**Interaction**   
To present the formula for the ANOVA table using repeated observations/cell, we shall consider a rectangular array/matrix with **r** rows, **c** columns, **n** observation/cell   
i.e **rc** cells with **n** observations/cell   
 N = **rcn**

|  |  |  |  |
| --- | --- | --- | --- |
| **Rows** | **Columns**   **1 2 3 ………….. j ………... c** | **Total** | **Mean** |
| **1** | 𝑦111 𝑦121 𝑦131 … … . . 𝑦 |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
|  | 𝑦𝑟1𝑛 𝑦𝑟2𝑛 𝑦𝑟3𝑛 … … . . 𝑦 |  |  |
|  |  |  |  |

The computational formula for the sums of squares are:

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SST = ∑ ∑ ∑ 𝑦 | | | | | | | |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

|  |  |
| --- | --- |
|  | 68 52 67 |
| **t3** | 59 66 58 68 71 39 65 59 42 |
| **t4** | 58 57 53 41 61 59 46 53 38 |

r = 4, c = 3, n = 3, N = rcn = 4x3x3 = 36

Test the hypothese**s** that   
a)The average yield of the beans is the same when different fertilisers are used. b)There is no difference in the average yield for the different varieties of the beans. c)There is no interaction between fertilisers and varieties.

Model   
 𝑦

Computations   
 Construct a table of cell totals

|  |  |  |
| --- | --- | --- |
| **Fertilisers** | **Varieties of beans**  **V1 V2 V3** | 𝒚𝒊𝒐𝒐 |
| **t1** | 200 217 190 | 607 |
| **t2** | 186 152 172 | 510 |
| **t3** | 192 196 139 | 527 |
| **t4** | 145 171 150 | 466 |
| 𝒚 |  |  |

**ANOVA table**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Source of variation** | **df** | **ss** | **ms** | **F-ratio** |
| Fertilisers | 3 | 1157 | 385.67 | F1c = 5.92 |
| Varieties | 2 | 350 | 175.00 | F2c = 2.69 |
| Interaction | 6 | 771 | 128.50 | F3c = 1.98 |
| Error | 24 | 1561 | 65.04 | - |
| **Total** | **35** | **3839** | **-** | **-** |

Conclusion   
F1c (5.92) > F1T (3.01), Reject Ho1   
There is a significant difference in the yield of beans due to the fertiliser effect.

F2c (2.69) < F2T (3.40), Accept Ho2   
The variety effect is not significant.

F3c (1.98) < F3T (2.51), Accept Ho3   
The interaction effect between fertilisers and varieties is not significant.