Assignment - 4

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 survey is summarized in the following table.

	Highschool	Bachelor	Masters	Phd
Female	60	54	46	41
Male	40	44	53	57

Are gender and education level independent at 5% level of significance?

Ans: observed (O)

					Total
	60	54	46	41	201
	40	44	53	57	194
Total	100	98	99	98	395

Expected (E)

$\frac{201 \times 100}{395}$ $\frac{201 \times 98}{395}$ $\frac{201 \times 99}{395}$ $\frac{201 \times 98}{395}$

$\frac{194 \times 100}{395}$ $\frac{194 \times 98}{395}$ $\frac{194 \times 99}{395}$ $\frac{194 \times 98}{395}$

$\Rightarrow$

51	50	50	50
50	48	49	48

$(O-E)^2$

81	36	16	81
100	16	16	81

$$\chi^2 = \frac{\Sigma(O-E)^2}{E}$$

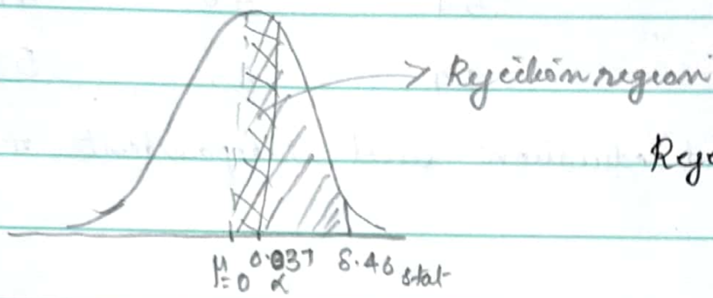
H_0 : Gender and education level are independent

H_1 : Gender and education level are dependent.

$$\chi^2_{stat} = 1.58 + 0.72 + 0.32 + 1.62 + 0.3 + 0.32 + 1.6$$
$$= \underline{\underline{8.46}}$$

$$df = \overset{r}{(2-1)}\ \overset{c}{(4-1)}$$
$$= 1 \times 3 = \underline{3}$$

χ^2- table ($\alpha = 0.05$, $df = 3$) = 0.037



Reject H_0.

Conclusion : Gender and Education level are dependent.

② Using the following data, perform a one way analyzis of variance using $\alpha = 0.05$. Write up the result in APA format.

Group1 : 51 45 33 45 67

Group2 : 23 43 23 43 45

Group3 : 56 76 74 87 56

Ans:

	G_1	G_2	G_3	$(G_1 - M_1)^2$	$(G_2 - M_2)^2$	$(G_3 - M_3)^2$
1	51	23	56	7.84	153.76	190.44
2	45	43	76	10.24	57.76	38.44
3	33	23	74	231.04	153.76	17.64
4	45	43	87	10.24	57.76	295.84
5	67	45	56	353.44	72.16	190.44
Total :	241	177	349	612.8	515.2	732.8
Mean :	48.2	35.4	69.8			

N = 15

K = 3.

Grand Mean = $\frac{153.4}{3}$ = 51.13

$$SST\ (SS_{betw}) = n_i \times \sum (\text{Sample Mean} - \text{Grand Mean})^2$$

$$= 5 \times (48.2 - 51.13)^2 + 5(35.4 - 51.13)^2 + 5(69.8 - 51.13)^2$$

$$= 3022.93$$

$$MSST\ (Mean_{bet}) = \frac{3022.93}{2} = 1511.465 \quad \left\{ \frac{SST}{K-1} \right\}$$

$$SSE\ (SS_{within}) = 612.8 + 515.2 + 732.8$$

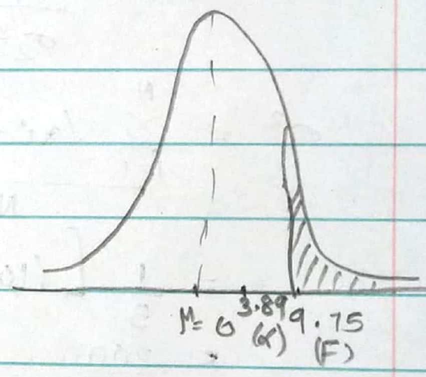
$$= 1860.8$$

$$MSSE\ (Mean_{within}) = \frac{SS_{within}}{df} \quad \left\{ \begin{array}{l} df = \text{Total no: of data} - \text{no: of Samples} \\ = 15 - 3 = 12 \end{array} \right\}$$

$$= \frac{1860.8}{12} = 155.06$$

$$F\ test = \frac{MSST}{MSSE} = \frac{1511.465}{155.06} = \underline{\underline{9.75}}$$

$$F\ table\ (\underset{(k-1)}{df_1 = 2},\ \underset{(N-k)}{df_2 = 12},\ \alpha = 0.05) = 3.89$$



APA - format

	Sum of Squares	df	Mean square	F	α
Between groups	3022.93	2	1511.46	9.75	0.05
within group	1860.8	12	155.06		
Total	4883.7				

$\{F(2,12) = 3.89,\ \alpha = 0.05\}$

(3) Calculate F test for given 10, 20, 30, 40, 50 and 5, 10, 15, 20, 25.

Ans:

	G_1	G_2
	10	5
	20	10
	30	15
	40	20
	50	25
Total:	150	75
Mean	30	15.

$$\text{F-test} = \frac{\sigma_1^2}{\sigma_2^2}$$

$$\sigma_1^2 = \frac{\sum_{i=1}^{N} (x_i - \bar{x})^2}{N}$$

$$= \frac{1}{5}\left[(10-30)^2 + (20-30)^2 + (30-30)^2 + (40-30)^2 + (50-30)^2\right]$$

$$= \underline{\underline{200}}$$

$$\sigma_2^2 = \frac{1}{5}\left[(5-15)^2 + (10-15)^2 + (15-15)^2 + (20-15)^2 + (25-15)^2\right]$$

$$= \underline{\underline{50}}$$

$$\text{F-test} = \frac{200}{50} = \underline{\underline{4}}$$

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