**Problem Statement 1:**

**Is gender independent of education level? A random sample of 395 people were**

**surveyed and each person was asked to report the highest education level they**

**obtained. The data that resulted from the survey is summarized in the following table:**

**High School Bachelors Masters Ph.d. Total**

**Female 60 54 46 41 201**

**Male 40 44 53 57 194**

**Total 100 98 99 98 395**

**Question: Are gender and education level dependent at 5% level of significance? In**

**other words, given the data collected above, is there a relationship between the gender**

**of an individual and the level of education that they have obtained?**

**Solution**

## H0: Gender and education are independent to each other

## H1: Gender and education are dependent to each other

Row totals and column totals are given above sample size = 395

Therefore, we have expected frequencies as follows:

Gender HighSchool Bachelors Masters Ph.d.  
Female 50.886 49.868 50.377 49.868   
Male 49.114 48.132 48.623 48.132

Total 100 98 99 395

Therefore, chi-squared = (60-50.886)2/50.886+…….(57-48.623)2 / 48.623

= 8.006

The critical value of chi-squared with 3 degree of freedom is close to 7.815.

We got chi-squared 8.006 > 7.815, so we reject null hypothesis

**Problem Statement 2:**

**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]**

**Ans**

**H0 :** Means are equal for Group1,Group2 and Group 3

**H1:** Means are different

Sample means for Group1=48.2, Group 2 = 35.4, Group 3 = 69.8

Variance for Group 1 = 153.2, Group 2 = 128.8, Group 3 = 183.2

Mean Squared Error = Variances /3 = 155.07

Sum of squares between Treatments = Σ nj(X̄j - X̄)2

Sum of squares (Error) = ΣΣ (X - X̄j)2

Test-statistic = Σ nj(X̄j - X̄)2 / (k - 1) / ΣΣ (X - X̄j)2 / (N-k) where k = 3, N = 15

F- Statistic = MeanSqaurebetween/MeanSquared Error

= 1511.45/155.07 = 9.75

Fcritical(2,12) = 3.89

We got 9.75 > 3.89, so we reject null hypothesis

We conclude that means are different for each of these groups

**ANOVA table**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **source** | **SS** | **df** | **MS** | **F** |
| group | 3023 | 2 | 1511.5 | 9.75 |
| error | 1861 | 12 | 155.07 |  |
| total | 4884 |  |  |  |

**Effect size**

**n2 = 3023/4884 = 0.62**

**APA writeup**

*Fcrit*(2, 12)=9.75, *p* <0.05, **n2** **=0.62**

**Problem Statement 3:**

**Calculate F Test for given 10, 20, 30, 40, 50 and 5,10,15, 20, 25.**

**For 10, 20, 30, 40, 50:**

**Solution**

For 10,20,30,40,50

Mean = (10+20+30+40+50)/5 = 150/5 = 30

Variance1 = Σ(X - X̄)2/ N-1

= (400+100+0+100+400)/4 = 250

For 5,10,15,20,25

Mean = (5+10+15+20+25)/5 = 75/5 = 15

Variance2 = Σ(X - X̄)2/ N-1

**=** (100+25+0+25+100)/4 **= 62.5**

F – Test = Variance1/Variance2 = 250/62.5 = 4