

## Practice Problems Section 3F

1. Write out the traditional assumptions for a one-population proportion Z-test.
2. Write out the traditional assumptions for a one-population mean average T-test.
3. Write out the assumptions for a one-population randomized simulation hypothesis test.

*(#4-7) Directions: Check the assumptions for a one-population proportion Z-test. You must check all of the assumptions. Explain your answers. Does the problem meet all the assumptions? Can we use this data to perform the hypothesis test?*

4. Marsha works for the Republican Party and is asked to test a claim about the percentage of people in Sacramento will vote for the republican candidate in the next election. She has a computer randomly pick phone numbers with a Sacramento area code. She then calls the phone numbers and asks people if they would vote for the republican candidate. She spoke with 123 people and 37 said they would vote for the republican candidate.

5. A health organization is doing a study on smoking tobacco and need to test a claim about the population percentage of tobacco smokers use a pipe. They had people hang out in stores that sell tobacco and pipes and counted how many total people came to the store and how many of them used a pipe. They found that out of the 79 people, eight of them used a pipe.

6. The COC Admissions department needs to test a claim about the population percentage of students that would be in favor of using a new program to register for classes. They put a link on their website so that any students that want to try out the program can. The students can then take a survey and say how well they like the new system. A total of 247 students tried the system and 112 of them said they liked the new system.

7. Michelle, a teacher at Valencia High, wants to test a claim about the population percentage of students at Valencia High school will be attending COC. She gives the students in her English 1 class a questionnaire to fill out that asks where they will be attending college. Of the 34 students in her class, 26 are planning to attend COC.

*(#8-11) Directions: Check the assumptions for traditional one-population mean average T-test. You must check all of the assumptions. Explain your answers. Does the problem meet all the assumptions? Can we use this data to perform the hypothesis tests?*

8. A company wants to test a claim about the population mean average amount of alcohol drunk by people vacationing in Las Vegas per day. They also want to test a claim about the population standard deviation. They posted a survey on Facebook asking how much people drink when on vacation in Las Vegas. A total of 8,355 people responded and listed how much they drink. The sample mean was 3.5 drinks per day with a standard deviation of 1.2 drinks. A histogram of the alcohol consumption data was skewed to the right.

9. Jimmy works for a company that designs new homes and just moved to Oklahoma City. Jimmy's boss wants him to test a claim about the population mean average price of all homes in Oklahoma City and test a claim about the population variance. Jimmy had a computer randomly select 28 homes. He then found out the price paid for each home. A histogram of the home prices showed a normal distribution. The sample mean average price of the 28 homes was \$212.4 thousand dollars with a standard deviation of \$27.6 thousand dollars.

10. Rick works for a sports equipment manufacturing company. He needs to test a claim about the population mean average amount customers spend at his stores and test a claim about the population standard deviation. He went to the store by his house and kept track of how much people spent on a Tuesday. There were 45 customers and the histogram of the data showed a skewed right distribution. The mean average price of the sample was \$71 with a standard deviation of \$19.

11. Mike is trying to take an opinion poll and found out the population mean average amount of money in thousands of dollars that people in Los Angeles would pay per year in order to have an NFL football team. He randomly selects three streets in Los Angeles and asks every person living on those streets. His sample size was 63 people, but the histogram was drastically skewed right. The mean average amount of money was 1.3 (thousand dollars) with a standard deviation of 0.6 (thousand dollars).



(#12-24) Directions: For each of the following problems answer the following questions.

a) Give the null and alternative hypothesis. Which is the claim? Is this a right-tailed, left-tailed, or two-tailed test? Explain how you know what tail to use.

b) Check the assumptions.

c) Give the test statistic and write the standard sentence to explain it. Compare your test statistic to the critical value. Did the sample data significantly disagree with the null hypothesis? Explain how.

d) Give the p-value and write the definition sentence to explain it. Could the sample data have happened because of sampling variability (random chance) or is it unlikely to be sampling variability? Explain why.

e) Compare the p-value to the significance level. State whether you reject the null hypothesis or fail to reject the null hypothesis. Explain your answer.

f) Write the standard conclusion.

g) Explain your conclusion in easy to understand language.

12. The United States has the highest teen pregnancy rate in the industrialized world. The Center for Disease control says that as of 2011, 33% of girls get pregnant before the age of 20. We are wondering if the teen pregnancy rate this year is even higher than 33%. A random sample of 400 girls is taken. Of the 400 girls randomly selected, 144 of them were pregnant before the age of 20. Use the following Statcato printout and a 5% significance level to test the claim that the teen pregnancy rate is higher than 33%.

