MA 1st Sem
Paper II (Research Methods & Statistics)

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Topic for the day:

Analysis of Variance

Using - Analysis of Variance

- **Problem Statement**:

To know if there is any significant difference between the three methods of teaching- Lecture/Seminar/Discussion

Using - Analysis of Variance

- **What possible data do we need for analysis?**

Performance scores of subjects (students) who were taught using different methods (Lecture/Seminar/Discussion) on different days

KNOW YOUR DATA

Distribution of performance scores of subjects treated by the three different methods of instructions (Lecture/ Seminar/ Discussions)

Subject Number	Method		
	Lecture (1)	Seminar (2)	Discussions (3)
1	8	11	5
2	10	13	5
3	11	13	8
4	11	15	9
5	12	16	10

QUICK RECAP OF BASIC TERMS

Subject Number	Method		
	Lecture (1)	Seminar (2)	Discussions (3)
1	8	11	5
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In our example

- n = number of subjects — **5**
- k = number of independent variables — **3**
- N = number of observations = k*n — **15**
- G = sum of all observations — **157**

Using - Analysis of Variance

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∑	52	68	37

157 G

n = 5; **k = 3;** **N = kn = 5*3 = 15**

RECAP OF TERMS & FORMULAS

- C = Correction Term = $\frac{G^2}{kn}$
- Total Sum of Squares = Total SS = $(\sum X^2) - C$
- Between Groups Sum of Squares = Between Groups SS = $\frac{\sum (\sum X)^2}{n} - C$
- Within Groups Sum of Squares = (Total SS) – (Between Groups SS)

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RECAP OF TERMS & FORMULAS

- df = Degree of freedom
  - Between Groups = k-1 — In our example: 2
  - Within Group = (n-1)*k — In our example: 12
- Mean Square (MS) = $\frac{SS}{df}$
- Significant Difference (F) = $\frac{\text{MS Between Groups}}{\text{MS Within Groups}}$

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Computations

Step 1: Correction Term (**C**) = $\frac{G^2}{kn} = \frac{(157)^2}{15}$ = **1643.27**

Step 2: Total SS = $(\sum X^2) - C$

$= (8^2+10^2+11^2+11^2+12^2+11^2+13^2+13^2+15^2+16^2+5^2+5^2+8^2+9^2+10^2) - C$

$= 1785.00 - 1643.27 =$ **141.73**

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∑	52	68	37

Computations

Step 3: Between Groups SS = $\frac{\sum(\sum X)^2}{n} - C = \frac{52^2 + 68^2 + 37^2}{5} - C$

$= \frac{(2704 + 4624 + 1369)}{5} - C = \frac{8697}{5} - C = 1739.4 - 1643.27 = \mathbf{96.13}$

Step 4: Within Groups SS = (Total SS) – (Between Groups SS)

= 141.73 – 96.13 = **45.6**

KNOW YOUR TABLE

Summary of one-way analysis of variance

Source of Variation	SS	df	MS	F
Between Groups	96.13	2	48.07	12.65**
Within Groups (Error)	45.6	12	3.8	
Total	141.73	14		

*Table value **F.,, (2,12) = 6.93*

- **How to interpret?**

There is significant difference if, Calculated value of F **>** table value

Interpretation of our data: Since 12.65 > 6.93, hence significant diff between 3 methods

Tip:
When is this method used?

When we have

More than 2 values of independent variables

Questions??

Thank You!