

Business Statistics

Homework #4, Fall 2013

This homework assignment is due at the beginning of class on December 12, 2013.

Instructions: For all problems, use the 7 Steps in Hypothesis testing and round all z and t-values to 2 decimal places. Small samples are collected from normally distributed populations. Large sample samples are collected from populations with an unknown distribution.

Problem 1

Wikipedia.org - James Naismith, a teacher in Springfield, Massachusetts, is credited with inventing basketball in 1891. The first "hoops" were actually just peach baskets and the basketball was first played by a soccer ball until it was changed in 1929. Today, the National Basketball Association (NBA) allows only one official ball: The ball must be the official NBA game ball manufactured by Spalding. The ball should be orange in color, 29.5 (749mm) inches in circumference and weighs 22 ounces (624 g) (size 7). It must also be inflated to between 7.5 and 8.5 pounds per square inch.



Therefore, ordering basketballs for 2014-15 NBA Games, a shipment of 2,000 basketballs was shipped from Spalding's factory in Asia to USA. A sample of 81 basketballs was tested to see if they fulfilled the above weigh specifications. The average weigh was 21.6 ounces with a standard deviation of 0.5 ounces. Should NBA keep the shipment or return the basketballs to Spalding?

- a) Interpret your results with 90% confidence.
- b) Interpret your results with 95% confidence.

Problem 2

Sleepfoundation.org - Teens' natural sleep cycle puts them in conflict with school start times. Most high school students need an alarm clock or a parent to wake them on school days. They are like zombies getting ready for school and find it hard to be alert and pay attention in class. Because they are sleep deprived, they are sleepy all day and cannot do their best. NSF's Sleep in America Poll found that many adolescents' exhibit symptoms of a depressive mood on a frequent were more likely to have sleep problems. In fact, 73% of those adolescents who reported feeling unhappy, sad, or depressed also reported not getting enough sleep at night and being excessively sleepy during the day.



Research shows that lack of sleep affects mood, and a depressed mood could lead to lack of sleep. To combat this vicious cycle, sleep experts recommend that teens should prioritize sleep and focus on healthy sleep habits. Teens should get at least 8 hours of sleep in average each night, keeping consistent sleep and wake schedules on school nights. A sample of 50 adolescents in Kearney High School was asked how many hours they slept on school nights last week. The mean length of sleep was 7.8 hours with a standard deviation of 0.84 hours.

- a) Using $\alpha = .05$, can you concluded that the average hours of an adolescents slept on school nights last week is insufficient?
- b) Using $\alpha = .10$, can you concluded that the average hours of an adolescents slept on school nights last week is sufficient?

Problem 3

Madehow.com- Approximately 600,000 baseballs are used by all Major League teams combined during the course of a season. The average baseball remains in play for only five to seven pitches in a Major League game. A baseball has three basic parts: the round cushioned cork pill at its core, the wool and poly/cotton windings in its midsection, and the cowhide covering that makes up its exterior. The maximum weight of each ball must not exceed 5 ounces with a minimum circumference of 9 inches to conform to Major League standards.



Rawlings has been the official supplier of baseballs to the major leagues since 1977. It takes a sample of its manufactured baseballs each day to make sure their maximum weight and minimum circumference exceeds the requirements of Major League standards. Rawlings took a sample of 27 baseballs. The average weight was 5.06 ounces with a standard deviation of 0.15 ounces; the average circumference was 9.12 inches with a standard deviation of 0.25 inches.

- a) Do Rawlings baseballs meet the weight requirements? (Let $\alpha = .01$)
- b) What is the Type I error in this situation? What are the consequences of making this error?
- c) What is the Type II error in this situation? What are the consequences of making this error?

- d) Do Rawlings baseballs meet the circumference requirements? (Let $\alpha = .025$)
- e) What is the Type I error in this situation? What are the consequences of making this error?
- f) What is the Type II error in this situation? What are the consequences of making this error?

Problem 4

Aetna.com - Men and women use health care services differently and, therefore, are charged different premiums when they purchase health insurance in the individual market, when permitted by state regulations. A research from Aetna has shown that at older ages (typically beginning around ages 50-55), men generally utilize more services than women, and thus they are more likely to pay higher premiums for health insurance. At younger ages, however, women typically use more services than men, and therefore have higher premium costs.



