooking system to reduce cooking time. Two samples of cooking times in minutes were recorded before and after the upgrade as shown in the table below. Use a significant level of 0.1 in the below tests.

Before	
n	30
$\bar{x}$	19.2
s_x	3.9

After	
m	31
$\bar{y}$	17.9
s_y	3.4

(a) Please perform a hypothesis test to show if there is strong evidence that the average cooking time before and after the upgrade are different.

(b) Please solve question (a) using the pooled variance method.