10.4 Section Exercises

Necessary Conditions for Using the Normal Distribution in Hypothesis Tests for Population Proportions

Determine whether the normal distribution can be used to perform a hypothesis test for the population proportion in each scenario.

1. After collecting data from a simple random sample of 43 townspeople on whether they approve of the local mayor, a statistics student wants to run a hypothesis test for the population proportion using a 95% level of confidence. Has he collected enough data to test the claim using a normal distribution that the currently accepted approval rating is incorrect if the current belief is that 35% of residents approve of the mayor?

2. An environmentalist wishes to conduct a hypothesis test on the percentage of cars driven in the city that are hybrids. Is it sufficient for him to use a simple random sample of 54 cars to perform a hypothesis test using a normal distribution if hybrids currently account for 4% of the car sales in the country and he claims that the percentage of hybrids in the city is higher than that?

   Source: Hirsch, Jerry. Los Angeles Times. "Hybrid vehicle sales speed up." 29 Mar. 2013. https://www.latimes.com/business/la-xpm-2013-mar-29-la-fi-hy-autos-hybrid-20130330-story.html (25 Mar. 2019).

3. A scientist believes that 12 out of every 100 office workers suffer from extreme sensitivity to dust in the workplace. Is it appropriate to use a normal distribution to conduct a hypothesis test at the 99% level of confidence if only 57 office workers are surveyed?

4. In a recent study at a local college, 48 students admitted that they had tried alcohol at least once while under the legal drinking age, while 34 students said they had not. Is there a large enough sample to use a normal distribution to conduct a hypothesis test to see if the percentage of students at the college who admit to drinking underage is the same as the national percentage of 65%?

   Source: National Institute on Alcohol Abuse and Alcoholism. "Fall Semester—A Time for Parents To Discuss the Risks of College Drinking." Aug. 2019. https://pubs.niaaa.nih.gov/publications/CollegeFactSheet/CollegeFact.htm (20 Sept. 2019).

Hypothesis Tests for Population Proportions

Perform each hypothesis test. For each exercise, complete the following steps.

a. State the null and alternative hypotheses.
b. Determine which distribution to use for the test statistic, and state the level of significance.
c. Calculate the test statistic.
d. Draw a conclusion using the given level of significance and interpret the decision.

5. One study claimed that a whopping 95% of college students identify themselves as procrastinators. Since the report also claims that only 20% of the general population claim to be procrastinators, one professor believes that the claim regarding college students is too high. The professor conducts a simple random sample of 275 college students and finds that 251 of them identify themselves as procrastinators. Does this evidence support the professor's claim that fewer than 95% of college students are procrastinators? Use a 0.10 level of significance.

   Source: Gaille, Brandon. "19 Lazy Procrastination Statistics." 19 May 2017. https://brandongaille.com/17-lazy-procrastination-statistics/ (25 Mar. 2019).

6. The National Academy of Science reported in a 1997 study that 40% of research in mathematics is published by US authors. The mathematics chairperson of a prestigious university wishes to test the claim that this percentage is no longer 40%. He has no indication of whether the percentage has increased or decreased since that time. He surveys a simple random sample of 130 recent articles published by reputable mathematics research journals and finds that 62 of these articles have US authors. Does this evidence support the mathematics chairperson's claim that the percentage is no longer 40%? Use a 0.10 level of significance.

Source: Panel on International Benchmarking of US Mathematics Research and Committee on Science, Engineering, and Public Policy. *International Benchmarking of US Mathematics Research*. National Academy of Sciences, National Academy of Engineering, Institute of Medicine (SEM). 1997. http://www.nap.edu/openbook.php?record_id=9089&page=22 (2 Dec. 2011).

7. Sleep apnea is a condition in which the sufferers stop breathing momentarily while they are asleep. This condition results in lack of sleep and extreme fatigue during waking hours. A current estimate is that 18 million out of the 312.7 million Americans suffer from sleep apnea, or approximately 5.8%. A safety commission is concerned about the percentage of commercial truck drivers who suffer from sleep apnea. They do not have any reason to believe that it would be higher or lower than the population's percentage. To test the claim that the percentage of commercial truck drivers who suffer from sleep apnea is not 5.8%, a simple random sample of 350 commercial truck drivers is examined by a medical expert, who concludes that 30 suffer from sleep apnea. Does this evidence support the claim that the percentage of commercial truck drivers who suffer from sleep apnea is not 5.8%? Use a 0.01 level of significance.

Source: American Sleep Apnea Association. "Sleep Apnea." 2011. http://www.sleepapnea.org/learn/sleepapnea.html (2 Dec. 2011).

Source: US Census Bureau. "American FactFinder." http://factfinder2.census.gov (2 Dec. 2011).

8. In the romantic comedy *Sleepless in Seattle*, Meg Ryan's character, Annie, begins the movie concerned over a report that "a woman over age 40 has a better chance of being killed by a terrorist than of getting married." While this claim is clearly exaggerated, according to snopes.com it is actually based on a true, though flawed, study that "did conclude that the likelihood of marriage for a never-previously-wed, 40-year-old university-educated American woman was 2.6%." To demonstrate that this percentage is too small, Annie uses her resources at the Baltimore Sun to conduct a simple random sample of 450 never-previously-wed, university-educated, American women who were single at the beginning of their 40s and who are now 45. Of these women, 15 report now being married. Does this evidence support Annie's claim, at the 0.10 level of significance, that the chances of getting married for this group are greater than 2.6%?

Source: Mikkelson, David. "Woman's Chance of Marriage Over 40." 11 Apr. 2008. https://www.snopes.com/fact-check/marry-go-round/ (25 Mar. 2019).

9. Postpartum depression and anxiety (PPD), is a common medical condition affecting mothers and their families after the birth of a baby. In 2008, the CDC estimated that 15% of women who have recently given birth suffer from PPD. However, this research only reflected self-reported cases. Therefore, one group dedicated to helping women and their families with PPD believes that the true percentage of women who suffer from PPD is much higher. The group conducts a simple random sample of 85 women who had given birth in the last year and discovers that 19 of them report having PPD. Based on this evidence, can the group claim that the true percentage of women who have PPD is greater than 15%? Use a 0.05 level of significance.

Source: Stone, Katherine. Postpartum Progress. "How Many Women Get Postpartum Depression? The Statistics on PPD." https://postpartumprogress.com/how-many-women-get-postpartum-depression-the-statistics-on-ppd (25 Mar. 2019).

10. A direct mail appeal for contributions from a university's alumni and supporters is considered to be too costly if less than 15% of the alumni and supporters provide monetary contributions. To determine if a direct mail appeal is cost effective, the fundraising director sends the direct mail brochures to a simple random sample of 250 people on the alumni and supporters mailing lists. They receive monetary contributions from 36 people. Does this evidence demonstrate that the direct mail campaign is not cost effective? Use a 0.05 level of significance.