Lesson 64: Extra Examples and project

For the next example, assume the true proportion is 0.7

Alternate Example

Who does more homework? Part 2

Suppose that two counselors at School 1, Michelle and Julie, independently take a random sample of 100 students from their school and record the proportion of students who did their homework last night. When they are finished, they find that the difference in their proportions, $\hat{p}_M - \hat{p}_J$, is 0.08. They are surprised to get a difference this big, considering that they were sampling from the same population.

Problem:

(a) Describe the shape, center, and spread of the sampling distribution of $\hat{p}_M - \hat{p}_J$.

(b) Find the probability of getting two proportions that are at least 0.08 apart.

(c) Should the counselors have been surprised to get a difference this big? Explain.

Presidential approval

Many news organizations conduct polls asking adults in the United States if they approve of the job the president is doing. How did President Obama's approval rating change from August 2009 to September 2010? According to a CNN poll of 1024 randomly selected U.S. adults on September 1–2, 2010, 50% approved of Obama's job performance. A CNN poll of 1010 randomly selected U.S. adults on August 28–30, 2009, showed that 53% approved of Obama's job performance.

Problem:

(a) Use the results of these polls to construct and interpret a 90% confidence interval for the change in Obama's approval rating among all U.S. adults.

(b) Based on your interval, is there convincing evidence that Obama's job approval rating changed between August 2009 and September 2010?

As part of the Pew Internet and American Life Project, researchers conducted two surveys in late 2009. The first survey asked a random sample of 800 U.S. teens about their use of social media and the Internet. A second survey posed similar questions to a random sample of 2253 U.S. adults. In these two studies, 73% of teens and 47% of adults said that they use social-networking sites. Use these results to construct and interpret a 95% confidence interval for the difference between the proportion of all U.S. teens and adults who use social-networking sites.

Hearing loss

Are teenagers going deaf? In a study of 3000 randomly selected teenagers in 1988–1994, 15% showed some hearing loss. In a similar study of 1800 teenagers in 2005–2006, 19.5% showed some hearing loss. Do these data give convincing evidence that the proportion of all teens with hearing loss has increased? (These data were reported in *Arizona Daily Star*, August 18, 2010.)

Problem: State the hypotheses we are interested in testing. Define any parameters you use.

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Problem:

(a) Do these data give convincing evidence that the proportion of all teens with hearing loss has increased?

(b) Between the two studies, Apple introduced the iPod. If the results of the test are statistically significant, can we blame iPods for the increased hearing loss in teenagers?

Cash for quitters

In an effort to reduce health care costs, General Motors sponsored a study to help employees stop smoking. In the study, half of the subjects were randomly assigned to receive up to $750 for quitting smoking for a year while the other half were simply encouraged to use traditional methods to stop smoking. None of the 878 volunteers knew that there was a financial incentive when they signed up. At the end of one year, 15% of those in the financial rewards group had quit smoking while only 5% in the traditional group had quit smoking. Do the results of this study give convincing evidence that a financial incentive helps people quit smoking? (These data are reported in *Arizona Daily Star,* February 11, 2009.)

Potato chips

A potato chip manufacturer buys potatoes from two different suppliers, Riderwood Farms and Camberley, Inc. The weights of potatoes from Riderwood Farms are approximately Normally distributed with a mean of 175 grams and a standard deviation of 25 grams. The weights of potatoes from Camberley are approximately Normally distributed with a mean of 180 grams and a standard deviation of 30 grams. When shipments arrive at the factory, inspectors randomly select a sample of 20 potatoes from each shipment and weigh them. They are surprised when the average weight of the potatoes in the sample from Riderwood Farms $\bar{x}_r$ is higher than the average weight of the potatoes in the sample from Camberley $\bar{x}_c$.

