Problem 1

Using the following data, perform a one way 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**

Sample means (x¯) for the groups: = 48.2, 35.4, 69.8

**Intermediate steps in calculating the group variances:**

[[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:

[1] 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

Note: this is just the average within-group variance; it is not sensitive to group mean differences!

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 (x¯grand) = 48.2+35.4+69.8/3=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=604.58/ (3−1) =302.29

MSbetween= (302.29) (5) =1511.45

 Note: This method of estimating the variance IS sensitive to group mean differences!

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

dfgroups=3−1=2

SSgroup= (1511.45) (3−1) =3022.9

Test statistic and critical value

F=1511.45/155.07=9.75

Fcritical (2,12) =3.89

 Decision: reject H0

ANOVA table

| **source** | **SS** | **df** | **MS** | **F** |
| --- | --- | --- | --- | --- |
| group | 3022.9 | 2 | 1511.45 | 9.75 |
| error | 1860.8 | 12 | 155.07 |  |
| Total | 4883.7 |  |  |  |

**Effect size**

η2=3022.9/4883.7=0.62

**APA writeup**

*F* (2, 12)=9.75, *p* <0.05

η2=0.62.