MAT5007 – Applied Statistical Methods

Embedded Lab – R Statistical Software

FALL SEMESTER – 2022~2023 L25+L26 SLOT

E-RECORD

Assignment No.: 10

Submitted By

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MCA– I Year

SITE

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Experiment 1:

A company appoints 4 salesman (A, B, C & D) and observes their sales in 3 seasons (Summer, Winter & Monsoon). The figures (Rs. in Lakhs) are given in the following table. Write down the R programming code to perform an analysis of variance at 5 % level of significance.

	Treatments			
Seasons	A	B	C	D
Summer	36	36	21	35
Winter	28	29	31	32
Monsoon	26	28	29	29

```
> salesFigures = c(36, 36, 21, 35, 28, 29, 31, 32, 26, 28, 29, 29)
> salesFigures
> seasonsLabels = c(rep('Summer', 4), rep('Winter', 4), rep('Monsoon', 4))
> seasonsLabels
> salesmanLabels = c(rep(c('A', 'B', 'C', 'D'), 3))
> salesmanLabels
> anova = aov(salesFigures ~ seasonsLabels + salesmanLabels)
> summary(anova)
```

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```
> salesFigures = c(36, 36, 21, 35, 28, 29, 31, 32, 26, 28, 29, 29)
>
> salesFigures
 [1] 36 36 21 35 28 29 31 32 26 28 29 29
>
> seasonsLabels = c(rep('Summer', 4), rep('Winter', 4), rep('Monsoon', 4))
>
> seasonsLabels
 [1] "Summer"  "Summer"  "Summer"  "Summer"  "Winter"  "Winter"  "Winter"  "Winter"
 [9] "Monsoon" "Monsoon" "Monsoon" "Monsoon"
>
> salesmanLabels = c(rep(c('A', 'B', 'C', 'D'), 3))
>
> salesmanLabels
 [1] "A" "B" "C" "D" "A" "B" "C" "D" "A" "B" "C" "D"
>
> anova = aov(salesFigures ~ seasonsLabels + salesmanLabels)
>
> summary(anova)
              Df Sum Sq Mean Sq F value Pr(>F)
seasonsLabels  2     32   16.00   0.706  0.531
salesmanLabels 3     42   14.00   0.618  0.629
Residuals      6    136   22.67
```

Interpretation: Here since both the Pr(>F) > 0.05 we fail to reject the null hypothesis i.e. there is no significant difference in sales figures between different seasons and also there is no significant difference in sales between different salesman at 5% level of significance.

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Experiment 2:

The following data resulted from an experiment to compare three burners (B1, B2 & B3). A Latin square design was used as the tests were made on 3 engines and were spread over 3 days. Write down the R programming code to test the hypothesis that there is no difference between (i). days, (ii). engines and (iii). burners at 5 % level of significance.

	Engines		
Days	Engine 1	Engine 2	Engine 3
Day 1	B1 – 16	B2 – 17	B3 – 20
Day 2	B2 – 16	B3 – 21	B1 – 15
Day 3	B3 – 15	B1 – 12	B2 – 13

```
> data = c(16, 17, 20, 16, 21, 15, 15, 12, 13)

> data

> engineLabels = c(rep(c('Engine1', 'Engine2', 'Engine3'), 3))

> engineLabels

> daysLabels = c(rep('Day1', 3),  rep('Day2', 3), rep('Day3', 3))

> daysLabels

> burnerLabels = c('B1', 'B2', 'B3', 'B2', 'B3', 'B1', 'B3', 'B1', 'B2')

> burnerLabels

> anova = aov(data ~ engineLabels + burnerLabels + daysLabels)
```

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```
> summary(anova)
```

```
> data = c(16, 17, 20, 16, 21, 15, 15, 12, 13)
>
> data
[1] 16 17 20 16 21 15 15 12 13
>
> engineLabels = c(rep(c('Engine1', 'Engine2', 'Engine3'), 3))
>
> engineLabels
[1] "Engine1" "Engine2" "Engine3" "Engine1" "Engine2" "Engine3" "Engine1" "Engine2"
[9] "Engine3"
>
> daysLabels = c(rep('Day1', 3),  rep('Day2', 3), rep('Day3', 3))
>
> daysLabels
[1] "Day1" "Day1" "Day1" "Day2" "Day2" "Day2" "Day3" "Day3" "Day3"
>
> burnerLabels = c('B1', 'B2', 'B3', 'B2', 'B3', 'B1', 'B3', 'B1', 'B2')
>
> burnerLabels
[1] "B1" "B2" "B3" "B2" "B3" "B1" "B3" "B1" "B2"
>
> anova = aov(data ~ engineLabels + burnerLabels + daysLabels)
>
> summary(anova)
             Df Sum Sq Mean Sq F value Pr(>F)
engineLabels  2   1.56   0.778    1.00 0.5000
burnerLabels  2  30.89  15.444   19.86 0.0479 *
daysLabels    2  34.89  17.444   22.43 0.0427 *
Residuals     2   1.56   0.778
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

Interpretation:

For days we observe Pr(>F) < 0.05 so we reject the null hypothesis that there is no significant difference among the days.

For engines we observe Pr(>F) > 0.05 so we fail to reject the null hypothesis and accept the alternate hypothesis that there is a significant difference between engines.

For burners we observe Pr(>F) < 0.05 so we fail to reject the null hypothesis and accept the alternate hypothesis that there is a significant difference between burners.

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