CHECK YOUR UNDERSTANDING

A fast-food restaurant uses an automated filling machine to pour its soft drinks. The machine has different settings for small, medium, and large drink cups. According to the machine's manufacturer, when the large setting is chosen, the amount of liquid dispensed by the machine follows a Normal distribution with mean 27 ounces and standard deviation 0.8 ounces. When the medium setting is chosen, the amount of liquid dispensed follows a Normal distribution with mean 17 ounces and standard deviation 0.5 ounces. To test the manufacturer's claim, the restaurant manager measures the amount of liquid in a random sample of 25 cups filled with the medium setting and a separate random sample of 20 cups filled with the large setting. Let $\bar{x}_1 - \bar{x}_2$ be the difference in the sample mean amount of liquid under the two settings (large – medium).

1. What is the shape of the sampling distribution of $\bar{x}_1 - \bar{x}_2$? Why?
2. Find the mean and standard deviation of the sampling distribution.
3. Find the probability that $\bar{x}_1 - \bar{x}_2$ is more than 12 ounces. Show your work.
4. Based on your answer to Question 3, would you be surprised if the difference in the mean amount of liquid dispensed in the two samples was 12 ounces? Explain.

CHECK YOUR UNDERSTANDING

The U.S. Department of Agriculture (USDA) conducted a survey to estimate the average price of wheat in July and in September of the same year. Independent random samples of wheat producers were selected for each of the two months. Here are summary statistics on the reported price of wheat from the selected producers, in dollars per bushel:[24]

Month	n	$\bar{x}$	s_x
July	90	\$2.95	\$0.22
September	45	\$3.61	\$0.19

Construct and interpret a 99% confidence interval for the difference in the mean wheat price in July and in September.

The stronger picker-upper?

In commercials for Bounty paper towels, the manufacturer claims that they are the "quicker picker-upper." But are they also the stronger picker upper? Two AP Statistics students, Wesley and Maverick, decided to find out. They selected a random sample of 30 Bounty paper towels and a random sample of 30 generic paper towels and measured their strength when wet. To do this, they uniformly soaked each paper towel with 4 ounces of water, held two opposite edges of the paper towel, and counted how many quarters each paper towel could hold until ripping, alternating brands. Here are their results:

Bounty:	106,	111,	106,	120,	103,	112,	115,	125,		
	116,	120,	126,	125,	116,	117,	114,	118,		
	126,	120,	115,	116,	121,	113,	111,	128,		
	124,	125,	127,	123,	115,	114				
Generic:	77,	103,	89,	79,	88,	86,	100,	90,	81,	
	84,	84,	96,	87,	79,	90,	86,	88,	81,	
	91,	94,	90,	89,	85,	83,	89,	84,	90,	
	100,	94,	87							

Problem:

(a) Display these distributions using parallel boxplots and briefly compare these distributions. Based only on the boxplots, discuss whether or not you think the mean for Bounty is significantly higher than the mean for generic.

(b) Use a significance test to determine whether there is convincing evidence that wet Bounty paper towels can hold more weight, on average, than wet generic paper towels can.

(c) Interpret the *P*-value from part (b) in the context of this question.

CHECK YOUR UNDERSTANDING

How quickly do synthetic fabrics such as polyester decay in landfills? A researcher buried polyester strips in the soil for different lengths of time, then dug up the strips and measured the force required to break them. Breaking strength is easy to measure and is a good indicator of decay. Lower strength means the fabric has decayed.

For one part of the study, the researcher buried 10 strips of polyester fabric in well-drained soil in the summer. The strips were randomly assigned to two groups: 5 of them were buried for 2 weeks and the other 5 were buried for 16 weeks. Here are the breaking strengths in pounds:[26]

Group 1 (2 weeks):	118	126	126	120	129
Group 2 (16 weeks):	124	98	110	140	110

Do the data give good evidence that polyester decays more in 16 weeks than in 2 weeks? Carry out an appropriate test to help answer this question.

HW 64 Finish the examples shown here and complete the Quiz Reviews on pages 661-666