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Welcome to the Course ITE 3832: Probability and Statistics

Week 09 - Two-Sample Tests (21 Mar - 27 Mar) | Quiz 4 - Hypothesis testing 1

ITE 3832 - Probability and Statistics 2021S1
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Started on	Wednesday, 6 April 2022, 10:20 PM
State	Finished
Completed on	Wednesday, 6 April 2022, 10:23 PM
Time taken	3 mins 44 secs
Grade	**6.00** out of 25.00 (**24**%)

Question **1**

Incorrect

Mark 0.00 out of 1.00

☐ Flag question

The owner of a petrol shed wants to study petrol purchasing habits of motorists at his station. He selects a random sample of 60 motorists during a certain week, with the following results:

The average amount purchased
$\bar{X} = 11.3$ gallons, $S = 3.1$ gallons.

If the owner wants to test whether the mean purchase is 10 gallons, how should the null and alternative hypotheses be formulated?

Select one:

a.

$$H_0 : \mu \neq 10, \ H_1 : \mu = 10$$

b.
$$H_0 : \mu = 10, \ H_1 : \mu > 10$$

c.
$$H_0 : \overline{X} = 10, \ H_1 : \overline{X} \neq 10$$

☐

d.
$$H_0 : \mu = 10, \ H_1 : \mu \neq 10$$

Your answer is incorrect.

The correct answer is:
$$H_0 : \mu = 10, \ H_1 : \mu \neq 10$$

Question 2

Not answered

Marked out of 2.00

☐ Flag question

What is the test statistic for testing the above hypothesis?

Round up your answer to the nearest two decimal places.

Answer:

☐

$$\hat{t} = \frac{11.3 - 10}{\frac{3.1}{\sqrt{60}}} = 3.25$$

The correct answer is: 3.25

Question 3

Partially correct

Mark 1.00 out of 2.00

Select all correct statements.

Select one or more:

☐ Flag question

a.
We can reject the null hypothesis at 1% significance.

☐ Good!
The 1% critical value is roughly 2.7, so we can still reject the null hypothesis at 1% significance.

b.
We cannot reject the null hypothesis at 1% significance.

c.
We cannot reject the null hypothesis at 10% significance.

☐ That's incorrect!
If we can reject the null at 5%, we can also reject it at 10% significance.

d.
We can reject the null hypothesis at 5% significance.

Your answer is partially correct.

You have correctly selected 1.
The critical value from the t distribution with 59 degrees of freedom is 2. Therefore we can reject the null at 5% significance.

If we can reject the null at 5%, we can also reject it at 10% significance.

The 1% critical value is roughly 2.7, so we can still reject the null hypothesis at 1% significance.

The correct answers are: We can reject the null hypothesis at 5% significance., We can reject the null hypothesis at 1% significance.

Question 4

Not answered

Marked out of
3.00

☐ Flag question

The production manager of a garment producing company wishes to find out if the production target of 160 t-shirts per production line per day is being met or whether they are below target. From past experience she knows that daily production follows a normal distribution with population standard deviation, 30. Using data from a sample of 100 production lines, she finds that the sample average production is 156 t-shirts a day.

What is the p-value of the test?

Round up your answer to the nearest 4 decimal places.

Answer:

☐

$$H_0 : \mu = 160, \ H_1 : \mu < 160$$

Since daily production follows a normal distribution and the population standard deviation is known, we start by calculating the Z test statistic:

$$\hat{Z} = \frac{156 - 160}{30/10} = -1.33$$

$$p = P(Z < \hat{Z}) = P(Z < -1.33) = 0.0918$$

The correct answer is: 0.0918

Question 5

Correct

Mark 2.00 out of
2.00

What is your conclusion based on the test? (Select all that apply)

Select one or more:

Flag question

a.
 At 1% significance, there is evidence that
 the target is not being met.

b.
 At 10% significance, there is evidence that
 the target is being met

c.
 It is unclear what should be done and
 making a mistake is costly - taking a
 larger sample might help

☐   Correct!
We can reject the null at 10% but not at
5% significance. Making an incorrect
business decision is costly so taking a
larger sample would increase precision
and help make a better decision.

d.
 At 5% significance, there is evidence that
 the target is being met.

