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**Testing of Hypothesis**

**Lab: 2**

**PROJECT 2.1:** CONFIDENCE INTERVAL FOR POPULATION MEAN μ, (σ UNKNOWN AND LARGE n)

**OBJECT:**

THE FOLLOWING VALUES ARE THE LENGTHS OF 40 STEEL RODS SELECTED FOR LAB TEST FROM A FACTORY

LENGTH: 125, 120, 121, 123, 122, 130, 124, 122, 120, 122, 118, 119, 123, 124, 122, 124, 121, 122, 138, 149, 123, 128, 122. 130. 120, 122, 124, 134, 137, 128, 122, 121, 125, 120, 132, 130, 128, 130, 122, 124

TEST WHETHER THIS SAMPLE OF SIZE 40 HAS COME FROM A POPULATION WHOSE MEAN LENGTH IS 125 CM.

**WORKING EXPRESSIONS:**

To perform parametric test of hypothesis, we follow basic 5 steps. They are:

Step 1: Null hypothesis (H0)

In a null hypothesis, we assume that there is no significant difference in relationship between variables or groups being compared.

Step 2: Alternative hypothesis (H1)

In a null hypothesis, we assume that there is significant difference in relationship between variables or groups being compared.

Step 3: Test statistic: We perform the various expressions based on the type of question in test statistics.

Parametric test of hypothesis are of two types. They are:

1. Z – Test (when n>30)
2. Test of significance of Single Mean

Formula: Zcal =

1. Test of significance of Double Mean

Formula: Zcal =

1. Test of significance of Single Proportion

Formula: Zcal =

1. Test of significance of Double Proportion

Formula: Zcal  =

1. T - Test (when n<30)

Step 4: Tabulated value: In this step, we use tabulated values to determine the critical value or p-value for making decision regarding the null hypothesis.

Step 5: Conclusion and decision

In conclusion and decision, we assess the statistical significance of the results and determine what her there is sufficient evidence to accept or reject the null hypothesis.

**PROCESS:**

Solution: We wish to test the hypothesis that the samples differs significantly from a hypothesized population mean height of 125 cm. So we have

(H0) :μ = 125 Versus **(**H1) : μ ≠ 125

1. Enter the data in the data editor.
2. Select Analyze Compare Means One sample T test. Type in Test Value Box.
3. Click Options Type 95 in confidence interval percentage box.
4. Click on Continue and then Ok.

**CALCULATION:**

**Step 1**: **Null Hypothesis (H0),** μ = 125

i.e. The sample of size 40 has come from a population whose mean length is 125 cm.

**Step 2**: **Alternative Hypothesis (H1),** μ ≠ 125

i.e. There is significant difference in sample of size 40 has come from a population whose mean length is 125 cm.

**Step 3**: **Test Statistics:**

From SPSS,

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **One-Sample Statistics** | | | | |
|  | N | Mean | Std. Deviation | Std. Error Mean |
| Length | 40 | 125.28 | 6.148 | .972 |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **One-Sample Test** | | | | | | |
|  | Test Value = 125 | | | | | |
| t | df | Sig. (2-tailed) | Mean Difference | 95% Confidence Interval of the Difference | |
| Lower | Upper |
| Length | .283 | 39 | .779 | .275 | -1.69 | 2.24 |

Here, from the table,

|Zcal­| = 0.283

P-value (sig. (2-tailed)) = 0.779

At 95% confidence level, i.e. level of significance (α) = 0.05

**Step 4: Decision and Conclusion**

Since, P > α

Decision: We accept Ho region and reject H1 region

Conclusion: The sample of size 40 has come from a population whose mean length is 125 cm.

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**Testing of Hypothesis**

**Lab: 2**

**PROJECT 2.2:** HYPOTHESIS TESTING BETWEEN TWO POPULATION MEANNS FOR MATCHES PAIRED SAMPLES

**OBJECT:**

THE SALES OF A PRODUCT OF A COMPANY AFTER AND BEFORE ADVERTISEMENT ARE AS FOLLOW:

IS ADVERTISEMENT EFFECTIVE AT 5%?

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Month | 1 | 2 | 3 | 4 | 5 | 6 |
| Before X | 120 | 140 | 160 | 140 | 180 | 190 |
| After Y | 200 | 210 | 150 | 200 | 220 | 240 |

**WORKING EXPRESSIONS:**

To perform parametric test of hypothesis, we follow basic 5 steps. They are:

Step 1: Null hypothesis (Ho)

In a null hypothesis, we assume that there is no significant difference in relationship between variables or groups being compared.

Step 2: Alternative hypothesis (H1)

In a null hypothesis, we assume that there is significant difference in relationship between variables or groups being compared.

Step 3: Test statistic: We perform the various expressions based on the type of question in test statistics.

Parametric test of hypothesis are of two types. They are:

1. Z – Test (when n>30)
2. Test of significance of Single Mean

Formula: Zcal =

1. Test of significance of Double Mean

Formula: Zcal =

1. Test of significance of Single Proportion

Formula: Zcal =

1. Test of significance of Double Proportion

Formula: Zcal  =

1. T - Test (when n<30)

Step 4: Critical value: In this step, we use tabulated values to determine the critical value or p-value for making decision regarding the null hypothesis.

