Section 8.5

We now address the second of the two two-sample situations. In this situation, we compare two **different** groups of individuals, with each group coming from a different population.

Let μ_1 = mean of the first population.
Let μ_2 = mean of the second population.
Let $\bar{X}_1$ = mean of sample from first population.
Let $\bar{X}_2$ = mean of sample from second population.
Let n_1 = size of sample from first population.
Let n_2 = size of sample from second population.
Let s_1 = standard deviation of sample from first population.
Let s_2 = standard deviation of sample from second population.

It turns out that

$$\frac{(\bar{X}_1 - \bar{X}_2) - (\mu_1 - \mu_2)}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}} \sim t_{df}$$

where df = the smaller of (n_1 - 1) and (n_2 - 1).

Exercise 1. Does cocaine use by pregnant women cause their babies to have low birth weight? To study this question, birth weights of babies of women who tested positive for cocaine/crack during a drug-screening test were compared with the birth weights for women who either tested negative or were not tested, a group we call "other". Here are the summary statistics. The birth weights are measured in grams.

	n	$\bar{x}$	s
Positive Test	134	2733	599
Other	5974	3118	672

Formulate appropriate hypotheses and carry out the test of significance for these data.

Let μ_1 =

Let μ_2 =

H_0: H_1:

Let $\bar{X}_1$ =

Let $\bar{X}_2$ =

Since   0.05, we can reject H_o.

There is   evidence that the babies whose mothers took cocaine weigh less than the babies whose mothers didn't take cocaine.

Exercise 2. The pathogen *Phytophthora capsici* causes bell peppers to wilt and die. Because bell peppers are an important commercial crop, this disease has undergone a great deal of agricultural research. It is thought that too much water aids the spread of the pathogen. Two fields are under study. The first step in the research project is to compare the mean soil water content for the two fields (Source: *Journal of Agricultural, Biological, and Environmental Statistics*, Vol. 2, No. 2). Units are percent water by volume of soil. (#24)

Field A samples, x_1: 10.2, 10.7, 15.5, 10.4, 9.9, 10.0, 16.6, 15.1, 15.2, 13.8, 14.1, 11.4, 11.5, 11.0
Field B samples, x_2: 8.1, 8.5, 8.4, 7.3, 8.0, 7.1, 13.9, 12.2, 13.4, 11.3, 12.6, 12.6, 12.7, 12.4, 11.3, 12.5

(i) Use a calculator with mean and standard deviation keys to verify that $\bar{x_1} \approx 12.53$, $s_1 \approx 2.39$, $\bar{x_2} \approx 10.77$, and $s_2 = 2.40$.

(ii) Assuming the distribution of soil water content in each field is mound-shaped and symmetric, use a 5% level of significance to test the claim that field A has, on average, a higher soil water content than field B.

Class Exercise 1. Form 2 of the Gates-MacGintie Reading Test was administered to both an experimental group and a control group after 6 weeks of instruction, during which the experimental group received peer tutoring and the control group did not. For the experimental group $n_1 = 30$ children, the mean score on the vocabulary portion of the test was $\bar{x_1} = 368.4$, with sample standard deviation $s_1 = 39.5$. The average score on the vocabulary portion of the test for the $n_2 = 30$ subjects in the control group was $x_2 = 349.2$, with sample standard deviation $s_2 = 56.6$. Use a 1% level of significance to test the claim that the experimental group performed better than the control group. **Answer:** p**-value = 0.0692 (#22)**

Class Exercise 2. This problem is based on information regarding productivity in leading Silicon Valley companies. In large corporations, an "intimidator" is an employee who tries to stop communication, sometimes sabotages others, and, above all, likes to listen to him- or herself talk. Let x_1 be a random variable representing productive hours per week lost by peer employees of an intimidator.

$$x_1: \quad 8 \quad 3 \quad 6 \quad 2 \quad 2 \quad 5 \quad 2$$

A "stressor" is an employee with a hot temper that leads to unproductive tantrums in corporate society. Let x_2 be a random variable representing productive hours per week lost by peer employees of a stressor.

$$x_2: \quad 3 \quad 3 \quad 10 \quad 7 \quad 6 \quad 2 \quad 5 \quad 8$$

i. Use a calculator with mean and standard deviation keys to verify that $\bar{x}_1 = 4.00$, $s_1 \approx 2.38$, $x_2 = 5.5$, $s_2 \approx 2.78$.
ii. Assuming the variables x_1 and x_2 are independent, do the data indicate that the population mean time lost due to stressors is greater than the population mean time lost due to intimidators? Use a 5% level of significance. (Assume the population distributions of time lost due to intimidators and time lost due to stressors are each mound-shaped and symmetric. **Answer:** p**-value** $\approx$ **0.1516** (#26)

Class Exercise 3. The mean ACT score for 43 male high school students is 21.1 and the standard deviation is 5.0. The mean ACT score for 56 female high school students is 20.9 and the standard deviation is 4.7. At $\alpha = 0.01$, can you reject the claim that male and female high school students have equal ACT scores? **Answer:** p**-value = 0.840**

Class Exercise 4. A restaurant association says that households in the United States headed by people under the age of 25 spend less on food away from home than households headed by people ages 55-64. The mean amount spent by 30 households headed by people under the age of 25 is \$2,015 and the standard deviation is \$113. The mean amount spent by 30 households headed by people ages 55-64 is \$2,045 and the standard deviation is \$97. At $\alpha = 0.05$, can you support the restaurant association's claim? **Answer:** p**-value = 0.139**

Homework

C Problems

Section 8.5: 7-11 ODD, 15-25 ODD

B Problems

Section 8.5: 1, 3