Edhesive AP Statistics **Unit 9 Test**

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

*Questions 1-3 apply to the following situation:*

Most people, when they touch their thumb and pinky fingers together, can observe a vestigial tendon from our evolutionary history. Known as the palmaris longus, it is present in around 86% of the population. A random sample of 200 people from Iceland were surveyed, as were 200 people from Australia. The results are shown in the table below:

|  |  |  |
| --- | --- | --- |
|  | Tendon present | Tendon absent |
| Iceland | 171 | 29 |
| Australia | 175 | 25 |

Let be the proportion of Icelanders with palmaris longus, and the proportion of Australians with palmaris longus.

1. The researchers are trying to determine if the proportion of people who retain palmaris longus differs between the two groups. What is the appropriate pair of hypotheses to test?
2. Which of the following would violate the conditions necessary to carry out the test described in question 1?
3. If or were too small to ensure reasonable accuracy for Normal calculations
4. If the total population of Australia or Iceland is less than 2,000
5. If the sample of Australians or the sample of Icelanders was not random
   1. I only
   2. II only
   3. I and II only
   4. II and III only
   5. I, II and III would each violate a necessary condition
6. The test from question 1 results in a z-value of . If the researchers wanted to reach a significance level of what is the correct conclusion to draw from this study?
   1. P-value = 0.044, we can reject the null hypothesis. Significant evidence exists to suggest a difference between the two populations.
   2. P-value = 0.044, we cannot reject the null hypothesis. Significant evidence does not exist to support a difference between the two populations.
   3. P-value = 0.09, we can reject the null hypothesis. Significant evidence exists to suggest a difference between the two populations.
   4. P-value = 0.09, we cannot reject the null hypothesis. Significant evidence does not exist to support a difference between the two populations.
   5. P-value = 0.4564, we cannot reject the null hypothesis. Significant evidence does not exist to support a difference between the two populations.
7. The American Heart Association wants to assess the impact of marathon training on heart health. The researchers record the resting heart rate of 10 individuals before they begin their training program and measure them again at the end of the training program right before the marathon. Below are the results:

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Before training | 68 | 76 | 74 | 71 | 63 | 82 | 88 | 80 | 79 | 77 |
| After training | 65 | 73 | 67 | 62 | 55 | 72 | 72 | 69 | 65 | 67 |

Which test would be appropriate to determine if marathon training lowers a person’s resting heart rate?

* 1. Two sample t test with 9 degrees of freedom
  2. Two sample t test with 20 degrees of freedom
  3. Two proportion z test
  4. Paired t test with 9 degrees of freedom
  5. Paired t test with 10 degrees of freedom

1. A new type of food for goldfish is said to increase their lifespan by 5%. The hypotheses to be tested are:

The fish food does not increase the lifespan of the fish

The fish food does increase the lifespan of the fish

If the study results in a Type II error, which of the following is true?

1. The study rejects the null hypothesis and in reality the food does increase lifespan
2. The study rejects the null hypothesis but in reality the food does not increase lifespan
3. The study fails to reject the null hypothesis but in reality the food does increase lifespan
4. The study fails to reject the null hypothesis and in reality the food does not increase lifespan
5. The study is inconclusive due to too small a sample size
6. In an attempt to reduce traffic accidents, a city is going to install new LED speed limit signs to attract motorists’ attention. Since they are expensive, the city wants to install them where people speed the most. The police randomly sample vehicles at two 35 mph zones in town and record the following data:

|  |  |  |  |
| --- | --- | --- | --- |
|  | n | Mean (mph) | St. Dev (mph) |
| Location A | 56 | 42.2 | 4.86 |
| Location B | 72 | 44.1 | 5.83 |

Which of the following is the correct equation to compute the test statistic for the hypothesis that the mean speeds at the two locations are equal?