☐   Good!
The p-value is greater than 5% so we
cannot reject the null that the target is
being met (at 5% significance)

Your answer is correct.

The p-value is greater than 5% so we
cannot reject the null that the target is
being met (at 5% and 1% significance).
However, the p-value is less than 10% so
we reject the null and conclude that the
target is not being met (at 10%
significance).

We can reject the null at 10% but not at
5% significance so it is unclear what to
conclude. Making an incorrect business
decision is costly so taking a larger sample
would increase precision and help make a

better decision.

The correct answers are: At 5% significance, there is evidence that the target is being met., It is unclear what should be done and making a mistake is costly - taking a larger sample might help

Question **6**

Correct

Mark 1.00 out of 1.00

☐ Flag question

Two professors wanted to study how students from their two universities compared in terms of age. One school is a state university in the western United States, and the other school is a state university in the eastern United States. The following table contains information regarding the ages of the students:

School	Sample size	Mean	Standard deviation
Western	93	23.28	6.29
Eastern	135	21.16	1.32

What type of test should the professors do?

Select one:

a.
A two-sample test of differences in proportions

b.
A paired t-test

c.
A two-sample (independent samples) t-test for differences in means

☐ Correct!

d.
 A single sample test of the mean

Your answer is correct.

We are comparing the mean ages of two populations so the test cannot be a single sample t-test or a test of differences in proportions. The data is also clearly not paired so the correct test is a two-sample (independent samples) t-test for differences in means.

The correct answer is: A two-sample (independent samples) t-test for differences in means

Question 7

Not answered

Marked out of 2.00

Flag question

If we were to start by testing the equality of population variances, what would the test statistic be?

Round your answer up to the nearest decimal point.

Answer:

☐

We want to test:
$$H_0 : \sigma_1^2 = \sigma_2^2, \; H_1 : \sigma_1^2 \neq \sigma_2^2$$

$$\hat{F} = \frac{6.29^2}{1.32^2} = 22.7$$

Remember, the larger variance should be on the numerator.

The correct answer is: 22.7

Question 8

Correct

Mark 2.00 out of 2.00

☐ Flag question

Using the 5% critical value from the F-table of 1.46, what is your conclusion about the test?

Select one:

a.
We find evidence that there are significant differences in population variances

☐ That's correct!
We can reject the null hypothesis at even 1% significance so there are differences in the variances.

b.
We should use a pooled variance t-test to test differences in mean age

c.
We should use a paired t-test to test differences in mean age

d.
Do not reject the null hypothesis at 5% significance.

Your answer is correct.

The F-stat is much larger than the critical value so we reject the null hypothesis. Since we reject the null that the variances are equal, we should be doing an unequal variances t-test.

The correct answer is: We find evidence that there are significant differences in population variances

Question 9

Not answered

What is the test statistic that you would compute to test for differences in mean

Marked out of
2.00

☐ Flag question

age in the two universities?

Round your answer to the nearest 2
decimal places.

Answer:

☐

We compute the unequal variances test
statistic as:

$$\hat{t} = \frac{(23.28 - 21.16) - 0}{\sqrt{6.29^2/93 + 1.32^2/135}} = 3.16$$

The correct answer is: 3.16

Question **10**

Incorrect

Mark 0.00 out of
2.00

☐ Flag question

What is your final conclusion about age
differences between the two universities?
The t critical value for 1% with two-tails is
2.62.

Select one:

a.
Since the sample means are clearly
different, we can conclude that the means
are different without doing any further
tests

b.
There is no significant difference in mean
age between the two universities.
☐ That's incorrect.
The test statistic is larger than the 1%
critical value, so we can reject the null
hypothesis.

c.

The mean age in the Eastern University is significantly higher than in the Western university, at 1% significance.

d.

We cannot reject the null hypothesis at 10% significance level.

