ONE POPULATION TESTING HOMEWORK TEXT: 9.1, 9.2, 9.3, 9.4, 9.5

LAST NAME	FIRST NAME	DATE

An article in the San Jose Mercury News stated that students in the California state university system take 4.5 years, on average, to finish their undergraduate degrees. Suppose you believe that the mean time is longer. You conduct a survey of 49 students and obtain a sample mean of 5.1 with a sample standard deviation of 1.2. Run an appropriate test with 1% significance level.

1. State the null and the alternative hypotheses for your test.

2. What is the distribution of the test statistic?

3. Describe the rejection region.

4. Find the value of the test statistic.

5. Find the p-value for this test.

6. Do the data support your claim at the 1% level?

The mean number of sick days an employee takes per year is believed to be about ten. Members of a personnel department do not believe this figure. They randomly survey eight employees. The number of sick days they took for the past year are as follows:

$$12,\ 4,\ 15,\ 3,\ 11,\ 8,\ 6,\ 8$$

Should the personnel team believe that the population mean is ten?

7. State the null and the alternative hypotheses for your test.

8. Find a point estimate for the population mean number of sick days taken last year.

9. Find a 95% confidence interval estimate for the population mean number of sick days taken last year.

10. Find the p-value for this test.

11. Should the personnel team believe that the population mean is ten, if they want 95% confidence in their conclusion?

12. Is it reasonable to suppose that the conditions for performing the test are satisfied? Why or why not?

13. A two-tailed test for population mean with a sample of size 17 yields the test statistic 1.99

(a) State the distribution of the test statistic:

(b) Sketch the pdf of the test statistic and shade the p-value.

(c) Compute the p-value of the test.

(d) Can H_0 be rejected with $\alpha = 0.05$?

14. A two-tailed test for population mean with a sample of size 57 yields the test statistic -3.4

(a) State the distribution of the test statistic:

(b) Sketch the pdf of the test statistic and shade the p-value.

(c) Compute the p-value of the test.

(d) Can H_0 be rejected with $\alpha = 0.001$?

A poll done for a popular news outlet found that 13% of Americans reported to have seen or sensed the presence of an angel. You happen to doubt that the percent is really that high. You conduct your own survey. Out of 76 Americans surveyed, only two report they had seen or sensed the presence of an angel.

15. State the null and the alternative hypotheses for your test.

16. Find a point estimate for the population proportion of those who reported the presence of an angel.

17. Find the p-value for this test.

18. As a result of your survey, would you agree with the news outlet poll? Use significance level $\alpha = 0.01$.

In an attempt to increase business on weekday nights, a restaurant offers a free dessert with every dinner order. Before the offer, the mean number of customers on a weekday was 150. Following are the numbers of customers on a random sample of 12 days while the offer was in effect.

206, 169, 191, 142, 151, 174,

152, 212, 139, 220, 192, 153

19. Can we conclude that the mean number of diners increased while the free dessert offer was in effect? Use $\alpha = 0.01$.

20. Is it reasonable to suppose that the conditions for performing the test are satisfied? Why or why not?

A Pew poll taken in December 2012 surveyed 1802 Internet users and found that 829 of them had posted a photo or a video online.

21. Can we conclude that less than half of Internet users have posted videos or photos online? Run an appropriate test with 95% confidence level.

A 2011 survey sampled 1923 people in Colorado and asked them how long it took them to commute to work each day. The sample mean one-way commute time was 24.5 minutes with a standard deviation of 13.0 minutes. A transportation engineer claims that the mean commute time is less than 25 minutes. Do the data provide enough evidence for the engineer's claim? Use $\alpha = 0.05$ level of significance.

22. What is the distribution of the test statistic?

23. Find the rejection region for the test.

24. Find the value of the test statistic.

25. Find the p-value of the test.

26. State the conclusion.

27. 15 tobacco smokers were questioned about the number of hours they sleep each day. We want to test the hypothesis that the smokers need a different amount of sleep than the general public, which needs an average of 7.7 hours of sleep. The sample data are given below:

7, 7, 6, 6, 8, 10, 7, 7, 6, 5, 5, 8, 8, 7, 7

Is there enough evidence to conclude that smokers need more or less sleep on average than the general population? Conduct the test at 5% level of significance.

(a) H_0 : H_1 :

(b) State the distribution of the test statistic:

(c) Sketch a graph of the distribution of the test statistic, find and label the critical value(s), shade the rejection region.

(d) Compute the test statistic and sketch it on the graph above.

(e) Find the p-value of the test.

(f) State the conclusion.

28. Try running a hypothesis test for the mean, for a sample of size $n = 1$. Pick any number for the data, and any number for μ_0. Explain why this kind of test cannot be performed.

29. Find a way to use R to generate a random data set of a given size n with mean approximately $\overline{x}$ and standard deviation approximately s, also given.

30. A similar but different task would be to generate a data set of size n, not necessarily random, but with mean and standard deviation being exactly $\overline{x}$ and s. For dessert, implement your method as an R function.

ANSWERS

1. $H_0 : \mu = 4.5, \quad H_1 : \mu > 4.5, \quad$ using two-tailed t-test

3. $|t| > 2.682204$

5. 0.001015235

6. Yes, the data provides enough evidence to conclude that the mean time it takes to finish a degree is greater than 4.5 years.

7. $H_0 : \mu = 10, \quad H_1 : \mu \neq 10, \quad$ using two-tailed t-test

8. 8.375

9. (4.94433, 11.80567)

10. 0.2996

11. The data does not provide enough evidence to reject the claim that the population mean is 10 days, so it may well be.

13. $t \sim t_{16}$, p-value0.06396078,
not enough evidence to reject H_0 at 0.05 significance level

15. $H_0 : p = 0.13, \quad H_1 : p < 0.13, \quad$ using two-tailed binomial test

16. 0.02631579

17. 0.003305

18. Your data shows that the news outlet poll is likely wrong. According to your poll, the proportion of Americans who report having sensed the presence of an angel is significantly lower than 13%.

19. The data does not provide sufficient evidence to conclude that the mean number of diners have increased. (Two-tailed t-test, $\alpha = 0.01$, p-value $= 0.01099$.)

21. The data provides sufficient evidence to conclude that less than half of Internet users posted a photo or a video online. (Two-tailed binomial test, $\alpha = 0.05$, p-value $= 0.0007509$.)

23. $|t| > 1.961199$

25. 0.0918395