

In this assignment, you will use the StatCrunch U data set that you developed in Module 2 as part of the first StatCrunch assignment.

As you did in StatCrunch Assignment 1B, look at the items in the StatCrunch U survey and develop a question regarding population proportions that can be answered using the survey data you collected.

As a reminder, here are the items on the survey:

**Student Finances Survey**

1. What is your gender?  
 Female  
 Male
2. What is your classification?  
 1 - Freshman  
 2 - Sophomore  
 3 - Junior  
 4 - Senior
3. How many credit hours are you taking this semester?
4. How many hours do you work each week? Please provide your answer to the nearest half hour.
5. What is the total amount (in dollars) of your student loans to date?
6. What is the total amount (in dollars) of credit card debt you have accrued to date?

Here are some possible questions. Feel free to pick one of those questions—but it would be better for you to formulate a question of your own. For this assignment, you need a question related to **proportions** and one that will require the use of a confidence interval and hypothesis test to answer. NOTE: There is a sample StatCrunch Assignment 3 designed to give you an idea of how to do this assignment. It uses a question related to the proportions of female and male students at StatCrunch U. You cannot use that question on this assignment.

- Is the proportion of female students at StatCrunch U different from the proportion of male students at StatCrunch U?
- Is the proportion of seniors less than the proportion of freshman?
- Is the proportion of male students who work different from the proportion of female students who work?
- Is the proportion of students with student loans who work greater than the proportion of students without student loans who work?
- Is the proportion of female students with credit card debt greater than the proportion of male students with credit card debt?
- Is the proportion of male freshman students different from the proportion of male senior students?

Example answers follow the questions. Point values are indicated with each question.

1. (20 pts.) State your question. Remember that your question should be related to the population proportion or proportions and should be one that will require the use of a confidence interval and hypothesis test to answer. Assume that your sample is representative of the population.

According to a USA Today article in 2010, 57 percent of U.S. college students are female ([http://www.usatoday.com/news/education/2010-01-26-genderequity26\\_ST\\_N.htm](http://www.usatoday.com/news/education/2010-01-26-genderequity26_ST_N.htm)). Is the proportion of female students at StatCrunch U greater than the nationwide proportion as reported by USA Today?

2. (30 pts.) Explain the methodology you will use to answer the question you posed. Your explanation should include answers to the following questions. Do not include your analysis or answers to your question here—only describe how you will do the analysis.
  - What is the variable of interest?  
The proportion of female students at StatCrunch U.
  - What confidence interval will you use?  
I will use a 95% confidence interval for the population proportion.
  - What are your null and alternate hypotheses?  
 $H_0: p = .57$   
 $H_A: p > .57$
  - Is it a one-sample or two-sample test?  
This is a one-sample test for the population proportion.
  - Is it an upper (right)-, lower (left)-, or two-tail test?  
Because the sign of the inequality in the alternate hypothesis is  $>$ , this will be a right or upper-tail test.
  - What level of significance will you use and why?  
A .05 level of significance will be used. This coincides with a 95% confidence interval and is appropriate based on the consequences of a Type I error.
  - Are the conditions necessary for a confidence interval and hypothesis test for the population proportion satisfied? Explain.  
In my sample of size 30, there are 14 females and 16 males. The proportion of females in the sample is  $14/30 = .467$ .  
The conditions are shown on pages 312 and 348. They are satisfied because:
    1. Random Sample: The sample was randomly selected from the population of StatCrunch U students.
    2. For the confidence interval, there should be at least 10 successes and 10 failures in the sample. In this case there are 14 females (success) and 16 males (failure) in the sample. For the hypothesis test there must be at least 10 expected successes and 10 expected failures in the sample if the null hypothesis is true. In this case  $n \cdot p_0 = 30 \cdot 0.57 = 17.1$  and  $n \cdot (1 - p_0) = 30 \cdot 0.43 = 12.9$ , so the condition is satisfied.
    3. Because sampling was done without replacement, the population must be at least 10 times larger than the sample. This is satisfied because the sample size is approximately 46,000 and the sample size is 30.
    4. Items in the sample were independently selected.
    5. I am assuming that the null hypothesis is true.

3. (30 pts.) Carry out the methodology described in 2 above. Use StatCrunch and paste copies of the StatCrunch output in the space below. (NOTE: For the purposes of this assignment, go ahead and complete the confidence interval and hypothesis test even if there are not at least 10 successes and 10 failures.) Your explanation should include answers to the following questions:

- What are the upper and lower bounds of the confidence interval?

StatCrunch output for the confidence interval is shown below.

The screenshot shows the 'Options' tab for a 'One sample Proportion with summary' test. It displays the following results:

**95% confidence interval results:**  
 p : proportion of successes for population  
 Method: Standard-Wald

Proportion	Count	Total	Sample Prop.	Std. Err.	L. Limit	U. Limit
p	14	30	0.46666667	0.091084	0.2881453	0.64518803

The lower and upper bounds of the confidence interval are 0.228 and 0.645.

- What is the error term in the confidence interval?  
The error term in the confidence interval is  $(.6452 - .2881)/2 = .1785$ .
- What does the confidence interval mean in terms of the question you posed?  
I am 95% confident that the population proportion of female students at StatCrunch U is between .2881 and .6452.
- What is the p-value in your hypothesis test and what does it mean in terms of the question you posed?

The StatCrunch output for the hypothesis test is shown below.

The screenshot shows the 'Options' tab for a 'One sample Proportion with summary' test. It displays the following results:

**Hypothesis test results:**  
 p : proportion of successes for population  
 $H_0 : p = 0.57$   
 $H_A : p > 0.57$

Proportion	Count	Total	Sample Prop.	Std. Err.	Z-Stat	P-value
p	14	30	0.46666667	0.09038805	-1.143219	0.8735

The p-value is .8735. That means if the null hypothesis that the proportion of females in the population is .50 is true, then the probability of getting a sample proportion of females of .467 or more in a sample of size 30 is .8735.

- Did you reject or not reject the null hypothesis and why?  
The null hypothesis would not be rejected because the p-value of .8735 is greater than the level of significance of .05.
- What is the conclusion of your hypothesis test in terms of the question you posed?  
There is no evidence that the proportion of females at StatCrunch U is greater than 0.57.
- Do the results of the confidence interval and hypothesis test agree? Explain.  
The 95% confidence interval is .2881 to .6452 and we did not reject the null hypothesis that the proportion of females equals .57 at the .05 level of significance. The two agree because .57 is in the 95% confidence interval.

4. (20 pts.) Based on the results of 2 and 3 above, answer your question. Include an explanation of how you used the StatCrunch output to formulate your answer.

The question asked if the proportion of female students at StatCrunch U is greater than the nationwide proportion of .57 as reported by USA Today? The 95% confidence interval contains .57 and the null hypothesis that the proportion of female students at StatCrunch U equals .57 was not rejected. Therefore there is no evidence that the proportion of female students at StatCrunch U is greater than .57.