



মুজিব MUJIB
শতবর্ষ 100

One-Way ANOVA:

1	2	...	i	...	K
x_{11}	x_{21}	...	x_{i1}	...	x_{K1}
x_{12}	x_{22}	...	x_{i2}	...	x_{K2}
\vdots	\vdots		\vdots		\vdots
x_{1j}	x_{2j}	...	x_{ij}	...	x_{Kj}
\vdots	\vdots		\vdots		\vdots
x_{1n_1}	x_{2n_2}	...	x_{in_i}	...	x_{Kn_K}

Mean: $\bar{x}_1, \bar{x}_2, \dots, \bar{x}_i, \dots, \bar{x}_K$

Overall mean $\bar{x}_{..} = \frac{\sum_{i=1}^K \sum_{j=1}^{n_i} x_{ij}}{n}$

$$n = n_1 + n_2 + \dots + n_K$$

$$\text{Total SS (TSS)} = \sum_i^K \sum_j^{n_i} (x_{ij} - \bar{x}_{..})^2$$

$$= \sum_i^K \sum_j^{n_i} [(x_{ij} - \bar{x}_i) + (\bar{x}_i - \bar{x}_{..})]^2$$

$$= \sum_i^K \sum_j^{n_i} (x_{ij} - \bar{x}_i)^2 + \sum_i^K \sum_j^{n_i} (\bar{x}_i - \bar{x}_{..})^2$$

+ Product term (= 0)

$$= \sum_i^K \sum_j^{n_i} (x_{ij} - \bar{x}_i)^2 + \sum_i^K n_i (\bar{x}_i - \bar{x}_{..})^2$$

$$\therefore \text{TSS} = \text{WSS} + \text{Between SS (BSS)}$$



ANOVA Table:

Source of Variance	df	SS	MS	F
Between SS	$K-1$	$\sum_i n_i (\bar{x}_i - \bar{x})^2$	$BSS/K-1$ $= BMS$	$F = \frac{BMS}{WMS}$
Within SS (Error SS)	$n-K$	$\sum \sum (x_{ij} - \bar{x}_i)^2$	$WSS/n-K$ $= WMS$	
Total SS	$n-1$	$\sum \sum (x_{ij} - \bar{x})^2$		

$H_0: \mu_1 = \mu_2 = \dots = \mu_K$
vs H_1 : At least two of them are unequal.

For Problem Solving

$$BSS = \sum n_i (\bar{x}_i - \bar{x}_{..})^2$$

$$TSS = \sum \sum x_{ij}^2 - n \bar{x}_{..}^2$$

$$\therefore WSS = TSS - BSS$$