Edhesive AP Statistics **Unit 1 – Solutions**

**Multiple Choice:** Choose the best answer choice for the following problems.

*Questions 1-3 apply to the following situation*

A new type of mercury sphygmomanometer is being developed to measure pregnant women’s blood pressure. In order to benchmark its performance, you want to test it against the established blood pressure instruments.

1. To determine if the two devices provide different measurements you record the blood pressure of 52 patients using both devices. Which test should you use?
   1. Paired t test
   2. 𝑂ne-sample z test
   3. Two-sample t test
   4. Two-sample z test
   5. None of these tests are appropriate

The paired t-test is appropriate when testing the same group. Here we make the first measurement of blood pressure and then are interested to see if there is any difference after we apply the second method of measurement.

1. Based on the results of the study conducted, the researchers end up committing both a Type I and Type II error. Which of the following describes their results?
   1. The study results in statistically significant evidence that the new method differs from the established method, when in reality the two methods produce the same results.
   2. The study provides insufficient evidence to claim that the new method differs from the established method, when in reality the two methods produce different results.
   3. The study results in statistically significant evidence that the new method differs from the established method, when in reality the two methods produce different results.
   4. The study provides insufficient evidence to claim that the new method differs from the established method, when in reality the two methods produce the same results.
   5. It is not possible to simultaneously commit a Type I and Type II error.

A Type I error is the incorrect rejection of a true null hypothesis whereas a Type II error is the incorrect acceptance of a false null hypothesis. Therefore you cannot simultaneously commit a Type I (null rejection) and Type II (null acceptance) error within the same test.

1. This test results in a value of . Which of the following best describes the test results at an level?

* 1. P-value < 0.05; 95% significance is reached and the null hypothesis can be rejected
  2. P-value < 0.05; 95% significance is not reached and the null hypothesis cannot be rejected
  3. P-value > 0.05; 95% significance is reached and the null hypothesis can be rejected
  4. P-value > 0.05; 95% significance is not reached and the null hypothesis cannot be rejected
  5. Not enough information is given to determine the test conclusions

For a 2-tailed test, a z-value of 1.87 gives a P-value of 1-2\*0.4693=0.614. Given a level of for this test, we do not achieve statistical significance at the 95% confidence level and cannot reject the null hypothesis.

Questions 4-5 refer to the following situation

A group of researchers wants to determine if airport pollution has any effect on the growth of plant life in the area. To assess this, they take a SRS of 100 trees from near the airport and another 100 trees from a wooded area across town and measure the average growth rate based on the width of the tree rings. They then conduct a statistical test against the hypotheses .

1. The tree ring sample test results in a P-value of 0.03. Which of the following is a valid interpretation of this result?

* 1. Assuming that the true mean tree growth is the same near the airport and far away, there is a 97% chance that there is no difference in tree growth rates.
  2. Assuming that the true mean tree growth is the same near the airport and far away, there is a 3% chance of observing a difference at least as extreme in the sample means.
  3. Assuming that the true mean tree growth is the same near the airport and far away, there is a 97% chance that the growth rates differ between the two locations.
  4. Assuming that the true mean tree growth is different near the airport and far away, there is a 3% chance of observing a difference at least as extreme in the sample means.
  5. Assuming that the true mean tree growth is different near the airport and far away, there is a 3% chance of observing a less extreme difference in the sample means.

The P-value is a measure of the probability of observing more extreme conditions than the ones observed under the assumption of the null hypothesis. In this context that means assuming there is no difference in growth rates there is a 3% chance of observing results as or more extreme than the ones measured.

1. Given the P-value in question 4, which of the following are true?

* 1. A 90% confidence interval for will contain 0.
  2. A 95% confidence interval for will contain 0.
  3. A 99% confidence interval for will contain 0.
  4. A 95% confidence interval for will not contain 0.
  5. A 99% confidence interval for will not contain 0.

With a P-value of 0.03, we can reject the null hypothesis at the 95% confidence level. We can therefore not say anything about what a 99% confidence interval would contain. Since we can reject the null hypothesis ( at both 90% and 95%, we know that these confidence intervals will not contain 0.

**Free Response – Solutions**

1. Bill is testing how his cycling performance depends on which drink he uses. Over a few months whenever he goes for a ride he randomly grabs a beverage from the fridge and records how far he rides. The results are below.

|  |  |  |  |
| --- | --- | --- | --- |
|  | n |  | s |
| Cycle-Ade | 21 | 29.7 | 2.41 |
| Power-Gulp | 22 | 32.4 | 1.88 |

* 1. Compute the standard error for the difference in mileage between the two beverages.

If is the mean mileage biked while drinking Cycle-Ade and is the mean mileage biked while drinking Power-Gulp, then the standard error can be computed as .

* 1. Construct a 95% confidence interval for the mileage difference between the two beverages and offer an interpretation.

We should conduct a 2-sample t test to determine, with 95% confidence, the difference . The conditions for this test are: random- selection of the beverage was made by randomly selecting from the fridge : 10%- does not apply, since each record was randomly assigned to one of two groups : Normal/Large Sample- satisfied since n1+n2>40.

Using the conservative (calculated) df=20 (37.83) the t-critical value for 95% is 2.086 (2.026) so the interval using the conservative df is . Using the calculated df gives . Thus we are 95% confident that this interval contains the true mean difference in mileage between the two beverages.

* 1. State the null and alternative hypotheses you would test to determine if the mean mileage biked while drinking Power-Gulp is higher than the mean while drinking Cycle-Ade.

versus

* 1. The test results in a statistic of t=2.45. Determine the P-value and draw an appropriate conclusion using .

For df=20 or df=37, a t-statistic of 2.45 gives 0.01<P-value<0.025. Therefore we can reject at the level and conclude that we have convincing evidence that Bill bikes further while drinking Power-Gulp than Cycle-Ade.