Hypothesis Testing Assignment

1. Scenario:

A F&B manager wants to determine whether there is any significant difference in the diameter of the cutlet between two units. A randomly selected sample of cutlets was collected from both units and measured? Analyze the data and draw inferences at 5% significance level. Please state the assumptions and tests that you carried out to check validity of the assumptions.

Ans:

1. Business Problem:

Is any significant difference in the diameter of the cutlet between two units?

1. Dataset: Cutlets-Y is continuous & X is Discrete (Unit A & Unit B).

|  |  |
| --- | --- |
| Unit A | Unit B |
| 6.809 | 6.7703 |
| 6.4376 | 7.5093 |
| 6.9157 | 6.73 |
| 7.3012 | 6.7878 |
| 7.4488 | 7.1522 |
| 7.3871 | 6.811 |
| 6.8755 | 7.2212 |
| 7.0621 | 6.6606 |
| 6.684 | 7.2402 |
| 6.8236 | 7.0503 |
| 7.393 | 6.881 |
| 7.5169 | 7.4059 |
| 6.9246 | 6.7652 |
| 6.9256 | 6.038 |
| 6.5797 | 7.1581 |
| 6.8394 | 7.024 |
| 6.597 | 6.6672 |
| 7.2705 | 7.4314 |
| 7.2828 | 7.307 |
| 7.3495 | 6.7478 |
| 6.9438 | 6.8889 |
| 7.156 | 7.422 |
| 6.5341 | 6.5217 |
| 7.2854 | 7.1688 |
| 6.9952 | 6.7594 |
| 6.8568 | 6.9399 |
| 7.2163 | 7.0133 |
| 6.6801 | 6.9182 |
| 6.9431 | 6.3346 |
| 7.0852 | 7.5459 |
| 6.7794 | 7.0992 |
| 7.2783 | 7.118 |
| 7.1561 | 6.6965 |
| 7.3943 | 6.578 |
| 6.9405 | 7.3875 |

1. ***Normality Test:***

H0: Data are normal

Ha: Data are not normal

95% Confidence Level(1-Alpha)

5% (Alpha)

P-value > alpha=> p-value > 0.05=> P high H0 fly=>Accept H0.

Unit A: P-value=0.287 >0.05=>P high H0 Fly=> Accept H0.

Unit B: P-value=0.687 >0.05=>P high H0 Fly=> Accept H0.

***Variance Test:***

H0: Variance of Unit A = Variance of Unit B

Ha: Variance of Unit A NOT = Variance of Unit B

P-value=0.297>0.05=>P high H0 Fly=> Accept H0.

***2 Sample T Test:***

Compare means using 2 Sample T

H0: Average of Unit A= Average of Unit B

Ha: Average of Unit A NOT = Average of Unit B

P-value=0.472>0.05=> P high H0 Fly=> Accept H0.

**Assumption: Unit A is equal to Unit B.**

1. Scenario:

A hospital wants to determine whether there is any difference in the average Turn Around Time (TAT) of reports of the laboratories on their preferred list. They collected a random sample and recorded TAT for reports of 4 laboratories. TAT is defined as sample collected to report dispatch.

Analyze the data and determine whether there is any difference in average TAT among the different laboratories at 5% significance level.

Ans:

1. Business Problem:

is any difference in the average Turn Around Time (TAT) of reports of the 4 laboratories?

