

Chapter 10 AP[®] Statistics Practice Test

Section I: Multiple Choice Select the best answer for each question.

T10.1 A study of road rage asked separate random samples of 596 men and 523 women about their behavior while driving. Based on their answers, each respondent was assigned a road rage score on a scale of 0 to 20. Are the conditions for performing a two-sample t test satisfied?

- (a) Maybe; we have independent random samples, but we need to look at the data to check Normality.
- (b) No; road rage scores in a range between 0 and 20 can't be Normal.
- (c) No; we don't know the population standard deviations.
- (d) Yes; the large sample sizes guarantee that the corresponding population distributions will be Normal.
- (e) Yes; we have two independent random samples and large sample sizes.

T10.2 Thirty-five people from a random sample of 125 workers from Company A admitted to using sick leave when they weren't really ill. Seventeen employees from a random sample of 68 workers from Company B admitted that they had used sick leave when they weren't ill. A 95% confidence interval for the difference in the proportions of workers at the two companies who would admit to using sick leave when they weren't ill is

- (a) $0.03 \pm \sqrt{\frac{(0.28)(0.72)}{125} + \frac{(0.25)(0.75)}{68}}$
- (b) $0.03 \pm 1.96\sqrt{\frac{(0.28)(0.72)}{125} + \frac{(0.25)(0.75)}{68}}$
- (c) $0.03 \pm 1.645\sqrt{\frac{(0.28)(0.72)}{125} + \frac{(0.25)(0.75)}{68}}$
- (d) $0.03 \pm 1.96\sqrt{\frac{(0.269)(0.731)}{125} + \frac{(0.269)(0.731)}{68}}$
- (e) $0.03 \pm 1.645\sqrt{\frac{(0.269)(0.731)}{125} + \frac{(0.269)(0.731)}{68}}$

T10.3 The power takeoff driveline on tractors used in agriculture is a potentially serious hazard to operators of farm equipment. The driveline is covered by a shield in new tractors, but for a variety of reasons, the shield is often missing on older tractors. Two types of shields are the bolt-on and the flip-up. It was believed that the bolt-on shield was perceived

as a nuisance by the operators and deliberately removed, but the flip-up shield is easily lifted for inspection and maintenance and may be left in place. In a study initiated by the U.S. National Safety Council, random samples of older tractors with both types of shields were taken to see what proportion of shields were removed. Of 183 tractors designed to have bolt-on shields, 35 had been removed. Of the 136 tractors with flip-up shields, 15 were removed. We wish to perform a test of $H_0: p_b = p_f$ versus $H_a: p_b > p_f$ where p_b and p_f are the proportions of all tractors with the bolt-on and flip-up shields removed, respectively. Which of the following is not a condition for performing the significance test?

- (a) Both populations are Normally distributed.
- (b) The data come from two independent samples.
- (c) Both samples were chosen at random.
- (d) The counts of successes and failures are large enough to use Normal calculations.
- (e) Both populations are at least 10 times the corresponding sample sizes.

T10.4 A quiz question gives random samples of $n = 10$ observations from each of two Normally distributed populations. Tom uses a table of t distribution critical values and 9 degrees of freedom to calculate a 95% confidence interval for the difference in the two population means. Janelle uses her calculator's two-sample t interval with 16.87 degrees of freedom to compute the 95% confidence interval. Assume that both students calculate the intervals correctly. Which of the following is true?

- (a) Tom's confidence interval is wider.
- (b) Janelle's confidence interval is wider.
- (c) Both confidence intervals are the same.
- (d) There is insufficient information to determine which confidence interval is wider.
- (e) Janelle made a mistake; degrees of freedom has to be a whole number.

Exercises T10.5 and T10.6 refer to the following setting. A researcher wished to compare the average amount of time spent in extracurricular activities by high school students in a suburban school district with that in a school district of a large city. The researcher obtained an SRS of 60 high school students in a large suburban school district and found the mean time spent in extracurricular activities per week

to be 6 hours with a standard deviation of 3 hours. The researcher also obtained an independent SRS of 40 high school students in a large city school district and found the mean time spent in extracurricular activities per week to be 5 hours with a standard deviation of 2 hours. Suppose that the researcher decides to carry out a significance test of $H_0: \mu_{\text{suburban}} = \mu_{\text{city}}$ versus a two-sided alternative.

T10.5 The correct test statistic is

(a) $z = \frac{(6 - 5) - 0}{\sqrt{\frac{3^2}{60} + \frac{2^2}{40}}}$

(b) $z = \frac{(6 - 5) - 0}{\sqrt{\frac{3^2}{60} + \frac{2^2}{40}}}$

(c) $t = \frac{(6 - 5) - 0}{\frac{3}{\sqrt{60}} + \frac{2}{\sqrt{40}}}$

(d) $t = \frac{(6 - 5) - 0}{\sqrt{\frac{3^2}{60} + \frac{2^2}{40}}}$

(e) $t = \frac{(6 - 5) - 0}{\sqrt{\frac{3^2}{60} + \frac{2^2}{40}}}$

T10.6 The P -value for the test is 0.048. A correct conclusion is to

- (a) fail to reject H_0 at the $\alpha = 0.05$ level. There is convincing evidence of a difference in the average time spent on extracurricular activities by students in the suburban and city school districts.
- (b) fail to reject H_0 at the $\alpha = 0.05$ level. There is not convincing evidence of a difference in the average time spent on extracurricular activities by students in the suburban and city school districts.
- (c) fail to reject H_0 at the $\alpha = 0.05$ level. There is convincing evidence that the average time spent on extracurricular activities by students in the suburban and city school districts is the same.
- (d) reject H_0 at the $\alpha = 0.05$ level. There is not convincing evidence of a difference in the average time spent on extracurricular activities by students in the suburban and city school districts.
- (e) reject H_0 at the $\alpha = 0.05$ level. There is convincing evidence of a difference in the average time spent on extracurricular activities by students in the suburban and city school districts.

