Warm-Up p. 479 #29 – Assume conditions have been met.

Hypotheses:
H_0: $p = 0.90$
H_A: $p < 0.90$
All conditions have been met to use the Normal model for a 1 proportion z-test.

Mechanics $p = 0.90; n = 122; \hat{p} = \frac{103}{122}; \alpha = 0.05$

$$z = \frac{\frac{103}{122} - 0.90}{\sqrt{\frac{(0.90)(0.10)}{122}}} = -2.052$$

P-Value = P(z < -2.052) = 0.0201

Conclusion:
Since the P-Value is smaller than alpha (0.0201 < 0.05), we reject the null hypothesis.
There is statistically significant evidence that the true proportion of lost luggage that is returned is less than 90%.

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1. What is Type I Error in this context?
That we state the proportion of lost luggage that is returned is less than 90% but it is still 90%.

2. What is Type II Error in this context?
That we state the proportion of lost luggage that is returned is not less than 90% but it is less than 90%.

3. What is Power in this context?
The probability that we state the proportion of lost luggage that is returned is less than 90% and it is less than 90%.

What does P-Value mean?

There is P-Value% chance of getting a sample proportion of $\hat{p}$ or (lower/higher/more extreme) if the true proportion of context is really p.

P-Value = 2.01% $\hat{p} = \frac{103}{122} = .8443$ $p = .9$

There is 2% chance of getting a sample proportion of 84.4% or lower if the true proportion of lost luggage returned is really 90%.

p. 499 #2(b,c)

1) Write the appropriate hypotheses
2) Describe Type I Error in context
3) Describe Type II Error in context
4) Describe the Power in context

b) 2-Tailed.

1) H_0: $p = 0.10$ The proportion of students that applied for study abroad is 10%.
H_A: $p \neq 0.10$ The proportion of students that applied for study abroad is not 10%.

2) Type I Error: We state that the proportion of students that applied for study abroad is not 10% when is still is 10%.

3) Type II Error: We state that the proportion of students that applied for study abroad has not changed from 10% when it has changed from 10%.

4) Power: The probability that we state that the proportion of students that applied for study abroad is not 10% when is not 10%.

c) 1-tailed
1) H_0: $p = 0.22$ The proportion of patients taking the new drug that experience headache relief is 22%.
H_A: $p > 0.22$ The proportion of patients taking the new drug that experience headache relief is more than 22%.

2) Type I Error: We state that the proportion of patients taking the new drug that experience headache relief is more than 22% when it is still 22%.

3) Type II Error: We state that the proportion of patients taking the new drug that experience headache relief is not more than 22% when it is more than 22%.

4) Power: The probability that we state that the proportion of patients taking the new drug that experience headache relief is more than 22% and it is more than 22%.

Practice 1:
p. 499 #5,7,9

assume conditions have been met

5. Alpha
Results were statistically significant at 5%.
(P-Value < 0.05)

- They would also be statistically significant at 10%.
- Since the P-Value is not given I can't tell if it is below 1% as well.

7. Significant?

H_0: p = 0.90 $\hat{p} = 0.894$

H_A: p < 0.90 $P - Value = 0.011$

a) There is a 1.1% chance of getting a sample proportion of 89.4% or less if the true proportion of children that have been vaccinated is 90%.

b) There is very little difference between 90% and 89.4%. But even a 0.6% difference when considering 1,000,000 children would be 6,000 children which would be important.

9. Success

a) 98% Confidence Interval

Conditions:

1. Random: Stated as a random sample
2. 10% Condition: 1302 men is less than 10% of all men
3. Success/Failure: $n\hat{p} = 39 \geq 10$

$n\hat{q} = 1263 \geq 10$

All conditions have been met to use the Normal model for a 1 proportion z-interval.

$$\frac{39}{1302} \pm 2.326\sqrt{\frac{\left(\frac{39}{1302}\right)\left(\frac{1263}{1302}\right)}{1302}}$$

(0.0190, 0.0409)

We are 98% confident that the true proportion of men that said their most important measure of success was their work lies between 1.9% and 4.1%.

b) H_0: $p = 0.05$; H_A: $p < 0.05$

Since our confidence interval falls completely below 5%, there is strong evidence that the proportion of men that judge their success primarily through work is less than 5%.

c) Since we used 98% confidence and it was a 1-Tailed test, the level of significance would be 1%.

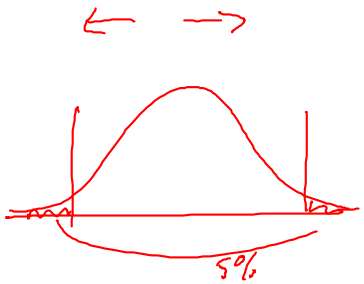
Significance Level -vs- Confidence Level

2 Tail Tests

Given α

Confidence Level = 1 – α

$\alpha = .05 \rightarrow 95\%$



Given Confidence Level

α = 1 – C.L.