In 2012, a sample of 34 men at the age below 50 paid an average of \$328 a month for a middle tier health plan with a standard deviation of \$110 while a sample of 40 women at the same age paid an average of \$380 with a standard deviation of \$105. Test if men's health insurance policies cost is less than women's health insurance policies for this age group. (Let $\alpha=.02$)

Problem 5

CNNMoney.com- Introduced in 2008, the Bitcoin exists as software and is used to pay for everything from candy to smartphones on the Internet. Bitcoin has surged this year on hopes the experiment in digital money will eventually become a legitimate global currency. Bitcoin, which trades non-stop on the Mt. Gox exchange and other online markets, has been extremely volatile. One Bitcoin was worth about \$13 in January. The price of one Bitcoin rose as high as \$1,242 early Friday, just two days after crossing \$1,000 for the first time. Bitcoins are now worth nearly as much as an ounce of gold.



So what do U.S. consumers make of Bitcoin right now? A study of U.S. consumers aimed at probing Bitcoin awareness and levels of trust has found more than 27% of consumers have heard of the decentralized digital currency and the majority of them trust it.

Test the claims that more than 27% of Americans have heard of Bitcoins.

- a) Out of the 50 Americans surveyed, 20 heard of Bitcoins. Using $\alpha = .05$, does the data support the claim that more than 27% of Americans have heard of Bitcoins?
- b) Likewise, in a sample of 83 Nebraskans, 14 heard of Bitcoins. With 90% confidence, does the data support the claim that more than 27% of Nebraskans have heard of Bitcoins?

Problem 6

AbcNews.com - Thanksgiving Day is no longer all about turkey: It's eating away at Black Friday shopping. U.S. shoppers spent \$9.74 billion at stores on Black Friday with a drop of 13.2 percent compared with the same day last year. Black Friday used to be the time when retailers would open early and offer deep discounts to draw shoppers into stores. But this year, retailers have started creeping into Thanksgiving by pushing Black Friday openings earlier and earlier. However, a new HuffPost/YouGov poll finds that a big majority of Americans think retailers should stay closed on Thanksgiving so workers can have the day off. According to the new poll, 62 percent of Americans think businesses should close on Thanksgiving so workers can have the day off, while only 28 percent said that they think stores should feel free to stay open if there is demand for it.



As stated above, 62% percent of Americans support business should close on Thanksgiving while 28% of Americans think stores should feel free to stay open. A survey of Nebraskans was taken to see if there is any difference from the national views. Out of 113 Nebraskans surveyed, 75 agreed that businesses should close on Thanksgiving, 25 agree that the business should feel free to stay open, and the remainder is undecided.

- a) With 90% confidence, can you conclude that the proportion of Nebraskans who think stores should feel free to stay open on Thanksgiving is smaller than the National proportion?
- b) The Chamber of Commerce Chairman in Nebraska believes that the percent of Nebraskans who think retailers should stay closed on Thanksgiving is larger than the national proportion. At a .20 level of significance, does the survey support the chairman's belief?

Problem 7

Additionally, we assume that the percentage of Americans in Nebraska think business should close on Thanksgiving is 62%, same as the national level. You decided to break it down to the county level believing that Buffalo County would have a higher percentage of residents who think the businesses should close on Thanksgiving than Lincoln County.



A sample from each county was taken to see if your claim held true. Use the table below to determine if a higher percent of residents in Buffalo County think the businesses should close on Thanksgiving than in Lincoln County.

- a) Interpret your results with 80% confidence.
- b) Interpret your results with 90% confidence.

	Buffalo	Lincoln
Number of adults sampled	44	68
Number of adults think the business should close on Thanksgiving	30	40

Problem 8

U.S. Airlines vary in numerous ways. Researchers want to determine the factors which cause each airline to have different fleet sizes. In the Excel Spreadsheet Airlines, several U.S. Airlines are listed with the year they were founded and the number of destinations where they fly. Researchers believe that these two characteristics are what help determine the number of planes (fleet size) each airline owns.



- a) Using Excel, create a Scatter Graph for the “fleet sizes” by the “year founded” and a Scatter Graph for “fleet sizes” by the “number of destinations”.
- b) Use regression analysis to develop an estimated regression equation that could be used to estimate the airline's fleet size given the year in which it was founded. Write the regression equation. Use the 7 steps of hypothesis testing to see if the year in which the airline was founded is significant.
- c) Use regression analysis to develop an estimated regression equation that could be used to estimate the airline's fleet size given the number of airline destinations. Write the regression equation. Use the 7 steps of hypothesis testing to see if the number of airline destinations is significant.