**Assignment 3 week 9-week 11**

**Student Full Name**:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ .

**Student ID**:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ .

**CRN No**:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ .

|  |  |
| --- | --- |
| **STATISTICS**  **(STAT-101)** |  |
|  | |

**Branch:** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

|  |  |
| --- | --- |
| **Total Points** |  |
| **True/False**  **MCQ**  **Short Answer** | \_\_\_\_/6  \_\_\_\_/6  \_\_\_\_/18 |
|  |  |
| **Total** | \_\_\_\_/30 |

**Good Luck**

**STATISTICS (STAT-101)**

Marks- 30

Answer all the Questions on the same question paper*.*

**Section-I**

***State whether the following statements are True or False. (***6 marks*, 1 Mark Each****)***

1. A type I error is the mistake of rejecting the null hypothesis when it is actually true. True
2. If P –value is greater than α (level of significance) reject the null hypothesis. False
3. Two samples are dependent if the sample values are matched pairs. True
4. In case of hypothesis testing for a sample, the t statistic is used if is not known and sample size n is greater than 30. True
5. A claim that two population proportions are equal, each of the two samples must satisfy the requirement that and . True
6. In an unpaired samples t-test with sample sizes = 21 and = 11, the value of t should be obtained at 10 degree of freedom. True

**Section-II**

**(Multiple Choice Questions)**  (6 marks, 1 Mark Each)

1. Area of the rejection region depends on …
   1. Size of α
   2. Size of β
   3. Test-Statistic.
   4. Number of values
2. A two-tailed test is one where:
3. results in only one direction can lead to rejection of the null hypothesis
4. negative sample means lead to rejection of the null hypothesis
5. results in either of two directions can lead to rejection of the null hypothesis
6. no results lead to the rejection of the null hypothesis

1. A decision in a hypothesis test can be made by using a
   1. P-value
   2. Critical Value
   3. A and B
   4. None of the above
2. When carrying out a large sample test of H0: = 10 vs. Ha: > 10 by using a rejection point, we reject H0 at level of significance when the calculated test statistic is:
   1. Less than
   2. Less than -
   3. Greater than
   4. Greater than
3. A randomly selected sample of 500 college students was asked whether they had ever used the drug Ecstasy. Sixteen percent (16% or 0.16) of the 500 students surveyed said they had. Which one of the following statements about the number 0.16 is correct?
4. It is a population proportion.
5. It is a margin of error.
6. It is a sample proportion.
7. It is a randomly chosen number.
8. Two teams of workers assemble automobile engines at a manufacturing plant in Michigan. A random sample of 145 assemblies from team 1 shows 130 acceptable assemblies. A similar random sample of 125 assemblies from team 2 shows 120 acceptable assemblies. The pooled proportion for acceptable assemblies is:

Part-II (Multiple Choice Questions) (6 marks, 1 Mark Each)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| MCQ | 1 | 2 | 3 | 4 | 5 | 6 |
| Answers | A | C | C | D | C | A |

**Section –III**

**Answer the following Essay Type Questions** (18 marks, 3 Mark Each)

1. A medical researcher claims that less than 20% of American adults are allergic to a medication. In a random sample of 100 adults, 15% say they have such an allergy. Test the researcher’s claim at α = 0.01.

**Solution:** The products and are both greater than 5. So, we can use the z-test. The claim is “less than 20% are allergic to a medication.”

**Step 1**

The claim is

**Step 2**

Alternative to claim is

**Step 3**

the null and alternative hypothesis are:

.

(Claim)

**Step 4**

the level of significance is

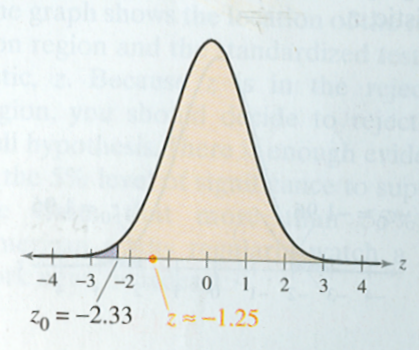
**Step 5**

Using the z-test, the standardized test statistic is:



**Step 6:**

Because the test is a left-tailed test and level of significance is , the critical value is and the rejection region is the area where .



The graph shows the location of the rejection region and the standardized test statistic. Because z is not in the rejection region, you should decide fail to reject the null hypothesis. Or P-value is the area to the left of z = -1.25; The P-value of 0.1056 is greater than the significance level of α = 0.01, fail to reject the null Hypothesis.

