MATH 3307

Test 3 Review

10 Multiple Choice Questions

(6 points each)

4 Free Response Questions

(10 points each)

A study is conducted to determine the difference in mean starting income between trade school graduates and college graduates. A 99% confidence interval was created, yielding a result of [1200, 2000].

Which of the following can be determined from this:

- ~~Which sample had the larger income.~~
- ~~Which sample had the larger sample size.~~
- ~~Whether sample or population standard deviation was known.~~
- **The difference in the sample means.**
- **The margin of error in the difference of the sample means.**

A two-sample z-test for proportions was performed to determine the difference in proportions for two samples with the result being [0.02, 0.06]. Determine the difference of the sample proportions and the margin of error.

Difference in Proportions: Center $\frac{0.02+0.06}{2}=\frac{0.08}{2}=0.04$

Margin of Error: $\frac{0.06-0.02}{2}=\frac{0.04}{2}=0.02$

0.06 – 0.04 = 0.02

0.04 – 0.02 = 0.02

A study was conducted with to determine the percentage of adults that have more than one job. A 99% confidence interval of [0.35, 0.50] was created. Describe the meaning of this interval.

We are 99% certain that the actual percentage of adults with more than one job falls between 35% and 50%.

A simple random sample of 10 students was selected to determine their commuting distance. The results are as follows:
35 23 12 25 30 19 22 31 27 24

Determine the 95% confidence interval for the true population mean.

```
assign("x",c(35,23,12,25,30,19,31,27,24))
mean(x)-qt(1.95/2,9)*sd(x)/sqrt(10)
1] 20.21412
mean(x)+qt(1.95/2,9)*sd(x)/sqrt(10)
1] 30.0081
```

[20.21, 30.01]

A simple random sample of 1000 students was selected to determine if they worked full-time while attending college full-time. Of the 1000 students 722 reported working full time. Determine the 90% confidence interval for the population proportion.

```
> phat=722/1000
> phat-qnorm(1.90/2)*sqrt(phat*(1-phat)/1000)
[1] 0.6986967
> phat+qnorm(1.90/2)*sqrt(phat*(1-phat)/1000)
[1] 0.7453033
```

[0.699, 0.745]

If the p-value in is larger than the confidence level, the researcher should ~~(a) Accept the H_o~~, ~~(b) Reject the H_o~~, **(c) Fail to Reject the H_o**, ~~(d) Accept the H_a~~

$p > \alpha$

You have created a confidence interval. When repeating the study, the width of the confidence interval has decreased. Which of the following may be also true:

- **The confidence level has decreased.**
- ~~The sample size has decreased.~~
- ~~The sample parameter has increased~~
- **The margin of error has decreased.**
- ~~The standard deviation or standard error has increased.~~

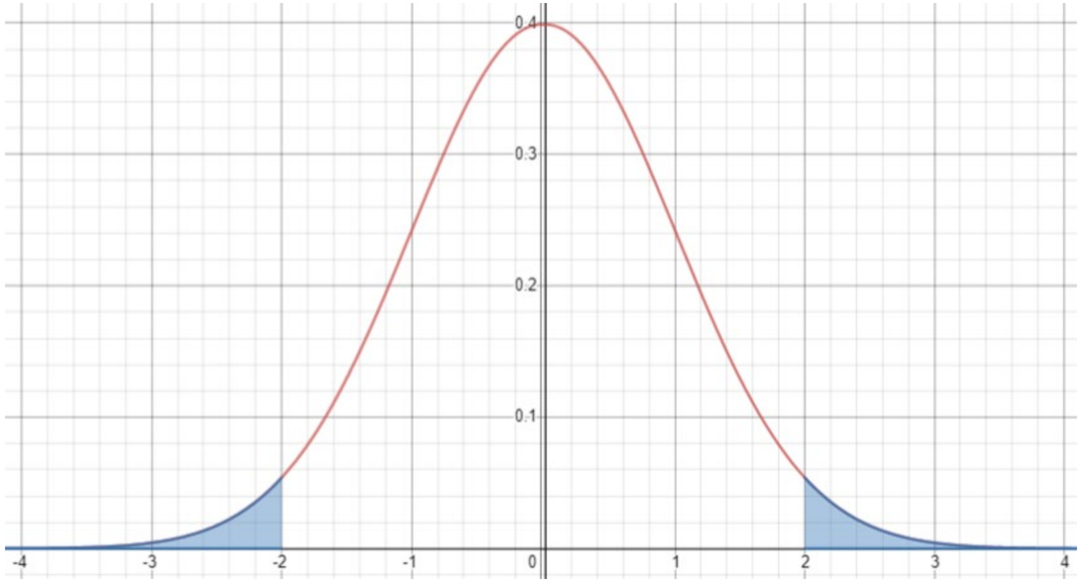
A population has a standard deviation of 0.03. You are selecting a sample to find the population mean with a confidence level of 95%. How large of a population should you select if you want a margin of error less than 0.004?