1. Datasets: LabTAT-Y is continuous & X is discrete (Lab1, Lab2, Lab3 & Lab4)

|  |  |  |  |
| --- | --- | --- | --- |
| Laboratory 1 | Laboratory 2 | Laboratory 3 | Laboratory 4 |
| 185.35 | 165.53 | 176.7 | 166.13 |
| 170.49 | 185.91 | 198.45 | 160.79 |
| 192.77 | 194.92 | 201.23 | 185.18 |
| 177.33 | 183 | 199.61 | 176.42 |
| 193.41 | 169.57 | 204.63 | 152.6 |
| 179.45 | 197 | 181.51 | 161.12 |
| 191.37 | 166.36 | 214.21 | 154.02 |
| 166.81 | 169.6 | 183.43 | 163.25 |
| 158.81 | 175.36 | 191.6 | 152.79 |
| 165.88 | 198.68 | 208.43 | 161.98 |
| 174.75 | 189.12 | 231 | 171.22 |
| 193.37 | 140.55 | 198.37 | 183.67 |
| 184.75 | 160.44 | 226.62 | 142.95 |
| 178.54 | 167.03 | 214.44 | 152.37 |
| 180.19 | 182.67 | 159.69 | 163.81 |
| 172.17 | 155.73 | 214.14 | 156.06 |
| 172 | 183.07 | 212.29 | 176.44 |
| 184.92 | 177.7 | 209.25 | 173.68 |
| 187.38 | 191.62 | 198.54 | 161.49 |
| 194.17 | 186.85 | 229.02 | 175.05 |
| 192.03 | 161.09 | 214.71 | 150.22 |
| 193.77 | 173.01 | 172.27 | 148.17 |
| 178.24 | 199.43 | 205.31 | 166.21 |
| 171.41 | 185.67 | 180.35 | 145.4 |
| 178.3 | 182.69 | 214.58 | 166.42 |
| 176.13 | 180.45 | 231.76 | 132.21 |
| 180.67 | 182.37 | 215.78 | 143.26 |
| 177.38 | 189.99 | 201.78 | 154.06 |
| 190.36 | 167.55 | 191.64 | 179.08 |
| 199.99 | 190.09 | 217.56 | 144.82 |
| 181.36 | 168.01 | 193.04 | 184.64 |
| 187.37 | 176.5 | 217.66 | 188.49 |
| 172.93 | 173.54 | 198.68 | 198.69 |
| 187.18 | 153.75 | 206.49 | 142.43 |
| 179.03 | 212.8 | 198.81 | 169.68 |
| 181.69 | 179.32 | 200.58 | 174.79 |
| 185.28 | 173.56 | 199.91 | 133.31 |
| 157.14 | 217.86 | 190.34 | 176.42 |
| 184.42 | 187.57 | 181.87 | 176.67 |
| 183.45 | 163.69 | 214.39 | 158.2 |
| 175.5 | 186.49 | 189.61 | 157.02 |
| 169.55 | 171.31 | 203.58 | 154.55 |
| 166.86 | 202.29 | 196.64 | 157.58 |
| 166.33 | 197.68 | 225.42 | 161.96 |
| 173.88 | 156.89 | 175.13 | 168.14 |
| 189.84 | 168.03 | 228.21 | 180.14 |
| 184.88 | 173.09 | 229.33 | 170.28 |
| 188.63 | 187.52 | 170.58 | 166.68 |
| 216.39 | 193.28 | 177.76 | 161.42 |
| 180.57 | 178.04 | 207.34 | 153.97 |
| 177.54 | 197.45 | 178.07 | 167.5 |
| 182.34 | 172.35 | 188.32 | 165.43 |
| 187.35 | 167.63 | 193.26 | 150.83 |
| 185.87 | 194.24 | 201.17 | 149.96 |
| 188.01 | 179.43 | 192.75 | 161.94 |
| 182.62 | 183.62 | 192.81 | 146.46 |
| 179.08 | 157.92 | 183.1 | 174.83 |
| 189.96 | 173.55 | 181.92 | 181.66 |