Step 5: Conclusion and decision

In conclusion and decision, we assess the statistical significance of the results and determine whether there is sufficient evidence to accept or reject the null hypothesis.

**PROCESS:**

H0 : μx = μy versus H1 : μx < μy

1. Enter the data into Data editor
2. Select Analyze Compare Mean Paired - samples T Test
3. Move value into Test variable(s) and type into grouping variable
4. Click options Continue OK.

**CALCULATION:**

**Step 1**: **Null Hypothesis (Ho),** μx = μy

i.e. The sales of a product of a company after advertisement is not effective at 5% significance level

**Step 2**: **Alternative Hypothesis (H1),** μx < μy

i.e. The sales of a product of a company after advertisement is effective at 5% significance level

**Step 3**: **Test Statistics:**

From SPSS,

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Paired Samples Test** | | | | | | | | | |
|  | | Paired Differences | | | | | t | df | Sig. (2-tailed) |
| Mean | Std. Deviation | Std. Error Mean | 95% Confidence Interval of the Difference | |
| Lower | Upper |
| Pair 1 | Before\_X - Before\_Y | -48.333 | 31.885 | 13.017 | -81.795 | -14.872 | -3.713 | 5 | .014 |

P-value = sig. (2-tailed) = 0.014

|Tcal|= -3.713

α = 0.05

**Step 4: Decision and Conclusion**

Since, p < α

Decision: We accept H1 region and reject H0 region

Conclusion: After testing of hypothesis, we can conclude that the sales of a product of a company was effective after advertisement at 5% significance level.

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**Testing of Hypothesis**

**Lab: 2**

**PROJECT 2.3:** HYPOTHESIS TESTING WHEN RAW DATA FOR INDEPENDENT SAMPLES IS GIVEN

**OBJECTS:** THE MONTHLY ADVERTISING COST OF A COMPANY FOR TWO PRODUCTS X AND Y WERE AS FOLLOWS DURING 6 MONTH PERIOD

IS THERE SUFFICIENT EVIDENCE TO CONCLUDE THAT AVERAGE COST ON ADVERTISING ON PRODUCT Y IS MORE THAN ON PRODUCT X.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Month | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Cost I (X) | 220 | 240 | 160 | 240 | 280 | 290 | - |
| Cost II (Y) | 100 | 110 | 150 | 100 | 120 | 140 | 145 |

**WORKING EXPRESSIONS:**

To perform parametric test of hypothesis, we follow basic 5 steps. They are:

Step 1: Null hypothesis (Ho)

In a null hypothesis, we assume that there is no significant difference in relationship between variables or groups being compared.

Step 2: Alternative hypothesis (H1)

In a null hypothesis, we assume that there is no significant difference in relationship between variables or groups being compared.

Step 3: Test statistic: We perform the various expressions based on the type of question in test statistics.

Parametric test of hypothesis are of two types. They are:

1. Z – Test (when n>30)
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Formula: Zcal =

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Formula: Zcal =

1. Test of significance of Single Proportion

Formula: Zcal =

1. Test of significance of Double Proportion

Formula: Zcal  =

1. T – Test (when n<30)

Step 4: Critical value: In this step, we use tabulated values to determine the critical value or p-value for making decision regarding the null hypothesis.

Step 5: Conclusion and decision

In conclusion and decision, we assess the statistical significance of the results and determine whether there is sufficient evidence to accept or reject the null hypothesis.

**PROCESS:**

Solution:

H0 : μ1 = μ2 VS H1 : μ1 < μ2

1. Enter the data into Data editor
2. Select Analyze Compare Mean Independent samples T Test
3. Move value into Test variable(s) and type into grouping variable
4. Click Define groups nd type 1 and 2 into group 2
5. Click options Continue OK.

**CALCULATION:**

**Step 1**: **Null Hypothesis (Ho),** μ1 = μ2

i.e. There is no sufficient evidence to conclude that average cost on advertising on product y in more than on product x.

**Step 2**: **Alternative Hypothesis (H1),** μ1 < μ2

i.e. There is sufficient evidence to conclude that average cost on advertising on product y in more than on product x.

**Step 3**: **Test Statistics:**

From SPSS,

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Independent Samples Test** | | | | | | | | | | |
|  | | Levene's Test for Equality of Variances | | t-test for Equality of Means | | | | | | |
| F | Sig. | t | df | Sig. (2-tailed) | Mean Difference | Std. Error Difference | 95% Confidence Interval of the Difference | |
| Lower | Upper |
| Cost | Equal variances assumed | 1.357 | .269 | 5.862 | 11 | .000 | 114.762 | 19.576 | 71.675 | 157.848 |
| Equal variances not assumed |  |  | 5.548 | 6.775 | .001 | 114.762 | 20.686 | 65.515 | 164.008 |

From the table,

P-value = 0.269

α = 0.05

**Step 4: Decision and Conclusion**

Since, P-value > α

Decision: We accept Ho region and reject H1 region.

Conclusion: There is no sufficient evidence to conclude that average cost on advertising on product y in more than on product x as average cost of both product X and Y are equal.