Work out the following assignments:  300 points total

1.        For the following three groups of scores find the:

1. Total groups sum of squares,
2. The between groups sum of squares,
3. Within groups sum of squares
4. Degree of freedom for within groups
5. Degree of freedom for between groups
6. The between groups mean square
7. The within groups mean square
8. The F value

**Group X**                     **Group Y**                   **Group Z**

62                                 60                               59

60                                  60                               49

50                                  58                               49 **n = 15**

48                                  53                               47

47                                  49                               42

|  |  |  |
| --- | --- | --- |
| **Group X** | **Group Y** | **Group Z** |
| X | $$X^{2}$$ | X | $$X^{2}$$ | X | $$X^{2}$$ |
| 62 | 62 x 62 = 3844 | 60 | 60 x 60 = 3600 | 59 | 59 x 59 = 3481 |
| 60 | 60 x 60 = 3600 | 60 | 60 x 60 = 3600 | 49 | 49 x 49 = 2401 |
| 50 | 50 x 50 = 2500 | 58 | 58 x 58 = 3364 | 49 | 49 x 49 = 2401 |
| 48 | 48 x 48 = 2304 | 53 | 53 x 53 = 2809 | 47 | 47 x 47 = 2209 |
| 47 | 47 x 47 = 2209 | 49 | 49 x 49 = 2401 | 42 | 42 x 42 = 1764 |
| $$ΣX=267$$ | $$ΣX^{2}= 14457$$ | $$ΣX=280$$ | $$ΣX^{2}= 15774$$ | $$ΣX=246$$ | $$ΣX^{2}= 12256$$ |

1. Total groups sum square

$SStot= ΣX^{2}- \frac{(ΣX)^{2}}{n}$

$$SStot=42487- \frac{\left(793\right)^{2}}{15}$$

$$SStot=42487-41923.27$$

$$SStot=563.73$$

1. Between groups sum of square

$$SSbet= \sum\_{}^{}\frac{(ΣX)^{2}}{ng}- \frac{(ΣX)^{2}}{n}$$

$$SSbet= \frac{(267)^{2}+(280)^{2}+(246)^{2}}{5} - \frac{(793)^{2}}{15}$$

$$SSbet= \frac{210205}{5}- \frac{628849}{15}$$

$$SSbet=42041-41923.27$$

$$SSbet=117.73$$

1. Within groups sum of squares

$SSwith= \sum\_{}^{}ΣX^{2}- \frac{(ΣX)^{2}}{ng}$

$$ΣX\_{x}^{2}- \frac{(ΣX)^{2}}{ng} $$

$$14457\_{X}- \frac{(267)^{2}}{5}$$

$$14457\_{X}- \frac{71289}{5}$$

$$14457\_{X}-14257.8$$

**Group X** = 199.2

$ΣX\_{Y}^{2}- \frac{(ΣX)^{2}}{ng}$

$$15774\_{Y}- \frac{(280)^{2}}{5}$$

$$15774\_{Y}- \frac{78400}{5}$$

$$15774\_{Y}-15680$$

**Group Y** = 94

$$ΣX\_{Z}^{2}- \frac{(ΣX)^{2}}{ng}$$

$$12256\_{Z}- \frac{(246)^{2}}{5}$$

$$12256\_{Z}- \frac{60516}{5}$$

$$12256\_{Z}-12103.2$$

**Group Z** = 152.8

1. Degree of freedom for within groups

$$df=n-k$$

$$df=15-3$$

$$df\_{with}=12$$

1. Degree of freedom between groups

$$df=k-1$$

$$df=3-1$$

$$df\_{bet}=2$$

1. Between groups mean square

$$MS= \frac{SSbet}{df\_{bet}}$$

$$MS= \frac{117.73}{2} $$

$$MS=58.87$$

1. Within groups mean square

$$MS= \frac{SSwith}{df\_{with}}$$

$$MS= \frac{(94+152.8+199.2)}{12}$$

$$MS= \frac{446}{12}$$

$$MS= 37.17$$

1. “F” value

$$F= \frac{MS\_{bet}}{MS\_{with}}$$

$$F= \frac{58.87}{37.17}$$

$$F= 1.58$$

The null hypothesis is rejected.

