9. Following table represents sales figures of the 3 new menu items in 18 restaurants. At 0.5 LOS test whether average sales volume are all equal

| | | | | | | |
|---|---|---|---|---|---|---|
| Item 1 | 22 | 42 | 44 | 52 | 45 | 37 |
| Item 2 | 52 | 33 | 8 | 47 | 43 | 32 |
| Item 3 | 16 | 24 | 19 | 18 | 34 | 39 |

Is

```
> df1 = read.csv("C:\\Users\\admin\\Desktop\\CRD.csv")
> t = c(t(as.matrix(df1)))
> f = c("Item1", "Item2", "Item3")
> k=3
> n=6
> tm = gl(k,1,n*k, factor(f))
> blk = gl(n,k,k*n)
```

Levels: Item1 Item2 Item3

Levels: 1 2 3 4 5 6

```
> rbdfit = aov(t-tm+blk)
> summary(rbdfit)
```

| | Df | Sum sq | Mean sq | F-value | $P_r(>F)$ |
|---|---|---|---|---|---|
| tm | 2 | 538.8 | 269.39 | 4.959 | 0.0319 |
| blk | 5 | 559.9 | 111.96 | 2.061 | 0.1547 |
| Residuals | 10 | 543.2 | 54.32 | | |

Signif codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '*' 0.1 '*' 1

p-value of 0.032 < p-value at 5% significance

⇒ We reject null hypothesis

10 Data recorded for yield in a randomized block design involving 6 treatments in 4 randomized blocks

Treatments and yields

| | | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|
| BLOCKS | 1 | 24.7 | 20.6 | 27.7 | 16.2 | 16.2 | 24.9 |
| | 2 | 27.3 | 28.8 | 22.7 | 15.0 | 17.0 | 22.5 |
| | 3 | 38.5 | 39.5 | 36.8 | 19.6 | 15.4 | 26.3 |
| | 4 | 28.5 | 31.0 | 34.9 | 14.1 | 17.7 | 22.6 |

ans

```
> data = c(Enter all data)
> Block = gl(4,6)
> lbdfit = aov(data - Block + Treatments)
> lbdfit
```

Call:

aov(formula = data ~ Block + Treatments)

Terms:

| | Blocks | Treatments | Residuals |
|---|---|---|---|
| Sum of squares | 219.4279 | 901.1921 | 229.6396 |
| Degree of freedom | 3 | 5 | 15 |

Residual standard error : 3.912711

Estimated effects may be unbalanced

> summary.aov(rbdfit)

| | Df | Sum sq | Mean sq | F-value | $P_r$(>F) |
|---|---|---|---|---|---|
| Blocks | 3 | 219.54 | 73.14 | 4.778 | 0.0157 |
| Treatments | 5 | 901.24 | 180.24 | 11.773 | 9.28e-05 |
| Residuals | 15 | 229.6 | 15.31 | | |

Signif codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Interpretation:

$P<0.05$. Blocks are not homogenous, hence treatments effects are not alike