

ANOVA: Analysis of Variance

3 or more groups

Comparison

(1)

stud marks

vs

Noise level

(93) samples

(10)

Low Noise		
stud	Marks (x)	x^2
1	10	100
2	9	81
3	6	36
4	7	49
32		266

Medium Noise		
stud	x	x^2
5	8	64
6	4	16
7	6	36
8	7	49
25		165

Loud Noise		
stud	x	x^2
9	4	16
10	3	9
11	6	36
12	4	16
17		77

Correction term:

$$C_x = \frac{\sum (x)^2}{n} = \frac{(32 + 25 + 17)^2}{12} = \frac{(74)^2}{12} =$$

$$= \frac{5476}{12} \Rightarrow 456.33 //$$

① Sum of square total :-

$$SS_T = \sum x^2 - C_x = 266 + 165 + 17 - 456.33$$

$$= 508 - 456.33$$
$$SS_T = 51.67$$

② Sum of squares among group:-

$$\begin{aligned}SS_A &= \frac{(\sum T^2)}{n} - C \times \\&= \left(\frac{32^2}{4} + \frac{25}{4} + \frac{17^2}{4} \right) - 456.33 \\&= \left(\frac{1024}{4} + \frac{625}{4} + \frac{289}{4} \right) - 456.33 \\&= (256 + 156.25 + 72.25) - 456.33 \\&= 484.5 - 456.33 \\SS_A &= \underline{\underline{28.17}}\end{aligned}$$

③ Sum of squares Within groups:

$$SS_W = SS_T - SS_A$$
$$= 51.67 - 28.17$$

$$SS_W = 23.5$$

$K \rightarrow$ category
 \downarrow
③ of noise

④ Mean of sum of squares among groups:

$$M_{SS_A} = \frac{SS_A}{K-1} = \frac{28.17}{3-1} = \frac{28.17}{2} = 14.085$$

⑤ Mean of sum of squares within groups - $N \Rightarrow$ Total no. of stud

$$M_{SSW} = \frac{SSW}{N-K} = \frac{23.5}{12-3} = \frac{23.5}{9} = 2.611$$

F-Ratio:

$$\frac{M_{SSA}}{M_{SSW}} = \frac{14.085}{2.611} = \underline{\underline{5.39}}$$

Compare F-Ratio (calculated F-value) with F-table

Source of Variance	df	SS	MS	F-Ratio
Among group	$k-1 \rightarrow 2$	28.17	14.08	5.394
Within group	$n-k \rightarrow 9$	23.5	2.611	
Total				

H_0 ε H_a

✓
 group $\Rightarrow 3-1$
 within $\Rightarrow N-k$

$H_0 \Rightarrow$ No significant effect of noise on number of answers solved

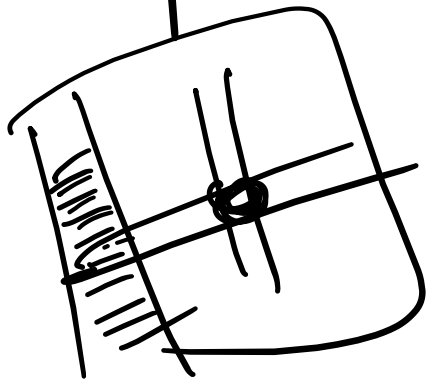
$H_a \Rightarrow$ Significant

Df \Rightarrow (9, 2)

Groups vs Total sample
 $3 - 1 = 2$
 $12 - 3 = 9$

Look up the F-table for value (9, 2)

$\alpha = 0.05$



rows \rightarrow sample / total
Col \rightarrow groups

4.256

df 2 = 9
df 1 = 2

0.025

F-calculated $\rightarrow 5.394$
(F-ratio)

F-table $\rightarrow 4.256$ (critical value)

F-table value? ($\alpha = 0.05$)

Is my F-ratio $>$ F-table value?

5.394	$>$	4.256
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We reject H_0 ; Accept the H_a

Inference: Yes, significant impact b/w
noise & the ^{answer} solve