**Assignment stats 4**

Q1. 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:

Observed 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 |

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?

Ans. Expected value (High School and female) = 201\*100 /395 = 51

Expected value (Bachelors and female) = 201\*98 /395 = 50

Expected value (Masters and female) = 201\*99 /395 = 50

Expected value (Ph.D. and female) = 201\*98 /395 = 50

Expected value (High School and male) = 194\*100 /395 = 49

Expected value (Bachelors and male) = 194\*98 /395 = 48

Expected value (Masters and male) = 194\*99 /395 = 49

Expected value (Ph.D. and male) = 194\*98 /395 = 48

Expected Table

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | High School | Bachelors | Masters | Ph.D. | Total |
| Female | 51 | 50 | 50 | 50 | 201 |
| Male | 49 | 48 | 49 | 48 | 194 |
| Total | 100 | 98 | 99 | 98 | 395 |

|  |  |  |  |
| --- | --- | --- | --- |
|  | Observed Frequency(O) | Expected Frequency(E) | (O-E)2/E |
| High School & female | 60 | 51 | 1.59 |
| Bachelors & female | 54 | 50 | 0.32 |
| Masters & female | 46 | 50 | 0.32 |
| Ph.D. & female | 41 | 50 | 1.62 |
| High School & male | 40 | 49 | 1.65 |
| Bachelors & male | 44 | 48 | 0.33 |
| Masters & male | 53 | 49 | 0.33 |
| Ph.D. & male | 57 | 48 | 1.9 |
| Total |  |  | 8.06 |

H0: there isn’t relationship between the gender and level of education

H1: there is a relationship between the gender and level of education

ᵡcal2  = 2

= 8.06

Degree of Freedom = (4 - 1) (2 - 1) = 3\*1 = 3

Level of Significance ( = 0.05

Critical Value(ᵡ∝)2 = 7.815

Since ᵡcal2 > (ᵡ∝)2

H0 is rejected

i.e. there is a relationship between the gender and level of education

Q2. 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]

Ans. H0: G1 = G2 = G3

H1: G1 ≠ G2 ≠ G3

k = 3

N = 15

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Group1(G1) | Group2(G2) | Group3(G3) | (G1 - G1\_mean)2 | (G2 - G2\_mean)2 | (G3 - G3\_mean)2 |
|  | 51 | 23 | 56 | 7.84 | 153.76 | 190.44 |
|  | 45 | 43 | 76 | 10.24 | 57.76 | 38.44 |
|  | 33 | 23 | 74 | 231.04 | 153.76 | 17.64 |
|  | 45 | 43 | 87 | 10.24 | 57.76 | 295.84 |
|  | 67 | 45 | 56 | 353.44 | 92.16 | 190.44 |
| Total | 241 | 177 | 349 | 612.8 | 515.2 | 732.8 |
| Mean | 48.2 | 35.4 | 69.8 |  |  |  |
| Grand mean | 51.13 |  |  |  |  |  |

SSbetween = 5 \* (48.2-51.13)2 + 5 \* (35.4 – 51.13)2 + 5 \* (69.8-51.13)2

= 3022.9335

MSST = 3022.9335 / (3-1) = 1511.46675

SSwithin = 612.8 + 515.2 + 732.8 = 1860.8

MSSE = 1860.8/(N-k) = 1860.8/12 = 155.067

F-statistics = MSST/MSSE = 1511.46675/ 155.067= 9.747

Critical F-value

At 5% significance and degree of freedom (2, 12):

F-critical = 3.89

Clearly, our F-statistics is more than F-critical. So, we can reject our null hypothesis.

i.e. G1 ≠ G2 ≠ G3

|  |
| --- |
| APA write-up |
| *F*(2, 12) = 9.747, *p* < 0.05, η2 = 0.62 |

Q3. Calculate F Test for given 10, 20, 30, 40, 50 and 5,10,15, 20, 25.

Ans. For 10, 20, 30, 40, 50

N = 5

Mean = 10+20+30+40+50 /5

= 3

Standard Deviation = (10 – 30)2 + (20 – 30)2 +(30 – 30)2 + (40 – 30)2 + (50 – 30)2 /5 - 1

= 15.8114

Variance = (15.8114)2 = 250

For 5,10,15, 20, 25

N = 5

Mean = 5+10+15+20+25/5

= 15

Standard Deviation = (5 – 15)2 + (10 – 15)2 +(15 – 15)2 + (20 – 15)2 + (25 – 15)2 /5 - 1

= 7.9057

Variance = (7.9057)2 = 62.5

F Test = (variance of 10, 20,30,40,50) / (variance of 5, 10, 15, 20, 25)  
 = 250/62.5  
 = 4