Test Your Knowledge–Hypothesis Testing

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

Identify the null hypothesis, alternative hypothesis, test statistic, P–value, conclusion about the null hypothesis, and final conclusion that addresses the original claim.

1) A manufacturer considers his production process to be out of control when defects exceed 3%. In a random sample of 85 items, the defect rate is 5.9% but the manager claims that this is only a sample fluctuation and production is not really out of control. At the 0.01 level of significance, test the manager's claim. 1) _____

2) A poll of 1,068 adult Americans reveals that 48% of the voters surveyed prefer the Democratic candidate for the presidency. At the 0.05 level of significance, test the claim that at least half of all voters prefer the Democrat. 2) _____

3) According to a recent poll 53% of Americans would vote for the incumbent president. If a random sample of 100 people results in 45% who would vote for the incumbent, test the claim that the actual percentage is 53%. Use a 0.10 significance level. 3) _____

4) A nationwide study of American homeowners revealed that 64% have one or more lawn mowers. A lawn equipment manufacturer, located in Omaha, feels the estimate is too low for households in Omaha. Can the value 0.64 be rejected if a survey of 490 homes in Omaha yields 331 with one or more lawn mowers? Use $\alpha = 0.05$. 4) _____

5) An article in a journal reports that 34% of American fathers take no responsibility for child care. A researcher claims that the figure is higher for fathers in the town of Littleton. A random sample of 234 fathers from Littleton yielded 96 who did not help with child care. Test the researcher's claim at the 0.05 significance level. 5) _____

6) In a sample of 167 children selected randomly from one town, it is found that 37 of them suffer from asthma. At the 0.05 significance level, test the claim that the proportion of all children in the town who suffer from asthma is 11%. 6) _____

7) In a clinical study of an allergy drug, 108 of the 202 subjects reported experiencing significant relief from their symptoms. At the 0.01 significance level, test the claim that more than half of all those using the drug experience relief. 7) _____

8) The health of employees is monitored by periodically weighing them in. A sample of 54 employees has a mean weight of 183.9 lb. Assuming that σ is known to be 121.2 lb, use a 0.10 significance level to test the claim that the population mean of all such employees weights is less than 200 lb. 8) _____

Test the given claim using the traditional method of hypothesis testing. Assume that the sample has been randomly selected from a population with a normal distribution.

9) A test of sobriety involves measuring the subject's motor skills. Twenty randomly selected sober subjects take the test and produce a mean score of 41.0 with a standard deviation of 3.7. At the 0.01 level of significance, test the claim that the true mean score for all sober subjects is equal to 35.0. 9) _____

10) A large software company gives job applicants a test of programming ability and the mean for that test has been 160 in the past. Twenty–five job applicants are randomly selected from one large university and they produce a mean score and standard deviation of 183 and 12, respectively. Use a 0.05 level of significance to test the claim that this sample comes from a population with a mean score greater than 160. 10) _____

11) A researcher wants to check the claim that convicted burglars spend an average of 18.7 months in jail. She takes a random sample of 11 such cases from court files and finds that $\bar{x} = 21.3$ months and $s = 7.7$ months. Test the null hypothesis that $\mu = 18.7$ at the 0.05 significance level. 11) _____

12) A public bus company official claims that the mean waiting time for bus number 14 during peak hours is less than 10 minutes. Karen took bus number 14 during peak hours on 18 different occasions. Her mean waiting time was 7.9 minutes with a standard deviation of 1.6 minutes. At the 0.01 significance level, test the claim that the mean is less than 10 minutes. 12) _____

13) A cereal company claims that the mean weight of the cereal in its packets is at least 14 oz. The weights (in ounces) of the cereal in a random sample of 8 of its cereal packets are listed below. 13) _____

14.6 13.8 14.1 13.7 14.0 14.4 13.6 14.2

At the 0.01 significance level, test the claim that the mean weight is 14 ounces.

14) A light–bulb manufacturer advertises that the average life for its light bulbs 900 hours. A random sample of 15 of its light bulbs resulted in the following lives in hours. 14) _____

995 590 510 539 739 917 571 555
916 728 664 693 708 887 849

At the 10% significance level, do the data provide evidence that the mean life for the company's light bulbs differs from the advertised mean?

