Online Homework System

Assignment Worksheet
6/1/20 - 10:11:00 AM EDT

Name: _____ **Class:**
Class #: _____ **Section #:** _____
Instructor: Nathaniel Stevens **Assignment:** Quiz 2

Question 1: (1 point)

Consider a pregnancy test analogy with with the following hypothesis:

H_0: the person is not pregnant vs. H_A: the person is pregnant

Which of the following corresponds to a Type I Error?

(a) The pregnancy test tells a non-pregnant person that they are pregnant.

(b) The pregnancy test tells a pregnant person that they are pregnant.

(c) The pregnancy test tells a pregnant person that they are not pregnant.

(d) The pregnancy test tells a non-pregnant person that they are not pregnant.

Question 2: (1 point)

Consider a pregnancy test analogy with with the following hypothesis:

H_0: the person is not pregnant vs. H_A: the person is pregnant

In the context of such a hypothesis, the power of the test is:

(a) The probability that the pregnancy test tells a pregnant person that they are not pregnant.

(b) The probability that the pregnancy test tells a non-pregnant person that they are not pregnant.

(c) The probability that the pregnancy test tells a non-pregnant person that they are pregnant.

(d) The probability that the pregnancy test tells a pregnant person that they are pregnant.

Question 3: (1 point)

Suppose we wish to compare the mean response in two conditions via a two-sample *t*-test. But first we use an *F*-test to test the following hypothesis:

$$H_0 : \sigma_1^2 = \sigma_2^2 \text{ versus } H_A : \sigma_1^2 \neq \sigma_2^2$$

If we fail to reject the null hypothesis, which of the following *t*-tests would be most appropriate?

(a) Teacher's *t*-test

(b) Welch's *t*-test

(c) Student's *t*-test

(d) Paired *t*-test

Question 4: (1 point)

Suppose that Vitamix is experimenting with two different versions of their checkout flow and a Student's *t*-test is used to compare the average dollar value of purchases in the two conditions. There are 495 units in condition 1 and 501 units in condition 2. What are the degrees of freedom for this test?

(a) 494

(b) 995

(c) 996

(d) 500

(e) 994

n_1 n_2

$n_1 + n_2 - 2 = 495 + 501 - 2$

$= 994$

Question 5: (2 points)

YouTube is experimenting with two versions of its recommendation algorithm. Two thousand users were randomly selected and then randomly assigned one of the two versions of the algorithm for their session (i.e., 1000 users in each condition). Interest lies in determining whether or not the users choose to watch one of the recommended videos. The data scientists running the experiment are worried about a day-of-week effect and so the experiment is run only on a Wednesday. Ultimately the algorithm that achieves a higher recommendation acceptance rate will be put into full production.

PART I: Which hypothesis statement is most appropriate for this experiment?

(a) $H_0 : \mu_1 = \mu_2$ versus $H_A : \mu_1 \neq \mu_2$

(b) $H_0 : \mu_1 \geq \mu_2$ versus $H_A : \mu_1 < \mu_2$

(c) $H_0 : \pi_1 = \pi_2$ versus $H_A : \pi_1 \neq \pi_2$

(d) $H_0 : \pi_1 \geq \pi_2$ versus $H_A : \pi_1 < \pi_2$

PART II: Which hypothesis test is most appropriate for this experiment?

(a) A *Z*-test

(b) A *t*-test

(c) An *F*-test

Question 6: (2 points)

Suppose an A/B test is performed resulting in the following data summaries:

- $n_1 = 300$; $\hat{\mu_1} = \bar{y_1} = 105$; $\hat{\sigma_1} = s_1 = 17$
- $n_2 = 325$; $\hat{\mu_2} = \bar{y_2} = 106$; $\hat{\sigma_2} = s_2 = 14$

For each of the null hypotheses below, calculate the appropriate test statistic. Enter the value of the test statistic in the boxes provided. Be sure to round to four decimal places.

(a) $H_0 : \sigma_1^2 = \sigma_2^2$

$t =$ _____

$$\frac{s_1^2}{s_2^2} = \frac{17^2}{14^2} = 1.4745$$

(b) $H_0 : \mu_1 = \mu_2$ (assuming $\sigma_1 \neq \sigma_2$)

$t =$ _____

$$\frac{\bar{y}_1 - \bar{y}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}} = \frac{105 - 106}{\sqrt{\frac{17^2}{300} + \frac{14^2}{325}}} = -0.7990$$

Question 7: (1 point)

Consider the following hypothesis and suppose the appropriate *t*-test statistic t is calculated. In the context of this hypothesis, what values of t are considered "extreme" and would give us evidence against H_0?

$$H_0 : \mu_1 = \mu_2 \text{ versus } H_A : \mu_1 \neq \mu_2$$

(a) Large positive numbers (i.e., $t >> 0$)

(b) Large negative numbers (i.e., $t << 0$)

(c) Both of the above (i.e., $t >> 0$ and $t << 0$)

(d) Values close to 0 (i.e., $t \approx 0$)

Question 8: (1 point)

Consider the following hypothesis and suppose the appropriate *Z*-test statistic t is calculated. In the context of this hypothesis, what values of t are considered "extreme" and would give us evidence against H_0?

$$H_0 : \pi_1 \geq \pi_2 \text{ versus } H_A : \pi_1 < \pi_2$$

(a) Large positive numbers (i.e., $t >> 0$)

(b) Large negative numbers (i.e., $t << 0$)

(c) Both of the above (i.e., $t >> 0$ and $t << 0$)

(d) Values close to 0 (i.e., $t \approx 0$)

Question 9: (1 point)

Consider the following hypothesis and suppose the appropriate *F*-test statistic t is calculated. In the context of this hypothesis, what values of t are considered "not extreme" and would give us evidence in favor of H_0?

$$H_0 : \sigma_1^2 = \sigma_2^2 \text{ versus } H_A : \sigma_1^2 \neq \sigma_2^2$$

(a) Large positive numbers (i.e., $t >> 1$)

(b) Small negative numbers (i.e., $t << 1$)

(c) Both of the above (i.e., $t >> 1$ and $t << 1$)

(d) Values close to 1 (i.e., $t \approx 1$)

Question 10: (3 points)

Suppose that you are determining the sample size required to test a hypothesis that has a significance level of α and a power of of $1 - \beta$, and that is designed for a minimum detecable effect of δ. For each part below, fill in the blank space by choosing the appropriate word from the dropdown menu.

(a) All else being equal, *increasing* δ will decrease the required sample size.

(b) All else being equal, *increasing* α will decrease the required sample size.

(c) All else being equal, *increasing* $1 - \beta$ will increase the required sample size.