| 169.15 | 180.86 | 209.43 | 164.82 |
| 169.83 | 161.02 | 180.11 | 181.35 |
| 181.45 | 178.42 | 172.92 | 176.21 |
| 196.13 | 165.12 | 205.01 | 152.4 |
| 172.02 | 183.75 | 206.46 | 159.63 |
| 181.83 | 186.77 | 192.48 | 156.56 |
| 170.41 | 177.59 | 237.49 | 168.11 |
| 161.99 | 202.78 | 173.08 | 145.07 |
| 138.3 | 176.63 | 193.08 | 128.93 |
| 170.61 | 169.11 | 203.24 | 165.95 |
| 201.27 | 148.7 | 215.17 | 181.76 |
| 202.12 | 154.19 | 186.83 | 168.17 |
| 172.62 | 189.65 | 199.7 | 162.11 |
| 159.13 | 186.93 | 225.14 | 177.03 |
| 143.52 | 168.2 | 213.18 | 124.06 |
| 195.85 | 159.14 | 237.23 | 138.48 |
| 186.22 | 182.17 | 189.98 | 167.83 |
| 168.62 | 198.69 | 193.63 | 165.07 |
| 164.88 | 167.9 | 184.7 | 153.74 |
| 155.29 | 178.21 | 175.87 | 172.72 |
| 168.39 | 170.73 | 180.94 | 159.97 |
| 190.02 | 199.62 | 211.19 | 167.26 |
| 188.99 | 186.03 | 205.54 | 164.98 |
| 175.49 | 156.23 | 219.55 | 154.06 |
| 190.88 | 158.08 | 197.33 | 168.92 |
| 178.08 | 163.74 | 205.62 | 168.9 |
| 210.38 | 161.45 | 238.7 | 157.48 |
| 164.27 | 163.45 | 192.5 | 164.03 |
| 166.97 | 178.17 | 208.35 | 162.76 |
| 176.16 | 194.1 | 208.04 | 173.37 |
| 199.72 | 182.6 | 222.47 | 152.13 |
| 176.93 | 168.51 | 207.6 | 187.08 |
| 185.16 | 191.89 | 194.59 | 162.84 |
| 161.05 | 180.53 | 184.28 | 162.67 |
| 186.32 | 165.45 | 174.55 | 157.21 |
| 149.24 | 168.8 | 188.53 | 156.79 |
| 168.62 | 159.92 | 204.28 | 172.38 |
| 171.64 | 188.49 | 202.95 | 167.62 |
| 185.42 | 205.27 | 177.62 | 172.72 |
| 162.43 | 185.63 | 201.99 | 167.55 |
| 178.81 | 197.38 | 195.6 | 132.49 |
| 172.65 | 186.71 | 178.86 | 166.18 |
| 164.65 | 194.81 | 211.23 | 176.79 |
| 178.52 | 198.09 | 213.29 | 197.98 |
| 170.11 | 164.07 | 199.12 | 184.78 |
| 167.15 | 170.48 | 187.97 | 180.51 |
| 190.32 | 184.86 | 180.93 | 167.27 |
| 167.25 | 189.11 | 213.22 | 159.34 |
| 179.2 | 179.68 | 175.36 | 142.35 |
| 171.65 | 142.38 | 187.6 | 167.07 |
| 166.35 | 167.72 | 208.33 | 126.94 |
| 175.41 | 199.9 | 172.86 | 205.18 |
| 172.05 | 174.43 | 211.64 | 152.31 |
| 181.88 | 168.2 | 183.19 | 191.26 |
| 201.11 | 195.07 | 203.05 | 160.98 |
| 154.21 | 193.79 | 197.88 | 192.23 |
| 145.89 | 175.16 | 203.39 | 139.34 |
| 178.49 | 170.66 | 193.8 | 172.68 |
| 176.08 | 183.98 | 215.25 | 177.64 |
| 202.48 | 174.54 | 203.99 | 170.27 |
| 182.4 | 197.18 | 194.52 | 150.87 |
| 182.09 | 215.17 | 221.49 | 162.21 |

