Chapter 9 Notes

Section 9.1 Notes
Confidence Interval for Mean

Statistic ± (critical value)(standard deviation of statistic)

If we know the population standard deviation, we can still use the *z* critical value.

<u>Example</u>:
30 students were randomly selected from a large group of students taking a certain Algebra test. The mean score for the students in the sample was 87. Assume that $\sigma = 6.5$. Construct a 99% confidence interval for the mean score of all students taking the test.

However…Knowing the population standard deviation is NOT very likely…

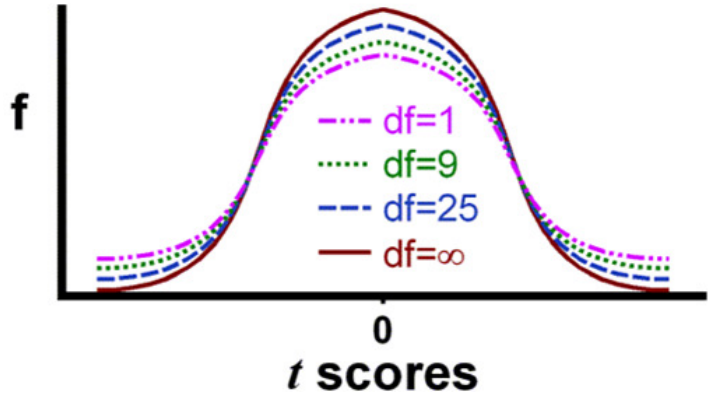
_____: the number used in the denominator when you calculate the standard deviation, *s*.

To find: _____

<u>Example</u>:
A sample size of n = 28 is a simple random sample selected from a normally distributed population. Find the critical value *t* corresponding to a 95% confidence level.

Important properties of the Student *t* Distribution:

1. The Student *t* distribution is different for _____.



2. The Student *t* distribution has the same general _____ shape as the standard normal distribution, but it reflects the _____ (with wider distributions) that is expected with small sizes.
3. The Student *t* distribution has a mean of _____ (just as the standard normal distribution has a mean of _____).
4. The _____ of the Student *t* distribution varies with the sample size, but it is _____ (unlike the standard normal distribution, which has _____.)
5. As the sample size n gets _____, the Student *t* distribution gets closer to the _____.

CONDITIONS:

1) The sample is a _____.
2) The sample must either be _____ or the sample has to be _____.
3) The population size must be at least _____ as large as the sample.

Confidence Interval for Mean: _____

Margin of Error: _____

<u>Example</u>:
A random sample of 15 movie patrons result in a mean IQ score of 103.0 and a standard deviation of 14.7. The 15 IQ scores appear to come from a normally distributed population. Construct a 95% confidence interval of the mean IQ of all movie patrons. Can we safely say that movie patrons have a mean IQ score greater than 100?

Section 9.2 Notes

A Significance Test for a Mean

#1: Give the name of the test and check the conditions for its use.
For a mean, three conditions must be met:

1) The sample is a _____
2) The sample must either be _____ or the sample has to be _____.
3) The population size must be at least _____ as large as the sample.

#2: State the hypotheses, defining any symbols.

H_0: _____ H_a: _____

#3: Compute the test statistic, and find the critical values, and the *P*-value. Include a sketch that illustrates the situation.

Test Statistic: _____

#4: Write a Conclusion. (Two Parts)

- Determine whether to reject or fail to reject the null hypothesis, linking the reason to the *P*-value or to the critical values.
- Tell what your conclusion means in the context of the situation.

<u>Example</u>:
The world's smallest mammal is the bumblebee bat. Listed below are weights (in grams) from a sample of these bats.

1.7	1.6	1.5	2.0	2.3	1.6	1.6	1.8	1.5	1.7	2.2	1.4	1.6	1.6	1.6

Test the claim that these bats come from the same population having a mean weight equal to 1.8.

Section 9.3 Notes
When Things Aren't Normal

The Effects of Skewness and Outliers

If the sample size is small and if the underlying distribution is highly skewed rather than normal or has extreme outliers, than the "capture rate" of the confidence interval or significance test will be _____ than advertised.

Try a Transformation.
Two common transformations:

1) _____: often useful when the distribution is skewed right.
2) _____: often useful if the data are ratios.

