**A 2 x 2 Multifactor Analysis of Variance**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| No | PBL (A1) | A12 | DI (A2) | A22 |  |  |
| 1 | 76 | 5776 | 72 | 5184 |  |  |
| 2 | 79 | 6241 | 73 | 5329 |  |  |
| 3 | 81 | 6561 | 74 | 5476 |  |  |
| 4 | 82 | 6724 | 74 | 5476 |  |  |
| 5 | 82 | 6724 | 73 | 5329 |  |  |
| 6 | 83 | 6889 | 76 | 5776 |  |  |
| 7 | 83 | 6889 | 76 | 5776 |  |  |
| 8 | 85 | 7225 | 77 | 5929 |  |  |
| 9 | 86 | 7396 | 79 | 6241 |  |  |
| 10 | 87 | 7569 | 80 | 6400 |  |  |
|  |  |  |  |  |  |  |
|  | 824 | 67994 | 754 | 56916 |  | 1578 |
|  | 82.4 |  | 75.4 |  |  | 78.9 |
| 1 | 60 | 3600 | 48 | 2304 |  |  |
| 2 | 60 | 3600 | 53 | 2809 |  |  |
| 3 | 60 | 3600 | 59 | 3481 |  |  |
| 4 | 60 | 3600 | 59 | 3481 |  |  |
| 5 | 61 | 3721 | 60 | 3600 |  |  |
| 6 | 61 | 3721 | 65 | 4225 |  |  |
| 7 | 62 | 3844 | 66 | 4356 |  |  |
| 8 | 64 | 4096 | 67 | 4489 |  |  |
| 9 | 65 | 4225 | 67 | 4489 |  |  |
| 10 | 67 | 4489 | 68 | 4096 |  |  |
| 11 |  |  |  |  |  |  |
|  | 620 | 38496 | 612 | 37330 |  | 1232 |
|  | 62 |  | 61.2 |  |  | 60.85 |
|  | 1444 |  | 1366 |  |  | 2810 |
|  | 72.2 |  | 68.3 |  |  | 70.25 |
|  |  |  |  |  |  | 200736 |

1. The total sum of squares:

= 200736 - = 200736 – 197402.5 = 3333.5

2. The sum of squares between groups:



= 

= 67897.6 + 56851.6 + 38440 + 37454.4 – 197402.5

= 3241.1

3. The sum squares within groups:

=3333.5 –3241.1= 92.4

4. The between-columns sum of squares:



=

= 104256.8 + 93297.8 – 197402.5 = 152.1

5. The between-rows sum of squares:



= 

= 124504.2 + 75891.2 –197402.5= 2892.9

6. The sum-of-squares interaction:

 = 3241.1 – (152.1+2892.9) = 186.1

7. The number of degrees of freedom associated with each source of variation:

df for between-columns sum of squares = C – 1 = 2 – 1 =1

df for between-rows sum of squares = R – 1 = 2 – 1 = 1

df for interaction = (C - 1)(R - 1) = 1 x 1 = 1

df for between-groups sum of squares = G – 1 = 4 – 1 = 3

df for within-groups sum of squares = ∑(n – 1) = 9 + 9 + 9 + 9 = 36

df for total sum of squares = N – 1 = 40 – 1 = 39

8. Summary of a 2 x 2 Multifactor Analysis of Variance

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Source of Variance | SS | df | MS | Fo | Ft |
| Between columns (strategy) | 152.1 | 1 | 152.1 | 59.2 | 4,08 |
| Between rows (intelligence) | 2892.9 | 1 | 2892.9 | 1125.64 | 4.08 |
| Columns by rows (interaction) | 186.1 | 1 | 186.1 | 72.41 | 4.08 |
| Between groups | 3241.1 | 3 | 114.04 |  |  |
| Within groups | 92.4 | 36 | **2.57** |  |  |
| Total | 3333.5 | 39 |  |  |  |

**1. Computation of Tukey Test (Between Columns)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Between Group | qo | n | qt  (α: 0.05) | Category | Meaning |
| A1 – A2 | 10.8 | 10 | 2.95 | Significant | qo > qt |
| A1B1 – A2B1 | 13.72 | 10 | 3.15 | Significant | qo > qt |
| A1B2 – A2B2 | 1.57 | 10 | 3.15 | Not Significant | qo < qt |



1. Between columns q = 

= 

= 

= 10.8

2. Between columns (HI) q = 

= 13.72

3. Between columns (LI) q = or q = 

= 1.57

**2. Computation of Tukey Test (Between Rows)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Between Group | qo | n | qt  (α: 0.05) | Category | Meaning |
| B1 – B2 | 50.14 | 20 | 2.95 | Significant | qo > qt |

Between rows q = 

= 50.14