In other words, there is not enough evidence to support the claim that less than 20% of Americans are allergic to the medication.

1. Suppose we would like to determine if the typical amount spent per customer for dinner at a new restaurant in town is more than $20.00. A sample of 49 customers over a three-week period was randomly selected and the average amount spent was $22.60. Assume that the standard deviation σ is known to be $5.50. Using a 0.05 level of significance, would we conclude the typical amount spent per customer is more than $20.00?

**Solution**: σ is known ( $5.50), sample size is 49 (n > 30)

**Step 1**

The claim is

**Step 2**

Alternative to claim is

**Step 3**

The null and alternative hypothesis are:

**Step 4**

the significance level is α = 0.05

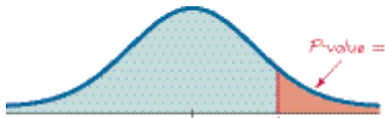
**Step 5**



**Step 6:**

Right-tailed test, so P-value is the area is to the right of z = 3.30;

The P-value of 0.0005 is less than the significance level of α = 0.05, reject the null Hypothesis.



*μ* = 20

or

z = 0

z = 3.30

P-value = 0.0005

There is sufficient evidence to conclude the typical amount spent per customer is more than $20.00.

1. The scores on an aptitude test required for entry into a certain job position have a mean at most 500. If a random sample of 36 applicants have a mean of 546 and a standard deviation of 120, is there evidence that their mean score is different from the mean that is expected from all applicants?. Use a 0.05 level of significance.

**Solution:** population standard deviation is not known, sample size is 36 (n > 30)

**Step 1**

The claim is

**Step 2**

Alternative to claim is

**Step 3**

Null and Alternative Hypothesis are:

.

**Step 4**

the significance level is α = 0.05

**Step 5**



**Step 6**

The degrees of freedom (df=n-1) is 36-1=35. Using t-table with 35 degrees of freedom and level of significance 0.05, the t-value is 1.690. t = 2.3 fall in the critical region bounded by t = 1.690. Reject the null hypothesis.

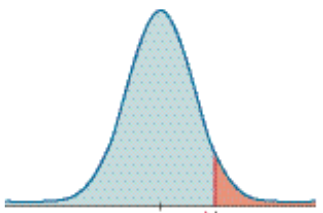
*μ* = 500

or

z = 0

t = 2.3

Critical value t = 1.690



There is sufficient evidence to conclude that the mean score is different from the mean that is expected from all applicants.

1. Suppose a researcher believes that college faculty vote at a lower rate than college students. She collects data from 200 college faculty and 200 college students using simple random sampling. If 120 of the faculty and 150 of the students voted in the 2016 Presidential election, is there enough evidence at the 5% level of significance to support the researcher’s claim?

**Solution:** two samples are independent and

.

.

Consider

p1: proportion of successes for population 1(Faculty)

p2: proportion of successes for population 2(Students)

**Step 1**

The claim is

**Step 2**

Alternative to claim is

**Step 3**

The null and alternative hypothesis are:

.

(Claim)

**Step 4**

significance level is α = 0.05

**Step 5**

.

.

,



So the P- value is 0.0007.

**Step 6**

The P-value of 0.0007 is less than the significance level of α = 0.05, we reject the null hypothesis of .

Because we reject the null hypothesis, we conclude that there is sufficient evidence to support the claim.

**Q. 5 & 6.Use the following information to answer Questions 5 and 6:**

Given the following data of two independent samples of normally distributed populations

|  |  |  |
| --- | --- | --- |
| Data | Population 1 | Population 2 |
| n | 23 | 13 |
|  | 43 | 41 |
| s | 4.5 | 5.1 |

1. Test the claim that at the α=0.05 level of significance
2. Construct a 95% confidence interval about .

**Solution(5) :** two samples are independent and

.

.

Consider

: mean of population 1

: mean of population 2

**Step 1**

The claim is

**Step 2**

Alternative to claim is

**Step 3**

The null and alternative hypothesis are:

.

(Claim)

**Step 4**

Significance level is α = 0.05

**Step 5**

.

.

**Step 6:**

The t- value at and df=n-1=13-1=12 is .

Because the test statistic does not fall within the critical region, fail to reject the null hypothesis:

**Solution(6):** Margin of error (E) is given by

Thus

Confidence interval is given by