Review and Practice – Chapters 8 & 9

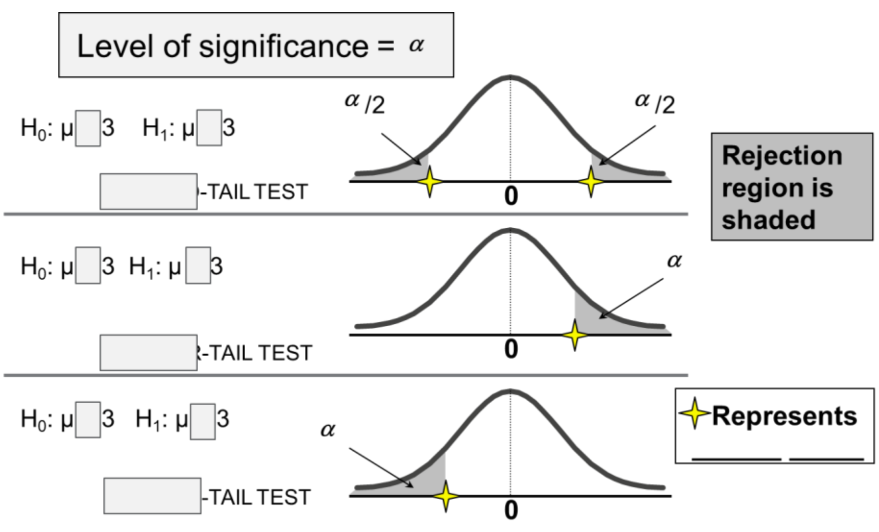
<u>Some important vocabulary:</u>

Type I and Type II errors
P-value
Degrees of freedom
Confidence level
Level of significance
Margin of error
Descriptive vs. Inferential statistics
Null vs. Alternative hypothesis
Point estimate vs. Interval estimate
Reject vs. Do not (fail to) reject

<u>You should know how to:</u>

Use the Z and t tables to find critical values
Determine the sample size for a given margin of error and confidence level
Calculate a margin of error
Construct a confidence interval for mean or proportion
Find a p-value
Know when to use a left-tail, right-tail, or 2-tail tests of hypothesis
Conduct a hypothesis test for mean or proportion

Possible Hypothesis Test Outcomes		
	Actual Situation	
Decision	H_0 True	H_0 False
Do Not Reject **H**		
Reject **H_0**		



Chapter 8 – Estimation

Practice finding the following confidence intervals for mean and proportion

A. In an article it was stated that baseball players were paid an average of $150 per autograph. You suspect this price is too high. The population standard deviation is known to be $22 for this distribution. You find that a random sample of 800 such autographs yields a mean of $135 per autograph. Find a 95% confidence interval for the true mean price of an autograph.

Will we use z or t? ________ Why? ____

What is the z or t critical value based on 95% confidence? ________

What is the standard deviation of the sampling distribution of the mean? ________

Calculate the margin of error: E = __________________________

Confidence interval: ____

B. The high cost of health care is a matter of major concern for a large number of families. A random sample of 25 families found that they spend an average of $143 per month and the standard deviation of the sample was found to be $28. Find the 98% confidence interval for the true mean cost of health care per month. Assume the underlying population from which the sample is drawn is known to be normally distributed.

Will we use z or t? ________ Why? ____

What is the z or t critical value based on 98% confidence? ________

What is the standard deviation of the sampling distribution of the mean? ________

Calculate the margin of error: E = __________________________

Confidence interval: ____

C. According to data from Cosmopolitan magazine, 64% of Americans say there is never enough time in the day to get things done. Suppose this percentage is based on a random sample of 900 Americans. Find the 90% confidence interval for the true proportion of Americans who hold this belief.

Will we use z or t? ________ Why? ____

What is the z or t critical value based on 90% confidence? ________

What is the standard deviation of the sampling distribution of the mean? ________

Calculate the margin of error: E = __________________________

Confidence interval: ____

Practice determining the sample size needed for the given confidence level and desired margin of error.

D. A city planner wants to estimate, with a 97% confidence level, the average monthly residential water usage in the city. Based on earlier data, the population standard deviation of water usage is 389.6 gallons. How large a sample should be selected so that the planner's estimate is within 100 gallons of the population mean?

E. Assume that a preliminary study has shown that 93% of all Tony's Pizza deliveries are delivered within their promised 30 minutes. How large should the sample size be so that the 99% confidence interval for the population proportion has a margin of error of 0.02?