N	Sample Proportion	Significance Level	Critical Value	Test Statistic Z	p-Value
400	0.36	0.05	1.645	1.276	0.1010

13. According to the National Association of College Stores, digital textbooks are projected to account for approximately 13% of course materials sold by the fall of 2012. In a random sample of 260 college course materials, 39 (or 15%) of the sample course materials were digital. Use the random sample data, a 10% significance level, and StatKey to test the claim that 13% of course materials are digital. Under the "Randomization Hypothesis Tests" menu, click on "Test for Single Proportion". Under the "Edit Data" button put in the random sample data of 39 (count) and 260 (sample size). Change the null hypothesis to 13% (0.13). Determine if the sample proportion fell in the tail and use the sample proportion (0.15) to calculate the P-value. After performing the simulation, make note of the standard error and use the following formula to calculate the test statistic. Write a sentence to explain the test statistic.

$$Z\text{-test statistic} = \frac{\text{Sample Proportion} - \text{Population Proportion}}{\text{Standard Error}}$$

14. An online source suggests that one out of every three people in the U.S have high blood pressure and the population proportion of U.S. adults is 33.3%. Another website disagrees with this and claims that the true percentage of U.S. adults with high blood pressure is actually dramatically lower than 1 in 3 (33.3%). A random sample of 500 U.S. adults found that 165 of them had high blood pressure. Use the Statcato printout below and a 10% significance level to test the claim that less than 33.3% of U.S. adults have high blood pressure.

N	Sample Proportion	Significance Level	Critical Value	Test Statistic Z	p-Value
500	0.33	0.10	-1.282	-0.142	0.4434



15. Childhood obesity has more than tripled in the past 30 years. The percentage of children aged 6–11 years in the United States who were obese increased from 7% in 1980 to nearly 20% in 2008. If this trend continues, we can expect that the percent of young children that are obese today to be significantly greater than 20%. In order to test this claim, a random sample of 800 children in the U.S. was taken and 179 of them were found to be obese. Use StatKey and a 10% significance level to test the claim that the population proportion of obese children in the U.S. is higher than 0.20. Under the “Randomization Hypothesis Tests” menu, click on “Test for Single Proportion”. Under the “Edit Data” button put in the random sample data of 179 (count) and 800 (sample size). Change the null hypothesis to 20% (0.20). Determine if the sample proportion fell in the tail and use the sample proportion (0.22375) to calculate the P-value. After performing the simulation, make note of the standard error and use the following formula to calculate the Z-test statistic. Write a sentence to explain the test statistic.

$$Z\text{-test statistic} = \frac{\text{Sample Proportion} - \text{Population Proportion}}{\text{Standard Error}}$$

16. Test the claim that exactly 25% of Math 140 statistics students take their class at the COC Canyon Country Campus. A census of the fall 2015 semester indicated that of the 334 statistics students at COC, 111 of them took their class at the Canyon Country campus. Assume the population of interest is all COC statistics students from all semesters. Use the Statcato printout below and a 5% significance level to test the claim.

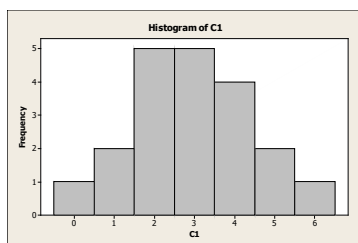
N	Sample Proportion	Significance Level	Critical Value	Test Statistic Z	p-Value
334	0.332	0.05	-1.96, 1.96	3.475	0.0005

17. Use StatKey and a 5% significance level to test the claim that more than 50% of Math 075 pre-stat students identify as female. A census of the fall 2015 semester indicated that of the 481 pre-stat students at COC, 270 of them identified as female. Assume the population of interest is all COC statistics students from all semesters. Under the “Randomization Hypothesis Tests” menu, click on “Test for Single Proportion”. Under the “Edit Data” button put in the random sample data of 270 (count) and 481 (sample size). Change the null hypothesis to 50% (0.50). Determine if the sample proportion fell in the tail and use the sample proportion (0.5613) to calculate the P-value. After performing the simulation, make note of the standard error and use the following formula to calculate the Z-test statistic. Write a sentence to explain the test statistic.

$$Z\text{-test statistic} = \frac{\text{Sample Proportion} - \text{Population Proportion}}{\text{Standard Error}}$$

18. The manager at a local Starbucks wants to make sure that customers wait less than 4 minutes from the time they order to the time that they pick up their coffee. In order to test this, twenty random customers were selected and the staff measured the number of minute between when the person ordered and when their drink was ready. The sample mean was 2.870 minutes and the sample standard deviation was 1.379 minutes. Here is a histogram of the twenty wait times. Does this data meet the assumptions necessary to perform a hypothesis test? If so, use a 1% significance level to test the claim that the average wait time is less than 4 minutes.

N	Sample Mean	Stdev s	Significance Level	Critical Value	Test Statistic	p-Value
20	2.87	1.379	0.01	-2.540	-3.665	0.0008



19. Redwood trees are the tallest plants on Earth. California is famous for its giant Redwood trees. However, just how tall are they? A random sample of 47 California Redwood trees was taken and their heights measured. (This was not easy by the way.) The sample mean average height was 248 feet with a standard deviation of 26 feet. Does this data meet the assumptions necessary to perform a hypothesis test? If so, use a 5% significance level to test the claim that Redwood trees have an average height greater than 240 feet.

