Assignment 18.2 : Problem Statement

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

Sample means ($\bar{x}$) 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:

```
612.8 515.2 732.8
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Var1 = [612.8 / (5-1)] =153.2
Var2 = [515.2 / (5-1)] =128.8
Var3 = [732.8 / (5-1)] =183.2
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MS_{error} = [(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:

$Df_{error} = 15-3 = 12$

$SS_{error} = (155.07)(15-3) = 1860.8$

Intermediate steps in calculating the variance of the sample means:

Grand mean $(\bar{X})$ = 48.2+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 (SS_{means}) = 604.58

Var_{means} = [604.58/ (3-1)] = 302.29

$MS_{between}$ = (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:

Df_{groups} = 3 - 1 = 2
SS_{group} = (1511.45)(3-1) = 3022.9

Test statistic and critical value
F = (1511.45/ 155.07) = 9.75
$F_{critical}(2,12)$ = 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

η^2 = [3022.9 / 4883.7] = 0.62

APA writeup

F(2, 12) = 9.75, p < 0.05, η^2 = 0.62