1. ***Normality Test:***

H0: Data are normal

Ha: Data are not normal

95% Confidence Level(1-Alpha)

5% (Alpha)

P-value > alpha=> p-value > 0.05=> P high H0 fly=>Accept H0.

Lab 1: P-value= 0.532>0.05=>P high H0 Fly=> Accept H0.

Lab 2: P-value= 0.733>0.05=>P high H0 Fly=> Accept H0.

Lab 3: P-value= 0.577>0.05=>P high H0 Fly=> Accept H0

Lab 4: P-value= 0.419>0.05=>P high H0 Fly=> Accept H0

***Variance Test:***

H0: Variance TAT of all 4 Labs are same

Ha: Variance TAT of at least 1 Lab is different

P-value=0.107>0.05=>P high H0 Fly=> Accept H0.

***ANOVA Test:***

H0: Average TAT of all 4 Labs are same

Ha: Average TAT of at least 1 Lab is different

P-value= 0.000<0.05=>P low H0 go=> Accept Ha

**At least different from all, which is not equal**

1. Scenarios:

Sales of products in four different regions is tabulated for males and females. Find if male-female buyer rations are similar across regions.

Ans:

1. **Business Problem:**

if male-female buyer ratios are similar across regions?

1. **Dataset**: Buyer Ratio-Y is discrete (Male/Female) & X is discrete (East, West, North & South)

Observed Values East West North South

Males 50 142 131 70

Females 435 1523 1356 750

1. ***Normality Test:***

H0: Data are normal

Ha: Data are not normal

95% Confidence Level(1-Alpha)

5% (Alpha)

P-value > alpha=> p-value > 0.05=> P high H0 fly=>Accept H0.

East: P-value= 0.227>0.05=>P high H0 Fly=> Accept H0.

West: P-value=0.227 >0.05=>P high H0 Fly=> Accept H0.

North: P-value= 0.227>0.05=>P high H0 Fly=> Accept H0

South: P-value=0.227 >0.05=>P high H0 Fly=> Accept H0

***Chi-Square Test:***

H0: Average buyer ratios of across regions are same

Ha: Average buyer ratios of at least 1 region is different

P-value=0.674>0.05=> P high H0 Fly=> Accept H0.

**Inference: Proportion of Male and female buying ratio is similar in across regions.**

1. Scenario:
2. Telecall uses 4 centers around the globe to process customer order forms. They audit a certain % of the customer order forms. Any error in order form renders it defective and has to be reworked before processing. The manager wants to check whether the defective % varies by centre. Please analyze the data at *5%* significance level and help the manager draw appropriate inferences

Ans:

1. **Business Problem:**

Manager wants to check whether the defective % varies by 4 Centre.

1. **Dataset:** Customer order form-Y is Discrete & X is Discrete (Philippines, Indonesia, Malta & India).

95% Confidence Level(1-Alpha)

5% (Alpha)

P-value > alpha=> p-value > 0.05=> P high H0 fly=>Accept H0.

1. **Chi-Square Test:**

H0: Average defective of 4 Centre are same

Ha: Average defective of at least 1 Centre is different

P-value=0.277>0.05=> P high H0 Fly=> Accept H0.

**Proportion of all the Centers are equal.**

1. Scenario:

Fantaloons Sales managers commented that *%* of males versus females walking into the store differ based on day of the week. Analyze the data and determine whether there is evidence at *5 %* significance level to support this hypothesis.

Ans: 1. **Business Problem:**

Fantaloons Sales managers commented that *%* of males versus females walking into the store differ based on day of the week.

1. **Dataset:** Fantaloons-Y is discrete (Weekdays & Weekend) & X is discrete (Male & Female).

95% Confidence Level(1-Alpha)

5% (Alpha)

P-value > alpha=> p-value > 0.05=> P high H0 fly=>Accept H0.

1. ***2 Proportion Test:***

H0: Proportion of M&F Weekdays =Proportion of M&F Weekend

Ha: Proportion of M&F Weekdays Not =Proportion of M&F Weekend

P-value=0.968>0.05=> P high H0 Fly=> Accept H0.

**Proportion of M&F walking into the store is equal on weekdays & weekends.**