T10.7 At a baseball game, 42 of 65 randomly selected people own an iPod. At a rock concert occurring at the same time across town, 34 of 52 randomly selected people own an iPod. A researcher wants

to test the claim that the proportion of iPod owners at the two venues is different. A 90% confidence interval for the difference in population proportions (game – concert) is $(-0.154, 0.138)$. Which of the following gives the correct outcome of the researcher's test of the claim?

- (a) Because the confidence interval includes 0, the researcher can conclude that the proportion of iPod owners at the two venues is the same.
- (b) Because the center of the interval is -0.008 , the researcher can conclude that a higher proportion of people at the rock concert own iPods than at the baseball game.
- (c) Because the confidence interval includes 0, the researcher cannot conclude that the proportion of iPod owners at the two venues is different.
- (d) Because the confidence interval includes more negative than positive values, the researcher can conclude that a higher proportion of people at the rock concert own iPods than at the baseball game.
- (e) The researcher cannot draw a conclusion about a claim without performing a significance test.

T10.8 An SRS of size 100 is taken from Population A with proportion 0.8 of successes. An independent SRS of size 400 is taken from Population B with proportion 0.5 of successes. The sampling distribution for the difference (Population A – Population B) in sample proportions has what mean and standard deviation?

- (a) mean = 0.3; standard deviation = 1.3
- (b) mean = 0.3; standard deviation = 0.40
- (c) mean = 0.3; standard deviation = 0.047
- (d) mean = 0.3; standard deviation = 0.0022
- (e) mean = 0.3; standard deviation = 0.0002

T10.9 How much more effective is exercise and drug treatment than drug treatment alone at reducing the rate of heart attacks among men aged 65 and older? To find out, researchers perform a completely randomized experiment involving 1000 healthy males in this age group. Half of the subjects are assigned to receive drug treatment only, while the other half are assigned to exercise regularly and to receive drug treatment. The most appropriate inference method for answering the original research question is

- (a) one-sample z test for a proportion.
- (b) two-sample z interval for $p_1 - p_2$.
- (c) two-sample z test for $p_1 - p_2$.
- (d) two-sample t interval for $\mu_1 - \mu_2$.
- (e) two-sample t test for $\mu_1 - \mu_2$.

T10.10 Researchers are interested in evaluating the effect of a natural product on reducing blood pressure. This will be done by comparing the mean reduction in blood pressure of a treatment (natural product) group and a placebo group using a two-sample t test. The researchers would like to be able to detect whether the natural product reduces blood pressure by at least 7 points more, on average, than the placebo. If groups of size 50 are used in the experiment, a two-sample t test using $\alpha = 0.01$ will have a power of 80% to detect a 7-point difference in mean blood pressure

reduction. If the researchers want to be able to detect a 5-point difference instead, then the power of the test

- (a) would be less than 80%.
- (b) would be greater than 80%.
- (c) would still be 80%.
- (d) could be either less than or greater than 80%, depending on whether the natural product is effective.
- (e) would vary depending on the standard deviation of the data.

Section II: Free Response Show all your work. Indicate clearly the methods you use, because you will be graded on the correctness of your methods as well as on the accuracy and completeness of your results and explanations.

T10.11 Researchers wondered whether maintaining a patient's body temperature close to normal by heating the patient during surgery would affect wound infection rates. Patients were assigned at random to two groups: the normothermic group (patients' core temperatures were maintained at near normal, 36.5°C , with heating blankets) and the hypothermic group (patients' core temperatures were allowed to decrease to about 34.5°C). If keeping patients warm during surgery alters the chance of infection, patients in the two groups should have hospital stays of very different lengths. Here are summary statistics on hospital stay (in number of days) for the two groups:

Group	n	\bar{x}	s_x
Normothermic	104	12.1	4.4
Hypothermic	96	14.7	6.5

- (a) Construct and interpret a 95% confidence interval for the difference in the true mean length of hospital stay for normothermic and hypothermic patients.
- (b) Does your interval in part (a) suggest that keeping patients warm during surgery affects the average length of patients' hospital stays? Justify your answer.
- (c) Interpret the meaning of "95% confidence" in the context of this study.

T10.12 A random sample of 100 of a certain popular car model last year found that 20 had a certain minor

defect in the brakes. The car company made an adjustment in the production process to try to reduce the proportion of cars with the brake problem. A random sample of 350 of this year's model found that 50 had the minor brake defect.

- (a) Was the company's adjustment successful? Carry out an appropriate test to support your answer.
- (b) Describe a Type I error and a Type II error in this setting, and give a possible consequence of each.

T10.13 Pat wants to compare the cost of one- and two-bedroom apartments in the area of her college campus. She collects data for a random sample of 10 advertisements of each type. The table below shows the rents (in dollars per month) for the selected apartments.

1 bedroom:	500	650	600	505	450	550	515	495	650	395
2 bedroom:	595	500	580	650	675	675	750	500	495	670

Pat wonders if two-bedroom apartments rent for significantly more, on average, than one-bedroom apartments.

- (a) State an appropriate pair of hypotheses for a significance test. Be sure to define any parameters you use.
- (b) Name the appropriate test and show that the conditions for carrying out this test are met.
- (c) The appropriate test from part (b) yields a P -value of 0.029. Interpret this P -value in context.
- (d) What conclusion should Pat draw at the $\alpha = 0.05$ significance level? Explain.