Example: p. 613, #E48

Do the Analysis with and without the Outliers.

If both analyses lead to the _____, then you're all set. If the two conclusions _____, you need more data.

Get a Large Sample Size

15/40 Guideline for Inference Using *t*-procedure

- Sample size _____: Your data MUST look like it came from a normal distribution – little skewness, no outliers.
- Sample size _____: Skewed distributions should be transformed or do analyses with and without outlier.
- Sample size _____: Skewness will not reduce capture rates since sample size is large enough.

Section 9.4 Notes
Inference for the Difference Between Two Means

Confidence Interval and Significance Tests
Two-Sample *t*-interval

Conditions:

- The two samples were _____ and _____ selected from two different populations. (In the case of experiments, the two treatments are randomly assigned to the available experimental units.)
- The two samples look as if they came from _____ population *or* the sample sizes are _____
- In the case of sample surveys, the population should be at least _____ larger than the sample size for both samples.

Confidence Interval Calculation:

_____

CI Interpretation in Context:

- You are 95% confident that if you knew the mean of both populations, the difference between those means, μ_1-μ_2, would lie in the confidence interval.
- For an experiment: If all experimental units could have been assigned to each treatment, you are 95% confident that the difference between the means of the two treatment groups would lie in the confidence interval.

<u>Example</u>:
You randomly select 6 boxes of Brand A cereal and 9 boxes of Brand B cereal and count the number of raisins per box. Use the data below to estimate a 90 percent confidence interval for the difference between the number of raisins in Brand A and Brand B.

Brand	n	$\bar{x}$	s
A	6	102.1	12.3
B	9	93.6	7.52

Forms of H_0 and H_a:

H_0: _____

H_a: _____

_____

_____

Test Statistic:

_____

<u>Example</u>:
Does right- or left-handedness affect how fast people type? Random samples of students from a typing class are given a typing speed test (words per minute), and the results are compared. Use a significance level for the test of 0.10.

Brand	-handed	n	$\bar{x}$	s
1	right	16	55.8	5.7
2	left	9	59.3	4.3

Getting the Most Power Out of Your Two-Sample *t*-Test

- The best way to get more power is to have _____ sample sizes.
  - If the population standard deviation are equal, make the sample sizes _____
  - If one population standard deviation is larger than the other, take a _____ sample from the _____ standard deviation.
- Follow these same rules to get the smallest margin of error for a confidence interval.

Pooled vs Unpooled

- If the population means seem to be the same, then the population standard deviations should also be the same.
- If the population standard deviations are the same, you can use the "pooled" option on the two-sample *t*-test.
  - For the purposes of this class, only use "pooled" if the problem specifically tells you to assume that $\sigma_1 = \sigma_2$.
  - In almost all cases, we will use the "unpooled" procedure.

Section 9.5 Notes
Paired Comparison

Three Design Studies:

1. _____
2. _____
3. _____

Conditions:

1. _____
   a. Random sample from a population
   b. Treatment randomly assigned within unit
   c. If the same subject has both treatments, they should be assigned in random order.
2. _____
3. _____: population should be at least ten times as large as the sample size.

Confidence Interval for the mean difference from paired observations

_____

Significance Test for the mean difference from paired observations

Test Statistic: _____

EXAMPLE:

Police trainees were seated in a darkened room facing a project screen. Ten difference license plates on the screen, one at a time, for 5 seconds each, separated by 15-second intervals. After the last 15-second interval, the lights were turned on and the police trainees were asked to write down as many of the 10 license plate numbers as possible, in any order at all. A random sample of 15 trainees who took this test were then given a week-ling memory training course. They were retested. The results are shown in the table below. Test, at the 5% level of significance, that the memory course improved the ability of the trainees to correctly identify license plates.

A: # plates correctly identified after training	B: # plates correctly identified before training	Difference A - B
6	6	0
8	5	3
6	6	0
7	5	2
9	7	2
8	5	3
9	4	5
6	6	0
7	7	0
5	8	-3
9	4	5
8	5	3
6	4	2
8	6	2
6	7	-1

Mean of DIFFERENCE column	1.5333
Standard Deviation for DIFFERENCE column	2.1996