

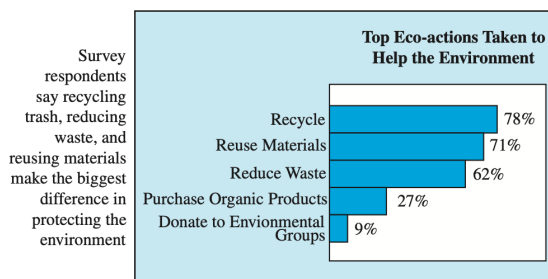
STA13 Homework 4

October 31, 2021

1. **Sports and Achilles Tendon Injuries** Sports that involve a significant amount of running, jumping, or hopping put participants at risk for Achilles tendinopathy (AT), an inflammation and thickening of the Achilles tendon. A study in The American Journal of Sports Medicine looked at the diameter (in mm) of the affected and nonaffected tendons for patients who participated in these types of sports activities.¹⁰ Suppose that the Achilles tendon diameters in the general population have a mean of 5.97 millimeters (mm) with a standard deviation of 1.95 mm.

1. What is the probability that a randomly selected sample of 31 patients would produce an average diameter of 6.5 mm or less for the nonaffected tendon?
2. When the diameters of the affected tendon were measured for a sample of 31 patients, the average diameter was 9.80. If the average tendon diameter in the population of patients with AT is no different than the average diameter of the nonaffected tendons (5.97 mm), what is the probability of observing an average diameter of 9.80 or higher?

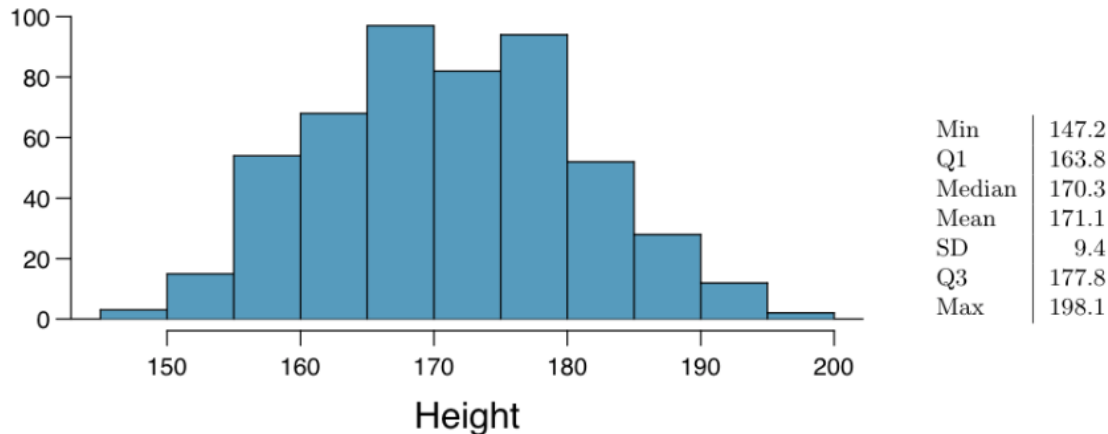
2. **Eco-Friendly** Recycling trash, reducing waste, and reusing materials are eco-actions that will help the environment. According to a USA Today snapshot (Exercise 6.45), 78% of respondents list recycling as the leading way to help our environment.¹¹ Suppose that a random sample of $n = 100$ adults is selected and that the 78% figure is correct.



1. Does the distribution of \hat{p} , the sample proportion of adults who list recycling as the leading way to help the environment have an approximate normal distribution? If so, what is its mean and standard deviation?
2. What is the probability that the sample proportion \hat{p} is less than 75% ?

3. What is the probability that \hat{p} lies in the interval .7 to .75?

3. **Heights of adults.** Researchers studying anthropometry collected body girth measurements and skeletal diameter measurements, as well as age, weight, height and gender, for 507 physically active individuals. The histogram below shows the sample distribution of heights in centimeters.



1. What is the point estimate for the average height of active individuals?
2. The researchers take another random sample of physically active individuals. Would you expect the mean of this new sample to be the ones given above? Explain your reasoning.
3. The sample means obtained are point estimates for the mean height of all active individuals, if the sample of individuals is equivalent to a simple random sample. What measure do we use to quantify the variability of such an estimate? Compute this quantity using the data from the original sample under the condition that the data are a simple random sample.
4. Margin of error at 95% confidence level
5. Construct a 95% confidence interval for the average height of active individuals.

4. **Diamonds** Prices of diamonds are determined by what is known as the 4 Cs: cut, clarity, color, and carat weight. The prices of diamonds go up as the carat weight increases, but the increase is not smooth. For example, the difference between the size of a 0.99 carat diamond and a 1 carat diamond is undetectable to the naked human eye, but the price of a 1 carat diamond tends to be much higher than the price of a 0.99 diamond. In this question we use two random samples of diamonds, 0.99 carats and 1 carat, each sample of size 23, and compare the average prices of the diamonds. In order to be able to compare equivalent units, we first divide the price for each diamond by 100 times its weight in carats. That is, for a 0.99 carat diamond, we divide the price by 99. For a 1 carat diamond, we divide the price by 100. The distributions and some sample statistics are shown below. ²⁰

We are interested in the difference between the average standardized prices of 0.99 and 1 carat diamonds.

	0.99 carats	1 carat
Mean	\$44.51	\$56.81
SD	\$13.32	\$16.13
n	23	23

1. What is the point estimate of the difference between the average standardized prices of 0.99 and 1 carat diamonds.
2. Margin of error?
3. Calculate a 95% confidence interval for the difference between the average standardized prices of 0.99 and 1 carat diamonds.

5. [Legalization of marijuana](#). The General Social Survey asked 1,578 US residents: "Do you think the use of marijuana should be made legal, or not?" 61% of the respondents said it should be made legal. ¹³

1. Is 61% a sample statistic or a population parameter? Explain.
2. Construct a 95% confidence interval for the proportion of US residents who think marijuana should be made legal, and interpret it in the context of the data.
3. A critic points out that this 95% confidence interval is only accurate if the statistic follows a normal distribution, or if the normal model is a good approximation. Is this true for these data? Explain.
4. A news piece on this survey's findings states, "Majority of Americans think marijuana should be legalized." Based on your confidence interval, is this news piece's statement justified?

6. [Sleep deprivation, CA vs. OR](#) According to a report on sleep deprivation by the Centers for Disease Control and Prevention, the proportion of California residents who reported insufficient rest or sleep during each of the preceding 30 days is 8.0%, while this proportion is 8.8% for Oregon residents. These data are based on simple random samples of 11,545 California and 4,691 Oregon residents. Calculate a 95% confidence interval for the difference between the proportions of Californians and Oregonians who are sleep deprived and interpret it in context of the data.