**Problem Statement 1:**

Using the following data, perform a one-way analysis of variance using a=.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**

SM-G1 = 51+45+33+45+67/5 = 48.2

SM-G2 = 23+43+23+43+45/5 = 35.4

SM-G3 = 56+76+74+87+56/5 = 69.8

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

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| --- | --- | --- | --- | --- |
| Group – 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 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Group – 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 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Group – 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 |

SS-G1 = 7.84+10.24+231.04+10.24+353.44 = 612.8

SS-G2 = 153.76+57.76+153.76+57.76+92.16 = 515.2

SS-G3 = 190.44+38.44+17.64+295.84+190.44=732.8

Sum of squared deviations from the mean (SS) for the groups: 612.8, 515.2, 732.8

VG1 = 612.8/(5-1) = 153.2

VG2 = 515.2/(5-1) = 128.8

VG3 = 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 = 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 (SSmeans)=8.58 + 247.43 + 348.57 = 604.58

VGM = 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, η2η2=0.62