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

MAT098/181C EXAM #4 (FORM D)

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 newspaper conducted an aggressive marketing campaign to check the number of customers who had their newspapers delivered to their doors. A random sample of 275 households showed102 has their newspaper delivered. Construct a 90% confidence interval for proportion of customers who have their newspapers delivered to their doors. (*20 pts*)

   a) Determine whether the conditions are met.

$p = \frac{102}{275} = 0.371, q = 1 - 0.371 = 0.629$

$$np = (275)(0.371) > 5$$

$$nq = 275(0.629) > 5$$

   b) Construct the 90% confidence interval.

$0.371 \pm 1.645\sqrt{\frac{(0.371)(0.629)}{275}}$

$0.371 \pm 0.048 = (\mathbf{0.323}, \mathbf{0.419})$

2. Many celebrities and public figures have Twitter accounts with large numbers of followers. However, some of these followers are fake, resulting from accounts generated by spamming computers. In a sample of 66 twitter audits conducted in December 2015, the mean percentage of fake followers was 19.7 with a population standard deviation of 8.4. Construct a 90% confidence interval for the mean percentage of fake Twitter followers. Round final answer to one decimal place. (*20 pts*)

$$19.7 \pm \frac{(1.645)(8.4)}{\sqrt{66}}$$

$$19.7 \pm 1.7 = (\mathbf{18},\ \mathbf{21.4})$$

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 90% 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)*

$$n = (\left(\frac{(1.645)(200)}{75}\right)^2 = 19.2 \approx 20$$

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. A nationwide survey of working adults indicates that only 60% of them are satisfied with their jobs. The president of a large company believes that less than 60% of employees at his company are satisfied with their jobs. To test his belief, he surveys a random sample of 150 employees, and 67 of them report that they are satisfied with their jobs. Can he conclude that less than 60% of employees at the company are satisfied with their jobs? Use the $\alpha = 0.05$ level of significance. (*24 pts)*

$Ho: p = 0.60 \qquad H1: p < 0.60$

$p = \frac{67}{150} = 0.45 \qquad q = 0.55 \qquad np = 150(0.45) > 5 \qquad nq = 150(0.55) > 5$

$z = \frac{0.45-0.60}{\sqrt{\frac{(0.60)(0.40)}{150}}} = -\frac{0.15}{0.04} = -3.75$

p-value = 0.0001

Reject Ho

There is enough evidence to support the claim that less than 60% of employees at the company are satisfied with their job.

5. A computer software vendor claims that a new version of its operating system will crash 6 times per year on average. A system administrator installs the operating system on a random sample of 65 computers. At the end of a year, the sample mean number of crashes is 6.8, with a standard deviation of 4.2. Use a 0.05 significance level to test the claim that the computer will not crash 6 times per year on average. (*24 pts)*

$Ho: \mu = 6 \qquad H1: \mu \neq 6$

$z = \frac{\sqrt{65}(6.8-6)}{4.2} = 1.23$

p-value = 2 P(z> 1.23) $= 2(0.1093) = 0.2186$

Accept Ho.

We do not have sufficient evidence to support the claim that the computers will not crash 6 times per year on average.

(EXTRA CREDIT)

1. The mean number of absences a student has per semester is believed to be about 5 days. Faculty in a university does not believe this figure. They randomly survey 10 students. The number of absences they took for the last semester are as follows:

4, 0, 1, 2, 2, 4, 8, 5, 1 ,4

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 5 days? Round to one decimal place. (*5 pts*)

$mean = \frac{4+0+1+2+2+4+8+5+1+4}{10} = 3.1$ Standard deviation =

Ho: $\mu = 5$ $H1: \ \mu \neq 5$

Test statistic = -2.5

P-value = 0.032

Accept Ho for alpha = 0.01 ***BUT*** **Reject Ho** at alpha =0.05

We have enough evidence to accept the claim that a student average number of absences per semester is 5

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

Type II error means false acceptance of the null hypothesis therefore the conclusion will be stating or claiming that ***" The mean breaking strength is 50 even though it is not".***

(Anything similar to the underlined conclusion should be accepted)

Confidence Interval for Population Parameters

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

- 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	$z = \dfrac{\hat{p} - p}{\sqrt{\dfrac{p(1-p)}{n}}}$	σ known $z = \dfrac{\bar{x} - \mu}{\frac{\sigma}{\sqrt{n}}}$	σ unknown $\mathrm{df} = n - 1$ $t = \dfrac{\bar{x} - \mu}{\frac{s}{\sqrt{n}}}$

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