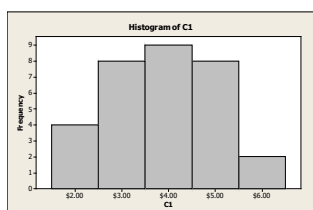
N	Sample Mean	Stdev s	Significance Level	Critical Value	Test Statistic	p-Value
47	248.0	26.0	0.05	1.679	2.109	0.0202

20. Maria is planning to attend UCLA. She is curious what the average age of UCLA students is. Since most students that attend UCLA are in their 20's yet there are also students up to 70 years old, the sample data is skewed right. The college conducted a random sample of 65 students and found that the sample mean was 29.0 years old with a standard deviation of 5.2 years. Does this data meet the assumptions necessary to perform a hypothesis test? If so, use a 10% significance level to test the claim that the average age of students at UCLA is 30 years old.

N	Sample Mean	Stdev s	Significance Level	Critical Value	Test Statistic	p-Value
65	29.0	5.2	0.10	-1.669, 1.669	-1.550	0.1260

21. Mike wants to know the average price of a hamburger. He randomly selected 24 restaurants and recorded the price of a regular hamburger. The sample mean price was \$3.88 and the sample standard deviation was \$1.14. A histogram of the data is below. Does this data set meet the assumptions necessary to perform a hypothesis test? If so, use a 10% significance level to test the claim that the average price of a hamburger is greater than \$3.50?

N	Sample Mean	Stdev s	Significance Level	Critical Value	Test Statistic	p-Value
24	3.88	1.14	0.10	1.320	1.633	0.0580



22. Use StatKey at [www.lock5stat.com](http://www.lock5stat.com) and the "Math 140 Survey Data Fall 2015" at [www.matt-teachout.org](http://www.matt-teachout.org) to test the claim that the population mean average age of math140 students is higher than 21 years old. Check the assumptions and use a 1% significance level. Under the "Randomization Hypothesis Test" menu, click on "Test for Single Mean". Under "Edit Data" copy and paste the age data into StatKey and click on "raw data". Do not click the "identifier" button. Push "OK". What is the sample mean age of the statistics students? Create the randomized simulation and make a note of the standard error. Use the significance level to determine the tail. Does the sample mean fall in the tail? Use the sample mean and the simulation to calculate the P-value. Finish the hypothesis test. After your test is complete, use the following formula to calculate the T-test statistic. Write a sentence to explain the T-test statistic.

$$\text{T-test statistic} = \frac{\text{Sample Mean} - \text{Population Mean}}{\text{Standard Error}}$$



23. Use StatKey at [www.lock5stat.com](http://www.lock5stat.com) and the “Math 140 Survey Data Fall 2015” at [www.matt-teachout.org](http://www.matt-teachout.org) to test the claim that the population mean average weight of math140 students is less than 160 pounds. Check the assumptions and use a 5% significance level. Under the “Randomization Hypothesis Test” menu, click on “Test for Single Mean”. Under “Edit Data” copy and paste the weight data into StatKey and click on “raw data”. Do not click the “identifier” button. Push “OK”. What is the sample mean weight of the statistics students? Create the randomized simulation and make a note of the standard error. Use the significance level to determine the tail. Does the sample mean fall in the tail? Use the sample mean and the simulation to calculate the P-value. Finish the hypothesis test. After your test is complete, use the following formula to calculate the T-test statistic. Write a sentence to explain the T-test statistic.

$$\text{T-test statistic} = \frac{\text{Sample Mean} - \text{Population Mean}}{\text{Standard Error}}$$

24. Test the claim that the population mean average height of math140 students is 64 inches. Assume the data met the assumptions. Use a 10% significance level.

Use StatKey at [www.lock5stat.com](http://www.lock5stat.com) and the “Math 140 Survey Data Fall 2015” at [www.matt-teachout.org](http://www.matt-teachout.org) to test the claim that the population mean average height of math140 students is 64 inches. Check the assumptions and use a 10% significance level. Under the “Randomization Hypothesis Test” menu, click on “Test for Single Mean”. Under “Edit Data” copy and paste the height data into StatKey and click on “raw data”. Do not click the “identifier” button. Push “OK”. What is the sample mean height of the statistics students? Create the randomized simulation and make a note of the standard error. Use the significance level to determine the tail. Does the sample mean fall in the tail? Use the sample mean and the simulation to calculate the P-value. Finish the hypothesis test. After your test is complete, use the following formula to calculate the T-test statistic. Write a sentence to explain the T-test statistic.

$$\text{T-test statistic} = \frac{\text{Sample Mean} - \text{Population Mean}}{\text{Standard Error}}$$

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