Assignment 5.2

Problem Statement 1:

Using the following data, perform a oneway analysis of variance using α=.05. Write up the results in APA format.

[Group1: 51, 45, 33, 45, 67]

[Group2: 23, 43, 23, 43, 45]

[Group3: 56, 76, 74, 87, 56]

Solution

Step 1: Define the Null and Alternate Hypotheses.

Null Hypothesis H0: Mean(Group1) = Mean (Group2) = Mean(Group3)

Alternate Hypothesis H1: Mean of all groups are not equal.

Step 2: State the significance level (alpha).

Significance Level α=.05

Step 3: Calculate degree of freedom.

Numbers in each group; n= 5

Total numbers in all groups; N = 15

Total levels; a = 3

df-between = a-1 = 2

df-within = N – a = 15 – 3 = 12

df-total = N -1 = 15 – 1 =14

Step 4: State decision rule.

To look up critical value, we need to use two different degree of freedom; df-between and df-within.

(2, 12)

If F is greater than 3.89, reject H0.

Step 5: Calculate test statistics

Sample means for the groups: = 48.2, 35.4, 69.8

Intermediate steps in calculating the group variance

[[1]]

	value	mean	deviations	sq deviations
1	51	48.2	2.8	7.84
2	45	48.2	-3.2	10.24
3	33	48.2	-15.2	231.04
4	45	48.2	-3.2	10.24
5	67	48.2	18.8	353.44

[[2]]

	value	mean	deviations	sq deviations
1	23	35.4	-12.4	153.76
2	43	35.4	7.6	57.76
3	23	35.4	-12.4	153.76
4	43	35.4	7.6	57.76
5	45	35.4	9.6	92.16

[[3]]

	value	mean	deviations	sq deviations
1	56	69.8	-13.8	190.44

2 76 69.8 6.2 38.44

3 74 69.8 4.2 17.64

4 87 69.8 17.2 295.84

5 56 69.8 -13.8 190.44

Sum of squared deviations from the mean (SS) for the groups:

612.8 515.2 732.8

Var1 = 612.8 / (5−1) =153.2

Var2 = 515.2 / (5−1) =128.8

Var3 = 732.8 / (5−1) =183.2

MSerror=(153.2+128.8+183.2)/ 3=155.07

Calculating the remaining error (or within) terms for the ANOVA table:

dferror=15−3=12

SSerror=(155.07) (15−3)=1860.8

Intermediate steps in calculating the variance of the sample means:

Grand mean ($\bar{x}$grand) = 48.2+35.4+69.83=51.1348.2+35.4+69.83=51.13

group mean grand mean deviations sq deviations

48.2 51.13 -2.93 8.58

35.4 51.13 -15.73 247.43

69.8 51.13 18.67 348.57

Sum of squares (SSmeans)=604.58

Varmeans=604.583−1=302.

MSbetween=(302.29)(5)=1511.

Calculating the remaining between (or group) terms of the ANOVA table:

dfgroups=3−1=2

SSgroup=(1511.45)(3−1)=3022.

Test statistic and critical value

$F=1511.45155.07=9.75$

$F_{critical}(2,12)=3.89$

Decision: reject H0 Decision: reject H0

ANOVA table

Source	SS	df	MS
Group	3022.9	2	1511.45
Error	1860.8	12	155.07
Total	4883.7		

Effect size

$\eta^2=3022.94883.7=0.62$

APA writeup

Step 5: State result

$F(2, 12)=9.75$, $p < 0.05$, $\eta^2=0.62$.

$\chi^2 = 8.006$

Result: Reject H0

Step 6: State conclusion

As 8.006 > 7.81473 It means, there is some relationship between gender and level of education.

We conclude that Gender and Education level are dependent, $\chi^2 = 8.006$, $p < 0.05$