Lab 13: Chapter 10

Stating Hypotheses **In exercises 1–5, the statement represents a claim. Write down the H_0 and the H_a** for each question.

1. $p < 0.55$

2. $p > 0.07$

3. $p \neq 0.29$

4. $p < 0.45$

5. $\mu > 158$

6. Which of the following are legitimate hypotheses?
   (a) $p = 0.65$ (a) _____
   (b) $\hat{p} = 0.60$ (b) _____
   (c) $\hat{p} = 0.10$ (c) _____
   (d) $p > 3.4$ (d) _____

7. Which of the following specify legitimate pairs of null and alternative hypotheses?
   (a) $H_0 : p = 0.25$ $H_a : p > 0.25$ (a) _____
   (b) $H_0 : \hat{p} = 0.60$ $H_a : \hat{p} > 0.60$ (b) _____
   (c) $H_0 : p > 0.45$ $H_a : p < 0.45$ (c) _____
   (d) $H_0 : p \neq 0.35$ $H_a : p = 0.35$ (d) _____
   (e) $H_0 : p = 0.12$ $H_a : p \neq 0.12$ (e) _____

Stating the Hypotheses **In Exercises 8–12, write the claim as a mathematical statement. State the null and alternative hypotheses, and identify which represents the claim.**

8. A recent poll (Washington Post – Schar School, Oct. 2019) claimed that a majority of Americans want Trump impeached and removed. Suppose you plan to select a representative sample of 100 students at the college. You will ask each student in the sample if he or she want Trump impeached and removed. You plan to use the resulting data to decide if there is evidence that the majority of students at the school want Trump impeached and removed. What hypotheses should you test?

9. Nearly 60 percent of adult men report drinking in the last month, and approximately 23% of adult men report binge drinking 5 times a month, averaging 8 drinks per binge. Suppose you plan to select a random sample of 100 male students at the college. You will ask each student in the sample questions about their alcohol use, including the question, "How many times per month do you binge drink?" You plan to use the resulting data to decide if there is evidence that the proportion of male students at the college who report binge drinking 5 times a month is under 23%. What hypotheses should you test?

10. Earlier this year, Pew Research Center found that 55% of Americans had a negative impression of socialism, while 42% expressed a positive view. About two-thirds (65%) said they had a positive view of capitalism, and a third viewed it negatively. Suppose you plan to select a representative sample of 100 students at the college. You will ask each student in the sample if he or she has a negative view of capitalism or a positive view of capitalism. You plan to use the resulting data to decide if there is evidence that more than a third of the college's students have a negative view of capitalism. What hypotheses should you test?

11. In a September 6, 2019, Gallup reported that 68% of Americans believe the government is withholding information about UFOs.Suppose you plan to select a representative sample of 100 students at the college. You will ask each student in the sample if he or she has a negative view of capitalism or a positive view of capitalism. You plan to use the resulting data to decide if there is evidence that more than a third of the college's students have a negative view of capitalism. What hypotheses should you test?

12. A new national poll by Quinnipiac University (Oct. 17 – 21, 2019), cited by fox news network, indicates that 55 percent of registered voters support the House Democrats' impeachment investigation into President Trump, with 43 percent opposed. A margin of error of ± 3.1 percentage points was reported. Interpret the meaning of the margin of error in the context of this problem.

Interpreting a Decision **In Exercises 13 and 14, write down the null hypothesis or the alternative hypothesis. If a hypothesis test is performed, how should you interpret a decision that**
(a) rejects the null hypothesis?
(b) fails to reject the null hypothesis?

13. A news poll claims that the majority of Americans want Trump impeached and removed from office.

14. According to a 2018 Gallup poll, 5% of U.S. adults consider themselves to be vegetarian. You plan to use sample data to decide if there is evidence that the proportion of adults who consider themselves to be vegetarian is different from 5%.

Identifying Tests **In Exercises 15–17, determine whether the hypothesis test is left-tailed, right-tailed, or two-tailed.**

15. $H_0: \quad p = 0.25$
$H_a: \quad p > 0.25$

16. $H_0: \quad p = 0.72$
$H_a: \quad p \neq 0.72$

17. $H_0: \quad p = 0.34$
$H_a: \quad p < 0.34$

18. A Newsweek article titled "America the Ignorant" (www.newsweek.com) described a Gallup poll that asked adult Americans if they believe that there are real witches and warlocks. Suppose that the poll used a random sample of 800 adult Americans and that you want to use the poll data to decide if there is evidence that more than 10% of adult Americans believe in witches and warlocks. Let p be the proportion of all adult Americans who believe in witches and warlocks.
    (a) Describe the shape, center, and spread of the sampling distribution of $\hat{p}$ for random samples of size 800 if the null hypothesis $H_0 : p = 0.10$ is true.
    (b) Would you be surprised to observe a sample proportion of $\hat{p} = 0.16$ for a sample of size 800 if the null hypothesis $H_0 : p = 0.10$ were true? Explain why or why not.
    (c) Would you be surprised to observe a sample proportion of $\hat{p} = 0.11$ for a sample of size 800 if the null hypothesis $H_0 : p = 0.10$ were true? Explain why or why not.

Identifying Errors **In Exercises 18–19, describe type I and type II errors for a hypothesis test of the indicated claim.**

19. A garden hose manufacturer advertises that the mean flow rate of a certain type of hose is 16 gallons per minute.

20. A computer repairer advertises that the mean cost of removing a virus infection is less than $100.