Chapter 9 – Hypothesis Testing

Practice conducting hypothesis tests for mean and proportion

Use either *p-value* or *critical value* approach for your tests. (Round decimals to three decimals)

A. A consumer advocacy group suspects that a local supermarket's 10-ounce packages of cheddar cheese actually weigh less than 10 ounces. The distribution of this cheese is known to be normal with a standard deviation equal to 0.15 ounces. A sample of 20 packages were analyzed and the mean weight was 9.955 ounces.

Using the sample data and a 1% significance level, are you able to conclude that the mean weight of the cheese is actually less than 10 ounces?

State the hypotheses____

Will you use z or t? ________ Why? ____

Describe your test in terms of the sampling distribution. A bell curve is a great way to visualize it!

p-value approach	*critical value approach*
What will prompt you to reject H_0? ______________________________________ Calculate the Test Statistic: What is the p-value? ______________________	What is the 'critical' z or t value? ___________ What will prompt you to reject H_0? ______________________________________ Calculate the Test Statistic:

Evaluate the results.

Make the appropriate comparison: ____

Do you reject or fail to reject H_0? __________________________

Conclusion (in words): ____

____

B. The average salary for nurses was reported to be $54,574. A random sample of 1000 nurses yielded a mean salary of $56,300 with a standard deviation of $6500. Using the 2.5% significance level can you conclude that the current mean salary for nurses exceeds $54,574?

State the hypotheses____

Will you use z or t? ________ Why? ____

Describe your test in terms of the sampling distribution. A bell curve is a great way to visualize it!

p-value approach	*critical value approach*
What will prompt you to reject H_0? ______________________________________ Calculate the Test Statistic: What is the p-value? ______________________	What is the 'critical' z or t value? ___________ What will prompt you to reject H_0? ______________________________________ Calculate the Test Statistic:

Evaluate the results.

Make the appropriate comparison: ____

Do you reject or fail to reject H_0? __________________________

Conclusion (in words): ____

____

C. Reportedly, 60% of U.S. companies did not pay federal taxes from 1996 to 2000. You are skeptical of this and you investigate. You find that in a random sample of 300 U.S. companies, 186 of these did not pay federal taxes during this time span. Testing the claim at the 2% level of significance, can you conclude that the percentage of companies that didn't pay federal taxes is actually higher than 60%?

State the hypotheses____

Will you use z or t? ________ Why? ____

Describe your test in terms of the sampling distribution. A bell curve is a great way to visualize it!

p-value approach	*critical value approach*
What will prompt you to reject H_0? ____	What is the 'critical' z or t value? ____________
Calculate the Test Statistic:	What will prompt you to reject H_0? ____
What is the p-value? _______________________	Calculate the Test Statistic:

Evaluate the results.

Make the appropriate comparison: ____

Do you reject or fail to reject H_0? ___________________________

Conclusion (words) ____

____

Answers:

CHAPTER 8

A) \$133.48 to \$136.52 B) \$129.04 to \$156.96 C) 0.614 to 0.666 D) n = 72 E) n = 1084

CHAPTER 9

A) H_0: $\mu \geq 10$ H_1: $\mu < 10$
Using a z test for mean because σ is known; looking for evidence to reject H_0 in the left tail
The value of the test statistic is z = -1.34 and
- The p-value is 0.0901
- The rejection region is anything less than the critical value of z = -2.33

Comparison:
- The p-value is not less than the level of significance (α = 0.01)
- The test statistic is not in the rejection region (-1.34 > -2.33)

Conclusion: Fail to reject the null; there is not enough evidence to say that the mean number of ounces of cheese in the packages is less than 10 ounces.

B) H_0: $\mu \leq \$54,574$ H_1: $\mu > \$54,574$ Will we use z or t? t (test for mean, sigma unknown)
Using a t test because σ is not known (only have *s*); looking for evidence to reject H_0 in the right tail
The value of the test statistic is t = 8.40 and
- The p-value is less than 0.001
- The rejection region is anything more than the critical value of z = 1.96

Comparison:
- The p-value is less than the level of significance (α = 0.025)
- The test statistic is in the rejection region (8.4 > 1.96)

Conclusion: Reject the null; there is evidence to say that the mean salary for nurses exceeds \$54,574.

C) H_0: $p \leq 0.60$ H_1: $p > 0.60$ Using a z test of a proportion (n*p and n*q are both greater than 5)
The value of the test statistic is z = 0.71 and
- The p-value is 0.2389 (1 – 0.7611)
- The rejection region is anything more than the critical value of z = 2.05

Comparison:
- The p-value is less than the level of significance (α = 0.025)
- The test statistic is not in the rejection region (0.71 < 2.05)

Conclusion: Do not reject the null; there is not enough evidence to say that the proportion of companies not paying federal taxes is greater than the reported 60%.