Your answer is incorrect.

The reason we do hypothesis testing is that we cannot simply look at sample means and make conclusions about the populations due to sampling variation.

When we do the test, the test statistic is larger than the 1% critical value, so we can reject the null hypothesis. The mean age in the Eastern University is significantly higher than in the Western university, at 1% significance.

The correct answer is: The mean age in the Eastern University is significantly higher than in the Western university, at 1% significance.

Question **11**

Not answered

Marked out of 1.00

☐ Flag question

Nine experts rated two brands of Colombian coffee in a taste-testing experiment. A rating on a 7-point scale (1 = extremely unpleasing, 7 = extremely pleasing) is given for each of four characteristics: taste, aroma, richness, and acidity. The following data display the ratings accumulated over all four characteristics.

Expert	Brand A	Brand B
CC	24	26
SE	27	27
EG	19	22

BL	24	27
CM	22	25
CN	26	27
GN	27	26
RM	25	27
PV	22	23

What is the mean difference, $\overline{D}$?

Round up your answer to two decimal places.

Answer:

☐

To calculate the mean difference, simply take the difference between each pair of scores and take the average of those differences. You would get the same answer if you take the average of each column and then subtract one from the other. This gives the value 1.56 or -1.56 depending on how you take the difference.

The correct answer is: -1.56

Question 12

Not answered

Marked out of 2.00

☐ Flag question

Compute the 95% confidence interval estimate of the difference in the mean ratings between the two brands.

Provide your answer in the format (x,x) where the upper and lower limits are rounded up to 1 decimal place.

Answer:

☐

The confidence interval is:

$$(-1.56 - 2.3 * \frac{1.42}{3}, -1.56 + 2.3 * \frac{1.42}{3}) = (-$$

or

$$(1.56 - 2.3 * \frac{1.42}{3}, 1.56 + 2.3 * \frac{1.42}{3}) = (0.5,$$

The correct answer is: (-2.7, -0.5)

Question 13

Not answered

Marked out of 2.00

☐ Flag question

Suppose we want to test:

$$H_0 : \mu_D = 0, \ H_1 : \mu_D \neq 0$$

If the computed standard deviation, S_D, is 1.42, what is the test statistic that you would use?

Round up your answer to the nearest decimal place.

Answer:

☐

$$\hat{t} = \frac{-1.56 - 0}{1.42/\sqrt{9}} = -3.3$$

or

$$\hat{t} = \frac{1.56 - 0}{1.42/\sqrt{9}} = 3.3$$

The correct answer is: -3.3

Question 14

Incorrect

Mark 0.00 out of 1.00

☐ Flag question

Using the confidence interval, what is your conclusion?

Select one:

a.
The 95% confidence interval doesn't include 0, therefore, we cannot reject the null that the two brands have the same mean score at 10% significance.

☐   Incorrect!
The 90% confidence interval is narrower than the 95% confidence interval so 0 is still within the 90% confidence interval. Therefore, we reject the null at 10% significance too.

b.
We cannot reach a conclusion using only the confidence interval.

c.
The confidence interval doesn't include 0, therefore we cannot reject the null that the two brands have the same mean score at 5% significance.

d.
The confidence interval doesn't include 0, therefore we reject the null that the two brands have the same mean score at 5% significance.

Your answer is incorrect.

The confidence interval doesn't include 0, therefore we reject the null that the two brands have the same mean score at 5% significance.

The 90% confidence interval is narrower than the 95% confidence interval so 0 is still within the 90% confidence interval. Therefore, we reject the null at 10% significance too.
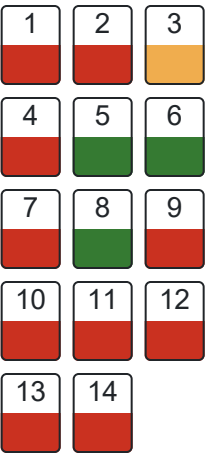
The correct answer is: The confidence interval doesn't include 0, therefore we

reject the null that the two brands have the
same mean score at 5% significance.

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