$$n = \left(\frac{z^{*}\sigma}{ME}\right)^{2}$$

```
(qnorm(1.95/2)*0.03/.004)^2
] 216.0821
```

n = 217 (always round up)

You run an experiment to test where
Ho: $\hat{p}$ = 0.34 and Ha: $\hat{p} \neq .34$. The value of your test statistic is z = 1.54. Determine the p-value.




```
2*pnorm(-1.54)
[1] 0.1235604
```

A cereal company claims that their marshmallow cereal contains the following shapes:

star	20%
heart	25%
diamond	15%
circle	35%
tree	5%

An actual box of cereal contained the following pieces:

star	212
heart	310
diamond	155
circle	223
tree	73

Use a $\chi 2$ Goodness of Fit Test to confirm the validity of the company's claim at a 10% significance level.

```
> assign("expper",c(.20,.25,.15,.35,.05))
> sum(expper)
[1] 1
> assign("obs",c(212,310,155,223,73))
> sum(obs)
[1] 973
> exp=expper*973
> exp
[1] 194.60 243.25 145.95 340.55  48.65
> sum((obs-exp)^2/exp)
[1] 73.19684
> 1-pchisq(73.197,4)
[1] 4.773959e-15
```

Test Statistic: 73.197

P-value: 0.00000000000000477

$p \approx 0 < \alpha = 0.10$

RHo: The company's claim is not correct

To determine the effectiveness of a video about traffic accidents on a group of new drivers, 100 new drivers had their maximum speed recorded while driving **before and after** the presentation. The mean difference was a decrease of 2.4 mph of speed with a standard deviation of 1.2. Determine if the video was effective at a 5% significance level.

- State the null and alternate hypothesis.

Ho: $\mu_D = 0$
Ha: $\mu_D < 0$

Since the same sample was tested twice, a matched pairs t-test must be used.

To determine the effectiveness of a video about traffic accidents on a group of new drivers, 100 new drivers had their maximum speed recorded while driving before and after the presentation. The mean difference was a decrease of 2.4 mph of speed with a standard deviation of 1.2. Determine if the video was effective at a 5% significance level.

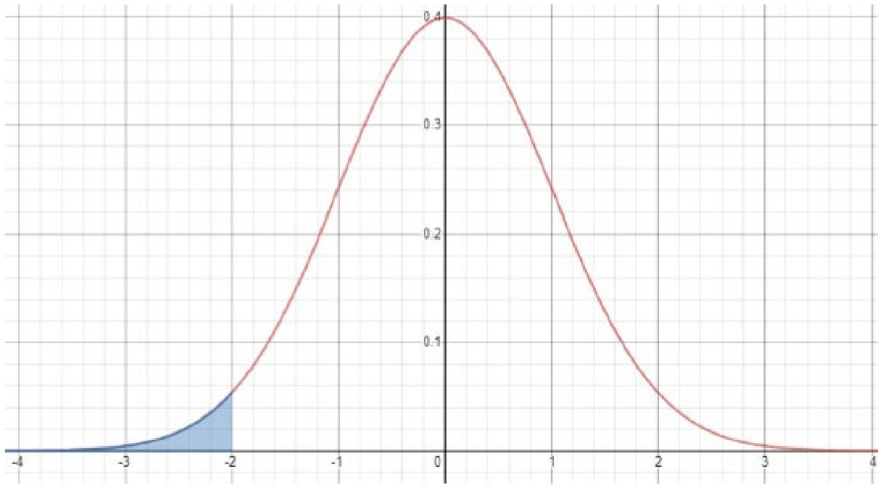
- Determine the rejection region.

```
> qt(0.05,99)
[1] -1.660391
```