2.       Compute a Single classification analysis of variance on the following data, determining the:

1. Sum of X for each group

**Group A**

14 + 12 + 10 + 10 + 9 + 6 + 6 = 67

**Group B**

17 + 15 + 12 + 9 + 9 + 7 + 7 = 76

**Group C**

14 + 12 + 12 + 11 + 11 + 10 + 10 = 80

**Group D**

8 + 6 + 5 + 4 + 2 + 2 + 2 = 29

1. X square for each score

**Group A** **Group B** **Group C** **Group D**

14 x 14 = 196 17 x 17 = 289 14 x 14 = 196 8 x 8 = 64

12 x 12 = 144 15 x 15 = 225 12 x 12 = 144 6 x 6 = 36

10 x 10 = 100 12 x 12 = 144 12 x 12 = 144 5 x 5 = 25

10 x 10 = 100 9 x 9 = 81 11 x 11 = 121 4 x 4 = 16

9 x 9 = 81 9 x 9 = 81 11 x 11 = 121 2 x 2 = 4

6 x 6 = 36 7 x 7 = 49 10 x 10 = 100 2 x 2 = 4

6 x 6 = 36 7 x 7 = 49 10 x 10 = 100 2 x 2 = 4

1. Total sum of square

**Group A**

196 + 144 + 100 + 100 + 81 + 36 + 36 = 693

**Group B**

289 + 225 + 144 + 81 + 81 + 49 + 49 = 918

**Group C**

196 + 144 + 144 + 121 + 121 + 100 + 100 = 926

**Group D**

64 + 36 + 25 + 16 + 4 + 4 + 4 = 153

|  |  |  |  |
| --- | --- | --- | --- |
| **Group A** | **Group B** | **Group C** | **Group D** |
| **X** | $$X^{2}$$ | **X** | $$X^{2}$$ | **X** | $$X^{2}$$ | **X** | $$X^{2}$$ |
| 14 | 196 | 17 | 289 | 14 | 196 | 8 | 64 |
| 12 | 144 | 15 | 225 | 12 | 144 | 6 | 36 |
| 10 | 100 | 12 | 144 | 12 | 144 | 5 | 25 |
| 10 | 100 | 9 | 81 | 11 | 121 | 4 | 16 |
| 9 | 81 | 9 | 81 | 11 | 121 | 2 | 4 |
| 6 | 36 | 7 | 49 | 10 | 100 | 2 | 4 |
| 6 | 36 | 7 | 49 | 10 | 100 | 2 | 4 |
| $$ΣX$$ | $$ΣX^{2}$$ | $$ΣX$$ | $$ΣX^{2}$$ | $$ΣX$$ | $$ΣX^{2}$$ | $$ΣX$$ | $$ΣX^{2}$$ |
| 67 | 693 | 76 | 918 | 80 | 926 | 29 | 153 |
| $\sum\_{}^{}(ΣX)$ = 252 |
| $\sum\_{}^{}(ΣX^{2})= $2690 |

Total sum X squares:

$$SStotal= ΣX^{2}- \frac{(ΣX)^{2}}{n}$$

$$SStotal= 2690- \frac{63504}{28}$$

$$SStotal= 2690- 2268$$

$$SStotal= 422$$

1. The between sum of squares

$$SSbet= \sum\_{}^{}\frac{(ΣX)^{2}}{ng}- \frac{(ΣX)^{2}}{n}$$

$$SSbet= \frac{(67)^{2}+(76)^{2}+(80)^{2}+(29)^{2}}{7}- \frac{(67)^{2}+(76)^{2}+(80)^{2}+(29)^{2}}{28}$$

$$SSbet= \frac{4489+5776+6400+841 }{7}- \frac{4489+5776+6400+841}{28}$$

$$SSbet= \frac{17506}{7}- \frac{17506}{28}$$

$$SSbet=2500.85-625.21 $$

$$SSbet=1875.64$$

1. The within sum of squares,

$$SSwith= \sum\_{}^{}ΣX^{2}- \frac{(ΣX)^{2}}{ng}$$

$$ΣX\_{A}^{2}- \frac{(ΣX)^{2}}{ng}$$

$$4489\_{A}- \frac{(67 x 67)}{7}$$

$$= 3847.71\_{A}$$

$$ΣX\_{B}^{2}- \frac{\left(ΣX\right)^{2}}{ng}$$

$$5776\_{B}- \frac{(76 x 76)}{7}$$

$$= 4620.8\_{B}$$

$$ΣX\_{C}^{2}- \frac{(ΣX)^{2}}{ng}$$

$$6400\_{C}- \frac{(80 x 80)}{7}$$

$$= 5574.86\_{C}$$

$$ΣX\_{D}^{2}- \frac{(ΣX)^{2}}{ng}$$

$$841\_{D}- \frac{(29 x 29)}{7}$$

$$= 720.86\_{C}$$

1. Degree of freedom for between groups

$$df=k-1$$

$$df=4-1$$

$$df=3$$

1. Degree of freedom for within groups

$$df=n-k$$

$$df=28-4$$

$$df=24$$

1. the between groups mean square,

$$MS= \frac{SSbet}{df\_{bet}}$$

$$MS= \frac{1875.64}{3}$$

$$MS= 625.21$$

1. the within groups mean square

$$MS= \frac{SSwith}{df\_{with}}$$

$$MS= \frac{(3847.71+4620.8+5574.86+720.86)}{24}$$

$$MS= \frac{14764.23}{24}$$

$$MS= 615.18$$

1. and the value of F

$$F= \frac{MS\_{bet}}{MS\_{with}}$$

$$F= \frac{625.21}{615.18}$$

$$F= 1.02$$

The null Hypothesis is rejected.