STA 205 STUDENT LEARNING OBJECTIVES

to accompany *Statistics: From Data to Understanding, 2nd ed.,* by Dietrich and Snodgrass

For any assignments or homework exercises that are collected students will create a neatly presented word document. This document will always include:

- **Supporting StatCrunch analyses that are copied into the document.**
- **Well written, grammatically correct, sentences for any interpretations or explanations.**

More details about such documents will be discussed in class.

Section 1.1

- Students will be able to identify **statistics** that are calculated for a specific example.

Section 1.2

- Students will be able to discuss how the science of **statistics** is used in a particular example for making interpretations, decisions, estimates, predictions, etc.

Section 2.1

- Students will be able to identify specific sets of data as either **quantitative** or **qualitative**.

Section 2.3

Students will be able to

- Use StatCrunch to construct a **histogram**.
- Fully interpret the following information provided by a histogram.
  - Describe **the shape: symmetric, right-skewed, or left-skewed**.
  - State what **the typical (central) values** are.
  - State what the **smallest and largest values** are.
  - State what values are **atypical or unusual**, if appropriate.

Section 2.4

- Students will be able to identify the **population, sample**, and what a **statistical inference** is for a specific example.

Section 2.5

- Students will be able to identify a sample as being **random, convenient (haphazard), or self selected (volunteer)** for a specific example.

Section 3.1

Students will be able to

- Calculate the **mean** and **median** of a sample (using StatCrunch for large sets of data).
- Explain what the symbols $\bar{x}$ and μ represent.
- Explain why the **mean and median have different relative values for symmetric and skewed distributions** of data.

Section 3.2

Students will be able to

- Calculate the **standard deviation** using StatCrunch for any set of data.
- Explain what the symbols s^2, s, σ^2 **and** σ represent.
- Describe the **properties of the standard deviation**.
- Use **the Empirical Rule** to describe sets of data.

Section 3.3

- Students will be able to use a **sampled observation to make an inference**, and explain the reasoning.

Section 4.1

- Students will be able to describe what a **normal distribution** is.

Section 4.2

- Students will be able to calculate a **z-score** and calculate the **proportion of measurements that fall under any part of a normal distribution**.

Section 4.3

- Students will be able to calculate the **probability** that values of a normally distributed variable occur.

Section 4.4

- Students will be able to calculate **the value of a normally distributed variable corresponding to any given proportion (or probability)**.

Section 4.5

- Students will be able to make **inferences using the normal distribution**, and explain the reasoning.

Section 5.1

Students will be able to

- Identify and explain what **the parameter and statistic** are for any specific example.
- Explain what the symbols $\mu_{\bar{x}}$ and $\sigma_{\bar{x}}$ represent.
- Calculate the **mean** and **standard deviation (standard error)** of the sample mean, $\bar{x}$.
- Explain when the **sampling distribution of $\bar{x}$ is approximately normal**.
- Calculate **probabilities** using the **normal sampling distribution of $\bar{x}$.**

Section 5.2

Students will be able to

- Explain what the symbols p **,** π**,** μ_p and σ_p represent.
- Be able to calculate the **mean** and **standard deviation (standard error)** of the sample proportion, p.
- Explain when the **sampling distribution of p is approximately normal**.
- Be able to calculate **probabilities** using the **normal sampling distribution of p.**

Section 5.3

- Students will be able to make **inferences using a sampling distribution of the sample mean or sample proportion**, and explain the reasoning.

Section 6.1

Students will be able to

- Form **a confidence interval for μ** using the following format:
    - Describe μ in words.
    - Give the formula to be used to calculate the interval.
    - Calculate the interval.
    - Interpret the interval in terms of the problem. This will include the variable, units, etc. of the problem; what is estimated to be in the interval; and the amount of confidence.

- State when it is **valid to use this procedure**.
- Explain **what "confidence" means**.

NOTE: THE FORMAT GIVEN ABOVE APPLIES TO ALL CONFIDENCE INTERVAL PROBLEMS.

Section 6.2

- Students will be able to calculate the **sample size** appropriate to estimate μ to within a specified margin of error for a desired degree of confidence.

Section 7.1

Students will be able to

- Set up each of the following parts of a **test of hypothesis**:
  - The **null hypothesis, H_0**.
  - The **alternative hypothesis, H_a**.
  - The **decision rule**.
  - The **test statistic**.

Section 7.2

Students will be able to

- Conduct a **test of hypothesis about μ** using the following format:
  - Give **the null hypothesis, H_0**.
  - Give the **alternative hypothesis, H_a**.
  - Give the **decision rule**.
  - Give the **test statistic, and calculate the p-value**.
  - **Interpret the results** of your analyses in terms of the problem. This will include the variable, units, etc. of the problem.
- State when it is **valid** to use this procedure.

NOTE: THE FORMAT GIVEN ABOVE APPLIES TO ALL TEST OF HYPOTHESES PROBLEMS.

Section 7.3

Students will be able to

- Define **Type I and Type II error**s in terms of the problem.
- Discuss **the consequences** of these errors.
- Discuss **the relative values of α and β** as related to the consequences.

Section 8.1

Students will be able to

- Form **confidence intervals for, and test hypotheses about, π** .
- State when it is **valid** to use this procedure.

NOTE: See the objectives in Sections 6.1 and 7.2 for the appropriate formats.

Section 8.2

- Students will be able to form **confidence intervals for, and test hypotheses about, μ using the t-distribution**.

NOTES: **1. See the objectives in Sections 6.1 and 7.2 for the appropriate formats**
2. Calculations will be performed with and without the help of StatCrunch.

Section 9.1

- Students will be able to identify whether two samples are **independent or dependent**.

Section 9.2

- Students will be able to **form confidence intervals for, and test hypotheses about, $\mu_1 - \mu_2$.**

NOTES: 1. See the objectives in Sections 6.1 and 7.2 for the appropriate formats.
2. Calculations will be performed with the help StatCrunch.

Section 9.3

- Students will be able **to form confidence intervals for, and test hypotheses about, μ_D.**

NOTES: 1. See the objectives in Sections 6.1 and 7.2 for the appropriate formats.
2. Calculations will be performed with the help of StatCrunch.

Section 10.2

- Students will be able to conduct an **analysis of variance F-test** with the help of StatCrunch.

Section 10.3

- Be able to interpret a **multiple comparison procedure** using the output supplied in class to **determine which means differ**.

Section 11.1 (All analyses in Chapter 11 will be done with StatCrunch.)

Students will be able to
- Identify a **dependent (response) variable, Y**, and an **independent (predictor) variable, X** in a specific problem
- Obtain a **scatter plot** relating Y to X and interpret this plot.
- Obtain the **correlation coefficient**, r, and interpret the value.

Section 11.2

- Students will be able to complete the **test to see if Y is related to X** in a straight-line manner.

Section 11.3

- Students will be able to obtain the **prediction equation**, and **interpret the coefficients** (y-intercept and slope of the line) in terms of the problem.

Section 11.4

Students will be able to
- Obtain and interpret a **confidence interval to estimate the average value of Y**.
- Obtain and interpret a **prediction interval to predict one value of Y**.
- Be able to identify what **values of X are appropriate for estimation and prediction**.

Section 11.5

- Students will be able to fully interpret the **strength of the straight-line relationship using r^2**.

Section 12.1

Students will be able to
- Conduct a **chi-square test** to determine if **two qualitative variables are dependent**.
(These calculations will be done with StatCrunch)

Section 12.2

- Students will be able to calculate the appropriate **sample percentages for every cell to describe the relationship between two qualitative variables**.