$90\% \rightarrow \alpha = .10$

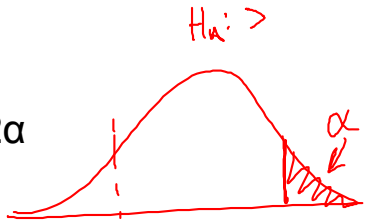
Significance Level -vs- Confidence Level

1 Tail Tests

Given α

Confidence Level = 1 – 2α

$\alpha = .05 \rightarrow 90\%$



Given Confidence Level

α = (1 – C.L.)÷2

$98\% \rightarrow \alpha = .01$

Practice Worksheet

1. Does this indicate that Americans are finding more jobs this year? Use a 5% level of significance.

H_0: $p = .11$ 11% of Americans are unemployed this year.
H_A: $p < .11$ Less than 11% of Americans are unemployed this year.
All conditions have been met to use the Normal model for a 1 proportion z-test

$$n = 1430 \quad p = 0.11 \quad \hat{p} = \frac{136}{1430} = 0.095 \quad \alpha = 0.05$$

$$z = \frac{\left(\frac{136}{1430}\right) - 0.11}{\sqrt{\frac{(0.11)(0.89)}{1430}}} = -1.800$$

P-Value = P(z < -1.800) = 0.0359

Conclusion:
Since the P-Value is less than alpha(0.0359 < 0.05), we reject the null hypothesis. There is statistically significant evidence that the proportion of Americans that are unemployed is less than 11%.

2. P-Value
There is a 3.59% chance of getting a sample proportion of 9.5% or one lower if the true proportion of Americans that are unemployed is really 11%.

3. 90% Confidence interval:
All conditions have been met to use the Normal model for a 1 proportion z-interval.

$$CI: \frac{136}{1430} \pm 1.645\sqrt{\frac{\left(\frac{136}{1430}\right)\left(\frac{1294}{1430}\right)}{1430}}$$

(0.0823,0.1079)

We are 90% confident that the true proportion of Americans that are unemployed lies between 8.23% and 10.79%.

4. Type I Error
We state the proportion of Americans who are unemployed is less than 11% but it still is 11%.

5. Type II Error
We state the proportion of Americans who are unemployed is not less than 11% but it is less than 11%.

6. Power
The probability that we state the proportion of Americans who are unemployed is less than 11% and it is less than 11%.

7. n = 400
Type I Error – Stays the same
Type II Error – Increases
Power – Decrease

p. 478 #23.

a) Run the full test with 5% level of significance
b) What Confidence Level would match this level of significance?
c) What does P-Value mean in this context?
d) What would a Type I error be in context?
e) What would a Type II error be in context?
f) What type of error could your conclusion have met?
g) What would the Power be in context?
h) Suppose that a new sample was taken with 250 readers. A new test is run with the same level of significance(5%). How would the Type I Error, Type II Error, and Power be affected by this change?

Hypotheses:
H_0: p = .25
H_0: p > .25
Conditions:
1. Random: stated as a random sample
2. 10% Condition: 500 subscribers is less than 10% of all subscribers
3. Success/Failure: np = 500*0.25= 125 ≥ 10
nq = 500*0.75= 375 ≥ 10

All conditions have been met to use the Normal model for a 1-proportion z-test.
Mechanics:

$$z = \frac{\left(\frac{137}{500}\right) - 0.25}{\sqrt{\frac{(0.25)(0.75)}{500}}} = 1.239$$

P-Value = P(z > 1.239) = 0.1076

Conclusion:
Since the P-Value is greater than alpha(0.1076 > 0.05), we fail to reject the null hypothesis. There is not enough statistically significant evidence that the proportion of current readers that will subscribe to the online edition is over 25%.

b) What Confidence Level would match this level of significance?

90%

c) Explain what the P-Value means in this context.

There is a 10.8% chance of getting a sample proportion of 27.4% or higher if the true proportion of readers that subscribe to the online edition is 25%.

d) What is a Type I Error in this context?
We stated that the proportion of current readers that subscribe to the online edition is more than 25% but in fact it is not.

e) What is a Type II Error in this context?
We stated that the proportion of current readers that subscribe to the online edition is not more than 25% but in fact it is greater.

f) Type II Error

g) Describe what power means in this context.
Power is the probability that we stated that the proportion of current readers that subscribe to the online edition is more than 25% but in fact it is more than 25%.

h) Suppose the test was run with a level of significance of 1%. How would the Type I Error, Type II Error, and Power be affected by this change?

Type I Error – Decrease
Type II Error – Increases
Power – Decreases

i) Suppose that a new sample was taken with 750 readers. A new test is run with the same level of significance(5%). How would the Type I Error, Type II Error, and Power be affected by this change?

Type I Error – Remains the same
Type II Error – Decrease
Power – Increase