**Name**: ______________________ **Section: MAT098/181C-**

**MAT098/181C EXAM #4 (FORM C)**

*A scientific calculator is permitted.* ***Cellphones may not be used as calculators and must be off or on vibrate during the exam****. Show all work on the test or on the work*

1. A random sample of 200 persons from labor force of a large city are interviewed and 22 of them are found to be unemployed. Give a 95% confidence interval for the proportion of unemployment in that city. (*20 pts*)

a) Determine whether the conditions are met.

$p = \frac{22}{200} = 0.11$ $q = 1 - 0.11 = 0.89$ $np = 200(0.11) > 5$ *and* $nq = 200(0.89) > 5$

b) Construct the 95% confidence interval.

$$0.11 \pm 1.96\sqrt{\frac{(0.11)(0.89)}{200}}$$

$$0.11 \pm 0.043 = (0.067, 0.153)$$

2. A manager of a large production facility wants to determine the average time required to assemble furniture. A random sample of the time to produce 50 assembled furniture gave a mean of 20.4 minutes and a population standard deviation of 3.7minutes. Construct a 95% confidence interval for the average time it takes to produce assembled furniture. Round final answer to one decimal place. (*20 pts*)

$20.4 \pm \frac{(1.96)(3.7)}{\sqrt{50}}$

$20.4 \pm 1.0 = \quad (19.4, 21.4)$

3. How many BHCC students must be randomly selected to estimate the mean amount of time students spend on social media per day? We want 99% confident that the sample mean is within 75minutes of the population mean, and the population standard deviation is known to be 200 minutes. (*12 pts)*

$$n = \left(\frac{(2.575)(200)}{75}\right)^2 = 47.15 = 48$$

For the next three problems, state:
1) Null, Alternate Hypothesis, type of test & level of significance
2) Check the conditions.
3) Compute the sample test statistic, draw a picture and find the P-value.
4) State the conclusion about the Null Hypothesis.
5) Interpret the conclusion.

4. In a recent American College Student Survey, 92% of female college students rated the social network site Facebook as "cool." Assume that the survey was based on a random sample of 500 students. A marketing executive at Facebook wants to advertise the site with the slogan "More than 88% of female college students think Facebook is cool." Use a 0.05 significance level to test the claim that more than 88% of female college students think that Facebook is cool. (*24 pts)*

$Ho: p = 0.88 \qquad H1: p > 0.88$

np$= 500(0.92) > 5 \quad nq = 500(0.08) > 5$

$$z = \frac{0.92-0.88}{\sqrt{\frac{(0.88)(0.12)}{500}}} = \frac{0.04}{0.014533} = 2.75$$

p-value $= 0.0030$

Reject Ho.

We have sufficient evidence to support the claim that more than 88% of female college students think that Facebook is cool.

5. In a recent medical study, 76 subjects were placed on a low-fat diet. After 12 months, their sample mean weight loss was 2.2 kilograms, with a standard deviation of 6.1 kilograms. Use a 0.05 significance level to test the claim that the average weight loss is not 0 (zero). (*24 pts)*

$Ho: \mu = 0 \qquad H1: \mu \neq 0$

$z = \frac{\sqrt{76}(2.2-0)}{6.1} = 3.14$

p value = 2 P(z> 3.14) = 2(0.0008) = 0.0016

Reject Ho

We have enough evidence to support the claim that average loss is not 0 (zero)

(EXTRA CREDIT)

1. The mean number of absences a student has per semester is believed to be about 4 days. Faculty in a university does not believe this figure. They randomly survey 9 students. The number of absences they took for the last semester are as follows:

2, 0, 1, 5, 2, 4, 3, 5, 7

Let $x$ = the number of absences a student had for the last semester. Assume that $x$ follows a normal distribution. Should the faculty team believe that the mean number is 4 days? Round to one decimal place. (*5 pts*)

Mean= $\frac{2+0+1+5+2+4+3+5+7}{9} = 3.2$ Standard deviation = 2.2

**Ho:** $\boldsymbol{\mu = 4}$ $\boldsymbol{H1: \mu \neq 4}$

Test statistic =-1.0

P-value = 0.32

***Accept Ho for alpha = 0.05 or 0.01.***

We have enough evidence to accept the claim that a student average number of absences per semester is 4

2. A company that manufactures steel wires guarantees that the mean breaking strength (in kilonewtons) of the wires is greater than 50. They measure the strengths for a sample of wires and test

**$H_0$: $\mu = 50$ versus $H_1$: $\mu > 50$.**

If a Type I error is made, what conclusion will be drawn regarding the mean breaking strength? (***5 pts***)

Type I error is false rejection of the null hypothesis therefore the conclusion will be stating or claiming that "***The mean breaking strength is greater than 50 even though it is equal to 50"***

(Any statement similar to this should be accepted)

## Confidence Interval for Population Parameters

| **Concept** | **Population Proportion $\boldsymbol{p}$** | **Population Mean $\boldsymbol{\mu}$** | |
|---|---|---|---|
| **confidence interval formula** | $\hat{p} \pm Z_c \cdot \sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$ | $\sigma$ known<br>$\bar{x} \pm Z_c \cdot \frac{\sigma}{\sqrt{n}}$ | $\sigma$ unknown<br>$\mathrm{df} = n-1$<br>$\bar{x} \pm T_c \cdot \frac{s}{\sqrt{n}}$ |
| **sample size formula** | $\hat{p} = \frac{x}{n}$ known<br>$n = \hat{p} \cdot \hat{q} \cdot \left(\frac{Z_c}{E}\right)^2$<br>$\hat{p}$ unknown<br>$n = \frac{1}{4} \cdot \left(\frac{Z_c}{E}\right)^2$ | $n = \left(\frac{Z_c \cdot \sigma}{E}\right)^2$ | |

- 90% confidence interval: $Z_c \approx 1.645$
- 95% confidence interval: $Z_c \approx 1.960$
- 99% confidence interval: $Z_c \approx 2.576$

## Hypothesis Testing

| **Concept** | **Population Proportion $\boldsymbol{p}$** | **Population Mean $\boldsymbol{\mu}$** | |
|---|---|---|---|
| **test statistics** | $z = \frac{\hat{p} - p}{\sqrt{\frac{p(1-p)}{n}}}$ | $\sigma$ known<br>$z = \frac{\bar{x} - \mu}{\frac{\sigma}{\sqrt{n}}}$ | $\sigma$ unknown<br>$\mathrm{df} = n-1$<br>$t = \frac{\bar{x} - \mu}{\frac{s}{\sqrt{n}}}$ |

- If the P-value $< \alpha$, we reject the null hypothesis.
- If the P-value $\geq \alpha$, we fail to reject the null hypothesis.