Use the traditional method to test the given hypothesis. Assume that the samples are independent and that they have been randomly selected

15) A marketing survey involves product recognition in New York and California. Of 558 New Yorkers surveyed, 193 knew the product while 196 out of 614 Californians knew the product. At the 0.05 significance level, test the claim that the recognition rates are the same in both states. 15) _____

16) Use the given sample data to test the claim that $p_1 < p_2$. Use a significance level of 0.10. 16) _____

Sample 1	Sample 2
$n_1 = 462$	$n_2 = 380$
$x_1 = 84$	$x_2 = 95$

17) A researcher finds that of 1,000 people who said that they attend a religious service at least once a week, 31 stopped to help a person with car trouble. Of 1,200 people interviewed who had not attended a religious service at least once a month, 22 stopped to help a person with car trouble. At the 0.05 significance level, test the claim that the two proportions are equal. 17) _____

18) In a random sample of 360 women, 65% favored stricter gun control laws. In a random sample of 220 men, 60% favored stricter gun control laws. Test the claim that the proportion of women favoring stricter gun control is higher than the proportion of men favoring stricter gun control. Use a significance level of 0.05. 18) _____

19) In a random sample of 500 people aged 20–24, 22% were smokers. In a random sample of 450 people aged 25–29, 14% were smokers. Test the claim that the proportion of smokers in the two age groups is the same. Use a significance level of 0.01. 19) _____

20) 7 of 8,500 people vaccinated against a certain disease later developed the disease. 18 of 10,000 people vaccinated with a placebo later developed the disease. Test the claim that the vaccine is effective in lowering the incidence of the disease. Use a significance level of 0.02. 20) _____

Test the indicated claim about the means of two populations. Assume that the two samples are independent and that they have been randomly selected.

21) Two types of flares are tested for their burning times (in minutes) and sample results are given below. 21) _____

Brand X	Brand Y
$n = 35$	$n = 40$
$\bar{x} = 19.4$	$\bar{x} = 15.1$
$s = 1.4$	$s = 0.8$

Refer to the sample data to test the claim that the two populations have equal means. Use a 0.05 significance level.

22) A researcher wishes to determine whether people with high blood pressure can reduce their blood pressure by following a particular diet. Use the sample data below to test the claim that the treatment population mean μ_1 is smaller than the control population mean μ_2. Test the claim using a significance level of 0.01. 22) _____

Treatment Group	Control Group
$n_1 = 85$	$n_2 = 75$
$\bar{x}_1 = 189.1$	$\bar{x}_2 = 203.7$
$s_1 = 38.7$	$s_2 = 39.2$