$\alpha = 0.05$

df = 100 – 1 = 99

Rejection Region: $t < -1.660$



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- Calculate the Test Statistic.

$$t = \frac{(\bar{x} - \mu)}{\left({}^{s}/_{\sqrt{n}}\right)} = \frac{(-2.4 - 0)}{\left({}^{1.2}/_{\sqrt{100}}\right)} = -20$$

To determine the effectiveness of a video about traffic accidents on a group of new drivers, 100 new drivers had their maximum speed recorded while driving before and after the presentation. The mean difference was a decrease of 2.4 mph of speed with a standard deviation of 1.2. Determine if the video was effective at a 5% significance level.

- Determine the p-value.

```
pt(-20,99)
] 7.532224e-37
```

$p \approx 0$

To determine the effectiveness of a video about traffic accidents on a group of new drivers, 100 new drivers had their maximum speed recorded while driving before and after the presentation. The mean difference was a decrease of 2.4 mph of speed with a standard deviation of 1.2. Determine if the video was effective at a 5% significance level.

- State your conclusion.

Option 1:
Since the test statistic ($t = -20$) falls within the rejection region ($t < -1.660$), RHo.

Option 2:
Since the p-value ($p \approx 0$) < alpha ($\alpha = 0.05$), RHo

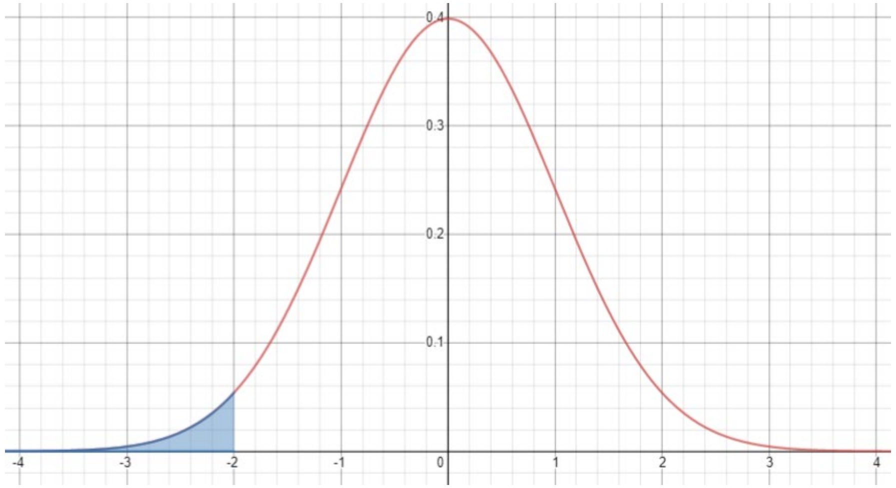
A prep school claims that 85% of their graduates are accepted to Ivy League schools. You believe that the <u>**proportion is less than that**</u>. To investigate, you find an SRS of 350 of their graduates and discover that 265 of them were accepted into Ivy League schools. We will test the claim at a 2% significance level.

- State the null and alternate hypothesis:

Ho: $p = 0.85$
Ha: $p < 0.85$

A prep school claims that 85% of their graduates are accepted to Ivy League schools. You believe that the proportion is less than that. To investigate, you find an SRS of 350 of their graduates and discover that 265 of them were accepted into Ivy League schools. We will test the claim at a 2% significance level.

- Sketch and state the rejection region.




```
qnorm(0.02)
1] -2.053749
```

z < -2.054

A prep school claims that 85% of their graduates are accepted to Ivy League schools. You believe that the proportion is less than that. To investigate, you find an SRS of 350 of their graduates and discover that 265 of them were accepted into Ivy League schools. We will test the claim at a 2% significance level.

