MSMS - 106

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Practical 10

✎ **Question :** The following table gives quality rating of ten service stations by five professional raters.

RATER	SERVICE STATION									
	1	2	3	4	5	6	7	8	9	10
A	99	70	90	99	65	85	75	70	85	92
B	96	65	80	95	70	88	70	51	84	91
C	95	60	48	87	48	75	71	93	80	93
D	98	65	70	95	67	82	73	94	86	80
E	97	65	62	99	60	80	76	92	90	89

Analyse the data and discuss whether there is any significant difference between raters or between service stations.

Two-way ANOVA with one observation per cell

Here two factors under study are "rater" and "service station".

Denote μ_i as the additional effect on rating due to ith rater; $i = A, B, \ldots, E$ and

τ_j as the additional effect on rating due to jth service station; $j = 1(1)10$.

We shall do two hypotheses testings. They are

(i) $H_{01} : \mu_A = \mu_B = \mu_C = \mu_D = \mu_E$ i.e. raters are not significantly different

against

H_{11} : at least one inequality in H_{01}.

(ii) $H_{02} : \tau_1 = \tau_2 = \ldots = \tau_{10}$ i.e. there is no significant difference between service stations

against

H_{12} : at least one inequality in H_{02}.

```r
rating <- read.csv('https://raw.githubusercontent.com/sakunisgithub/data_sets/refs/heads/master/cc12_prac_q3_data.csv', stringsAsFactors = TRUE)
```

```r
dim(rating)
```

```
## [1] 50  3
```

```r
names(rating)
```

```
## [1] "rater"           "service_station" "ratings"
```

```r
rating_anova <- aov(ratings ~ rater + service_station, data = rating)
```

```r
summary(rating_anova)
```

```
##                 Df Sum Sq Mean Sq F value  Pr(>F)
## rater            4    368    92.0   1.154   0.347
## service_station  9   6608   734.2   9.210 4.5e-07 ***
## Residuals       36   2870    79.7
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

So we conclude that, although the raters do not differ significantly from each other, the service stations have significant difference among themselves at 5% level of significance.