Data Set :

Student_Id	Study time	Sleep duration	Exam - Score
1	Medium	low	88.18153
2	Short	low	80.4664
3	Short	low	87.38021
4	Short	low	91.51831
5	Short	high	86.05794
6	Long	low	87.98522
7	Short	high	80.51832.

1. Sum of Squares :

$$SST = \sum_{i=1}^{a} \sum_{j=1}^{b} \sum_{k=1}^{n} \left(Y_{ijk} - \bar{\bar{Y}} \right)^2$$

$$= 101.7281$$

2. Sum of Square for factor A

$$SSA = \frac{1}{nB} \sum \frac{(TA)^2}{nA} - \frac{\left(\sum x_{ij} \right)^2}{N}$$

$$= 11.9933$$

3. Sum of Squares for factor B

$$SSB = \frac{1}{nA} \sum \frac{(TB)^2}{nB} - \frac{\left(\sum x_{ij} \right)^2}{N}$$

$$= 20.8267$$

Interaction

$$SSAB = \sum \frac{(TAB)^2}{nAB} - SSA - SSB - \frac{\left(\sum x_{ij} \right)^2}{N}$$

$$= -8.7920$$

Sum of Squares Error

$$SS_{Error} = \sum_{p=1}^{a} \sum_{q=1}^{b} \sum_{k=1}^{n} \left(y_{pqk} - \bar{y}_{pij} \right)^2$$

$$= 77.7001 \, p.n$$

Degrees of freedom

$$df \; Total = N - 1 = 7 - 1$$
$$= 6 \, 001.77$$

Study time $(A) = a - 1$
$$= 3 - 1$$
$$= 2$$

Sleep Duration $(B) = b - 1$
$$= 2 - 1$$
$$= 1$$

Interaction $(a-1)(b-1) = 2 \times 1$
$$= 2$$

Error $: N - ab$
$$= 7 - 6$$
$$= 1$$

mean Square (MS)

mean Square.

Stud time (A) SS = 11.9933

Sleep duration (B) = 20.8267

Interation (A×B) = -8.7920

Error = 77.7001

df:

Study time (A) = 2

sleep duration (B) = 1

Interation = 2

Error = 1

$MS = \dfrac{SS}{df}$:

Study time = 5.9967

Sleep duration = 20.8267

Interation = -1.3960

Error = 77.7001

F- statistic

$$F_A = \frac{MSA}{MS\,error} = 0.0772$$

$$F_B = \frac{MSB}{MS\,Error} = 0.2680$$