**1. 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.**

Minitab File: **Cutlets.mtw**

Ans: - Business Problem: - To identify that the diameter of both the cutlets are same or not.

Let A and B are the two units of cutlet and DA and DB are the diameters of cutlet A and B

Ho: DA = DB, Diameters of cutlet A and cutlet B are equal

H1: DA ≠ DB, Diameters of cutlet A and cutlet B are not equal

Datasets: y is continuous, Two populations

Normality test:

Ho: Data is normally distributed

H1: Data is not normally distributed

**shapiro.test(Unit.A),**

**shapiro.test(Unit.B)**

**Test Summary,**

data: Unit.A

W = 0.96495, **p-value = 0.32**

data: Unit.B

W = 0.97273, **p-value = 0.5225**

Since p-value > 0.05, p high, null fly,

So, fail to reject the null hypothesis.

Therefore, data is normally distributed.

Since External condition is same

Choose Test: ***It is paired T –test***

Ho: DA = DB, Diameters of cutlet A and cutlet B are equal.

H1: DA ≠ DB, Diameters of cutlet A and cutlet B are not equal.

**t.test(Unit.A, Unit.B, alternative = "two.sided", conf.level =0.95, paired = TRUE) Test** Summary :

Paired t-test

data: Unit.A and Unit.B

t = 0.75368, df = 34, **p-value = 0.4562**

alternative hypothesis: true difference in means is not equal to 0

95 percent confidence interval:

-0.09295486 0.20254343

sample estimates:

mean of the differences

0.05479429

p-value > 0.05 , p high, null fly

So fail to reject null hypothesis

Conclusion: DA = DB, Diameters of cutlet A and cutlet B are equal.

**2. 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.**

Minitab File: **LabTAT.mtw**

Ans: -

Business Problem: - To determine whether there is any difference in average TAT among the different laboratories

Let A1, A2, A3 and A4 are the average of recorded TAT for reports of Labrotary1, Labrotary2, Labrotary3 and Labrotary4 respectively

Ho: Average TAT of all the laboratories are same

H1 : Average TAT of all the laboratories are not same.

Data: y is continuous, 4 populations

Normality Test:

Ho: Data is normally distributed

H1: Data is not normally distributed

**shapiro.test(Laboratory.1)**

**shapiro.test(Laboratory.2)**

**shapiro.test(Laboratory.3)**

**shapiro.test(Laboratory.4)**

Test Summary

data: Laboratory.1

W = 0.99018, p-value = 0.5508

data: Laboratory.2

W = 0.99363, p-value = 0.8637

data: Laboratory.3

W = 0.98863, p-value = 0.4205

data: Laboratory.4

W = 0.99138, p-value = 0.6619

p- value > 0.05, p high null fly, fail to reject null hypothesis

So, data is normally distributed.

Variance Test:

Ho: All variances are equal

H1: All variances are not equal

Since more than two variance we have to do leveneTest available under Car package in R

**leveneTest (values~ind, data=stacked\_TAT)**

Test Summary:

Levene's Test for Homogeneity of Variance (center = median)

Df F value Pr(>F)

group 3 2.5996 0.05161 .

476

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Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

p-value > 0.05, p high null fly, fail to reject null hypothesis

Variances are equal

Choose Test: **It is One way Anova Test**

Ho: Average TAT of all the laboratories are same

H1 : Average TAT of all the laboratories are not same.

**Anova\_TAT <- aov(values~ind,data=stacked\_TAT)**

Test Summary:

Df Sum Sq Mean Sq F value Pr(>F)

ind 3 79979 26660 118.7 <2e-16 \*\*\*

Residuals 476 106905 225

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Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

p-value< 0.05, p low, null go, reject null hypothesis, accept alternative hypothesis

Conclusion: The average TAT(Turn Around Time) is not same for all the four laboratory and there is difference in average TAT among different laboratories.

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

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **East** | **West** | **North** | **South** |
| Males | 50 | 142 | 131 | 70 |
| Females | 550 | 351 | 480 | 350 |

Buyer Ratio.mtw

Ans: -

Business Problem: - To check weather male and female buyers’ ratio across nation is same or not

Let RE, RW, RN and RS arethe ratios of male and female buyers along the East, West, North and South region respectively.

Ho: The ratios of male and female buyers are same across East, West, North and South.

H1: The ratios of male and female buyers are not same across East, West, North and South.

Datasets:- y is discrete, male and female relations among East West North and South, so 4 populations

Choose Test: **It is chi-squared test**

Test Summary:

chisq.test(dat)

Pearson's Chi-squared test

data: dat

X-squared = 1.5959, df = 3, p-value = 0.6603

Since p-value = 0.6603>0.05, p high null fly

So fail to reject null hypothesis

Conclusion: The ratios of male and female buyers are same across East, West, North, South.

**4.) 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.**

Minitab File: **CustomerOrderForm.mtw**

Ans:-

Business Problem: - To analyse weather the defective percentage varies along four centres of Amazon.

Ho: Defective percentage is same along the countries.

H1: Defective percentage is not same along the countries.

Datasets: - y is discrete, 4 populations

Choose Test: **It is Chi- Squared Test.**

**Test Summary**

> cus\_ord <- apply(customer\_order\_form , 2,table)

> cus\_ord

Phillippines Indonesia Malta India

Defective 29 33 31 20

Error Free 271 267 269 280

> chisq.test(cus\_ord)

Pearson's Chi-squared test

data: cus\_ord

X-squared = 3.859, df = 3, p-value = 0.2771

Since p-value = 0.2771 > 0.05, p high null fly, So fail to reject null hypothesis

Conclusion**:** The defective percentage is same along the four centres.

**5.) Fantaloons Sales managers commented that *%* of males versus females walking in to 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.**

 Minitab File: **Fantaloons.mtw**

Ans:-

Business Problem: - To analyse the % of males and females walking in to the store differs in the weekdays and weekends

Ho: % of male and female in weekends is same % of male and female in weekdays

H1% of male and female in weekends is not same % of male and female in weekdays

Datasets: y is discrete, 2 populations’ weekdays and weekends

Choose Test : - It is 2-proportion tests

Case 1 :

Ho: % of male and female in weekends is same % of male and female in weekdays

H1% of male and female in weekends is not same % of male and female in weekdays

Summary:-

prop.test(x=c(167,233),n=c(280,520), conf.level = 0.95,correct = TRUE, alternative = "two.sided")

2-sample test for equality of proportions with continuity

correction

data: c(167, 233) out of c(280, 520)

X-squared = 15.434, df = 1, p-value = 8.543e-05

alternative hypothesis: two.sided

95 percent confidence interval:

0.07398567 0.22271763

sample estimates:

prop 1 prop 2

0.5964286 0.4480769

Since p-value less than 0.05 , p-low null go, accept alternative hypothesis

So, % of male and female is not same in weekdays and weekends

Case 2:-

Ho: % of male and female in weekdays is greater than % of male and female in weekends

H1: % of male and female in weekdays is less than % of male and female in weekends

Summary:-

prop.test(x=c(113,287),n=c(280,520), conf.level = 0.95,correct = TRUE, alternative = "less")

2-sample test for equality of proportions with continuity

correction

data: c(113, 287) out of c(280, 520)

X-squared = 15.434, df = 1, p-value = 4.272e-05

alternative hypothesis: less

95 percent confidence interval:

-1.00000000 -0.08550006

sample estimates:

prop 1 prop 2

0.4035714 0.5519231

p-value< 0.05, p low null go, accept alternative hypothesis

Conclusion: - % of male and female in weekdays is less than % of male and female in weekends.