FACULTY OF ENGINEERING & TECHNOLOGY

Dr. Vinod Kumar Yadav
Assistant Professor in Mathematics
Rama University Uttar Pradesh, Kanpur

LECTURE- 27

BSc (AG)
2nd Year , IIIrd Sem.
Statistical Methods
AES-213

Dr. Vinod Kumar Yadav
Assistant Professor in Mathematics
Rama University Uttar Pradesh, Kanpur

Outline of lecture

➢ Analysis of Variance (ANOVA)

➢ Numerical Problem on ANOVA

➢ Table of ANOVA

➢ Calculations in ANOVA

➢ Analysis of Result of Problem in ANOVA

➢ Suggested Readings & References

Numerical Problem

Question: The variety of wheat A, B, C were shown in 4 plots I, II, III, IV each and the following yields in quintals per acre were obtained.

Plots / Varieties	I	II	III	IV
A	8	4	6	7
B	7	6	5	3
C	2	5	4	4

Test the significance of difference b/w the yield of the varieties given that 5% tabulated value of F of $(2, 9)$ degree of freedom is 4.26.

Answer:

(I) Correction factor $(C.F.) = \dfrac{(Total)^2}{N}$

$$= \frac{(8+4+6+7+7+5+5+3+2+5+4+4)^2}{12}$$

$$= \frac{(60)^2}{12}$$

$$= \frac{3600}{12}$$

$$\boxed{C.F. = 300}$$

(II) Total Sum of square $= 8^2+4^2+6^2+7^2+7^2+5^2+5^2+3^2+2^2+5^2+4^2+4^2 - C.F$

$$= 64+16+36+49+49+25+25+9+4+25+16+16 - C.F$$

$$= 334 - 300$$

$$= 34$$

(III) Sum of Square Between classes $= \dfrac{(8+4+6+7)^2}{4} + \dfrac{(7+5+5+3)^2}{4} + \dfrac{(2+5+4+4)^2}{4} - CF$

$$= \frac{(25)^2}{4} + \frac{(20)^2}{4} + \frac{(15)^2}{4} - CF.$$

$$= \frac{1250}{4} - 300$$

ANOVA Table in Problem

$$= 312 \cdot 5 - 300$$
$$= 12 \cdot 5.$$

(IV) By using formula.

Total sum of square = Sum of square b/w classes − Sum of square within classes.

$$34 = 12 \cdot 5 + \text{Sum of square within classes}$$
$$34 - 12 \cdot 8 = \text{Sum of square within classes}$$

Sum of square within classes = $21 \cdot 5$.

ANOVA ~~classes~~ Table

Source of Variation	Degree of freedom (d.f)	Sum of Square (s·s)	mean sum of square	variance ratio calculated (Fc)
Between classes	$K-1$	V_1	$\dfrac{V_1}{K-1} = W_1$	$\dfrac{W_1}{W_2} = F_c$
within classes	$N-K$	V_2	$\dfrac{V_2}{N-K} = W_2$	...
Total	$N-1$			

Source of Variation	Degree of freedom (d.f)	Sum of square (s·s)	Mean sum of square	variance ratio calculated (Fc)
Between classes	$3-1=2$	$12 \cdot 5$	$\dfrac{12 \cdot 5}{2} = 6 \cdot 25$	$\dfrac{6 \cdot 25}{2 \cdot 38} = 2 \cdot 62$
within classes	$12-3=9$	$21 \cdot 5$	$\dfrac{21 \cdot 5}{2} = 2 \cdot 38$	
Total	$12-1=11$			

Where,
$$K = 3$$
$$N = 12 = \text{Total numbers.}$$

Analysis of Problem

Analysis of ANOVA table

Calculated F_c = 2.62

Tabulated F_T = 4.26

2.62		4.26
2.62	<	4.26
F_c	<	F_T

Hence, our hypothesis is accepted and difference b/w yields is not significant.

Suggested Readings & References

1) Statistical Methods: P.N. Arora, Sumeet Arora & S. Arora; S. Chand & Company Ltd.

2) Fundamental of Mathematical Statistics: S.C. Gupta & V. Kapoor; Sultan Chand & Sons.

3) Statistics: M.R. Spiegel; Schaum's Outline Series, Mc-Graw Hill Publication.

4) Advanced Engineering Mathematics: Erwin Kreyszig; John Wiley & Sons Inc.

5) Elements of Statistics: J.P. Chauhan & S. Kumar; Krishna Publication.

* THANK YOU *