1) H_0: $p = 0.03$. H_1: $p > 0.03$. Test statistic: $z = 1.57$. P–value: $p = 0.0582$.
Critical value: $z = 2.33$. Fail to reject null hypothesis. There is not sufficient evidence to warrant rejection of the manager's claim that production is not really out of control.
2) H_0: $p = 0.5$. H_1: $p < 0.5$. Test statistic: $z = -1.31$. P–value: $p = 0.0951$.
Critical value: $z = -1.645$. Fail to reject null hypothesis. There is not sufficient evidence to warrant rejection of the claim that at least half of all voters prefer the Democrat.
3) H_0: $p = 0.53$. H_1: $p \neq 0.53$. Test statistic: $z = -1.60$. P–value: $p = 0.0548$.
Critical value: $z = \pm 1.645$. Fail to reject null hypothesis. There is not sufficient evidence to warrant rejection of the claim that the actual percentage is 53%.
4) H_0: $p = 0.65$. H_1: $p > 0.65$. Test statistic: $z = 1.64$. P–value: $p = 0.0505$.
Critical value: $z = 1.645$. Fail to reject null hypothesis. There is not sufficient evidence to warrant rejection of the claim that the proportion with lawn mowers in Omaha is 0.64.
5) H_0: $p = 0.34$. H_1: $p > 0.34$. Test statistic: $z = 2.27$. P–value: $p = 0.0116$.
Critical value: $z = 1.645$. Reject null hypothesis. There is sufficient evidence to support the researcher's claim that the proportion for fathers in Littleton is higher than 34%.
6) H_0: $p = 0.11$. H_1: $p \neq 0.11$. Test statistic: $z = 4.61$. P–value: $p = 0.0001$.
Critical values: $z = \pm 1.96$. Reject null hypothesis. There is sufficient evidence to warrant rejection of the claim that the proportion of all children in the town who suffer from asthma is 11%.
7) H_0: $p = 0.5$. H_1: $p > 0.5$. Test statistic: $z = 0.99$. P–value: $p = 0.1611$.
Critical values: $z = 2.33$. Fail to reject null hypotheis. There is not sufficient evidence to support the claim that more than half of all those using the drug experience relief.
8) H_0: $\mu = 200$; H_1: $\mu < 200$; Test statistic: $z = -0.98$. P–value: 0.1635. Fail to reject H_0. There is not sufficient evidence to warrrant the rejection of the claim that the mean equals 200.
9) Test statistic: $t = 7.252$. Critical values: $t = -2.861, 2.861$. Reject the null hypothesis. There is sufficient evidence to warrant rejection of the claim that the mean is equal to 35.0.
10) Test statistic: $t = 9.583$. Critical value: $t = 1.711$. Reject the null hypothesis. There is sufficient evidence to support the claim that the mean is greater than 160.
11) Test statistic: $t = 1.12$. Critical values: $t = \pm 2.228$. Fail to reject H_0. There is not sufficient evidence to warrant rejection of the claim that the mean is 18.7 months.
12) Test statistic: $t = -5.57$. Critical values: $t = -2.567$. Reject H_0. There is sufficient evidence to support the claim that the mean is less than 10 minutes.
13) Test statistic: $t = 0.41$. Critical value: $t = -2.998$. Fail to reject H_0: $\mu = 14$ ounces. There is not sufficient evidence to warrant rejection of the claim that the mean weight is 14 ounces.
14) Test statistic: $t = -4.342$. Critical values: $t = \pm 1.761$. Reject H_0: $\mu = 900$ hours. There is sufficient evidence to support the claim that the true mean life differs from the advertised mean.
15) H_0: $p_1 = p_2$. H_1: $p_1 \neq p_2$.
Test statistic: $z = 0.97$. Critical values: $z = -1.96, 1.96$.
Fail to reject the null hypothesis. There is not sufficient evidence to warrant rejection of the claim that the recognition rates are the same in both states.
16) H_0: $p_1 = p_2$. H_1: $p_1 < p_2$.
Test statistic: $z = -2.41$. Critical value: $z = -1.28$.
Reject the null hypothesis. There is sufficient evidence to support the claim that $p_1 < p_2$.
17) H_0: $p_1 = p_2$. H_1: $p_1 \neq p_2$.
Test statistic: $z = 1.93$. Critical values: $z = 1.96, -1.96$.
Fail to reject the null hypothesis. There is not sufficient evidence to warrant rejection of the claim that the two proportions are equal.

18) H_0: $p_1 = p_2$. H_1: $p_1 > p_2$.
Test statistic: z = 1.21 . Critical value: z = 1.645.
Fail to reject the null hypothesis. There is not sufficient evidence to support the claim that the proportion of women favoring stricter gun control is higher than the proportion of men favoring stricter gun control.

19) H_0: $p_1 = p_2$. H_1: $p_1 \neq p_2$.
Test statistic: z = 3.19. Critical values: z = –2.575, 2.575.
Reject the null hypothesis. There is sufficient evidence to warrant rejection of the claim that the proportion of smokers in the two age groups is the same.

20) H_0: $p_1 = p_2$. H_1: $p_1 < p_2$.
Test statistic: z = –1.80. Critical value: z = –2.05.
Fail to reject the null hypothesis. There is not sufficient evidence to support the claim that the vaccine is effective in lowering the incidence of the disease.

21) H_0: $\mu_1 = \mu_2$. H_1: $\mu_1 \neq \mu_2$.
Test statistic t = 16.025. Critical values: t = 2.032, –2.032.
Reject the null hypothesis. There is sufficient evidence to warrant rejection of the claim that the two populations have equal means.

22) H_0: $\mu_1 = \mu_2$. H_1: $\mu_1 < \mu_2$.
Test statistic t = –2.365. Critical value: t = –2.377.
Fail to reject the null hypothesis. There is not sufficient evidence to support the claim that the treatment population mean μ_1 is smaller than the control population μ_2.