1. The concentrations of ozone in Florida vary with a known standard deviation of 21.3 (micrograms per cubic meter) in Tampa, and 34.4 in Miami. A random sample of 25 air quality measurements in Tampa and 47 in Miami yield concentration means of 221.4 and 243.1 respectively. In order to determine the likelihood that the two locations have the same ozone concentration means, which combination of test and hypotheses is appropriate? Let the subscripts M, T signify Miami and Tampa.
2. Two-sample unpooled t test
3. Paired t test
4. Two-sample z test
   1. I and IV
   2. I and VI
   3. II and V
   4. II and IV
   5. III and IV

*Questions 8-10 relate to the following scenario:*

The state of Florida decides to reduce their ozone concentrations and sets a goal threshold of 200. To do this, a number of air scrubbers are distributed around the state. A random sampling of air quality was taken at 200 locations beforehand and 127 tested above the 200 threshold. After the scrubbers had been in operation for six months, another 150 locations were tested and 82 tested above the threshold.

1. The researchers hope to show that the scrubbers are succeeding in pulling the ozone concentration below the desired threshold. What is the correct test statistic for the hypotheses

?

1. Suppose the results of the scrubber study give . If the researchers want a significance level of , what is the correct conclusion to draw from the study?
   1. P-value < 0.05; the evidence does not suggest that the scrubbers are reducing ozone concentrations to below the goal threshold.
   2. P-value = 0.0495; the evidence suggests that the scrubbers are reducing ozone concentrations to below the goal threshold.
   3. P-value > 0.05; the evidence does not suggest that the scrubbers are reducing ozone concentrations to below the goal threshold.
   4. P-value = 0.099; the evidence suggests that the scrubbers are reducing ozone concentrations to below the goal threshold.
   5. P-value = 0.901; the evidence suggests that the scrubbers are reducing ozone concentrations to below the goal threshold.
2. Given Florida’s success with the scrubbers, Georgia conducts a similar study. They conduct a two-proportion pooled z-test of the hypotheses , which results in a P-value of 0.13. Which of the following are true?
3. A 75% confidence interval will include the value 0.
4. A 85% confidence interval will not include the value 0.
5. A 95% confidence interval will not contain the value 0.
6. A 99% confidence interval will contain the value 0.
   1. II and IV only
   2. I and II only
   3. III and IV only
   4. I only
   5. None of the above

**Free Response**

1. The effects on an astronauts body from being in space are still being studied. One worrisome effect is the loss of bone mineral density (BMD) over time. While it is established that it happens, a study is being conducted to see if the rate of bone loss increases with the length of time spent in space. Over a number of years the National Aeronautics and Space Administration (NASA) records the decrease in bone mineral density for a number of astronauts who have spent either one or two months in space. Below are the results, where is the sample mean loss-rate in BMD over the given time period in grams per square centimeter per month.

|  |  |  |  |
| --- | --- | --- | --- |
|  | n |  | s |
| 1-month in space | 29 | 0.0129 | 0.0062 |
| 2-months in space | 17 | 0.0155 | 0.0107 |

Assume the necessary conditions have been met for this test.

* 1. Compute the test statistic for the data above using the appropriate test.
  2. Compute the degrees of freedom for this test.
  3. At what confidence level does this test suggest a change in the loss rate of BMD?

1. A supplier of sushi-grade fish conducts a survey of 1000 random people in order to better understand their market. The researchers asked the participants whether or not they lived within 250 miles of the ocean, and whether or not they liked sushi. Of those surveyed, 128 of the 210 who live near the coast say they like sushi while 393 of the 790 who live inland say they like sushi.

Construct a 95% confidence interval for the difference in the proportion of coastal and inland people who like sushi and offer an interpretation of the result.

1. A construction company claiming to have developed stronger I-beams wishes to rebuild a bridge and raise the weight rating, allowing more and heavier traffic. To investigate the performance of the new versus the old beams, a random sample of each of the two types is stress tested. The hypotheses the construction company will test are vs where , are the old and new mean stress limits respectively.
2. Describe a Type I error in this context and explain how it may have dangerous consequences
3. Concerned about the possibility of a Type I error, should the company conduct their test with a significance level of or ? Explain your reasoning.
4. A 90% confidence interval for the true difference in the stress limits between the new beams minus the old beams was found to be (0.45,1.28). Explain what this interval means in the context of this problem. Does it provide evidence that the new beams have significantly higher stress limits than the old beams?