- Calculate the test statistic.

```
phat=265/350
(phat-.85)/sqrt(.85*(1-.85)/350)
1] -4.865128
```

A prep school claims that 85% of their graduates are accepted to Ivy League schools. You believe that the proportion is less than that. To investigate, you find an SRS of 350 of their graduates and discover that 265 of them were accepted into Ivy League schools. We will test the claim at a 2% significance level.

- Determine the p-value for your test.

```
pnorm(-4.865128)
1] 5.719138e-07
```

$p \approx 0$

A prep school claims that 85% of their graduates are accepted to Ivy League schools. You believe that the proportion is less than that. To investigate, you find an SRS of 350 of their graduates and discover that 265 of them were accepted into Ivy League schools. We will test the claim at a 2% significance level.

- State your conclusion.

Option 1: $p < \alpha$
Option 2: z is in the Rejection Region

Reject the Null Hypothesis (RHo)

A study shows that a family of four, on average, spends \$255 per week on groceries. You believe that this **amount is incorrect**. To test your hypothesis, you select 35 local families of four and calculate their average grocery budget to be \$295 with a standard deviation of \$12.3 Test this claim using a significance level of 5%.

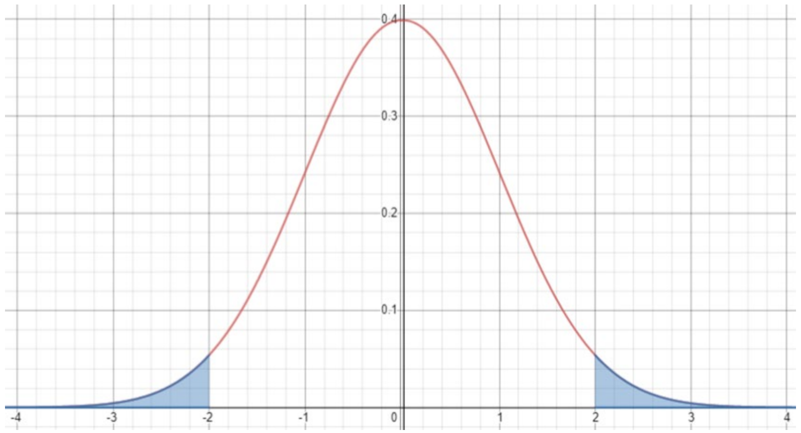
- State your null and alternate hypothesis

Ho: $\mu = 255$
Ha: $\mu \neq 255$

A study shows that a family of four, on average, spends \$255 per week on groceries. You believe that this amount is incorrect. To test your hypothesis, you select 35 local families of four and calculate their average grocery budget to be \$295 with a standard deviation of \$12.3 Test this claim using a significance level of 5%.

- Sketch and state the rejection region.

```
qt(0.05/2,34)
1] -2.032245
```



$t < -2.032$ or $t > 2.032$

A study shows that a family of four, on average, spends \$255 per week on groceries. You believe that this amount is incorrect. To test your hypothesis, you select 35 local families of four and calculate their average grocery budget to be \$295 with a standard deviation of \$12.3 Test this claim using a significance level of 5%.

- Calculate your test statistic.

```
(295-255)/(12.3/sqrt(35))
1] 19.23928
```

A study shows that a family of four, on average, spends \$255 per week on groceries. You believe that this amount is incorrect. To test your hypothesis, you select 35 local families of four and calculate their average grocery budget to be \$295 with a standard deviation of \$12.3 Test this claim using a significance level of 5%.

- Calculate your p-value.

```
2*pt(-19.23928,34)
1] 7.497357e-20
```

$p \approx 0$

A study shows that a family of four, on average, spends \$255 per week on groceries. You believe that this amount is incorrect. To test your hypothesis, you select 35 local families of four and calculate their average grocery budget to be \$295 with a standard deviation of \$12.3 Test this claim using a significance level of 5%.

- Draw your conclusion.

Option 1: $p < \alpha$
Option 2: t is in the Rejection Region

Reject the Null Hypothesis (RHo)