ANAKOVA
bagian 3

Model ANAKOVA dua faktor dan satu variabel konkomitan :

$$Y_{ijk} = \mu + \tau_i + \beta_j + (\tau\beta)_{ij} + \gamma\left(X_{ijk} - \overline{X}...\right) + \varepsilon_{ijk} \begin{cases} i = 1,2,...,a \\ j = 1,2,...,b \\ k = 1,2,...,n \end{cases}$$

Contoh

Seorang holtikuluturis ingin mengetahui pengaruh pengaruh varietas bunga (faktor A ; LP dan WB) dan tingkat kelembaban (faktor B ; rendah dan tinggi) pada hasil panen bunga (Y). Karena luas tanah pertanian tidak sama, maka Ia menggunakan ukuran petak sebagai kontrolnya (konkomitan, X)

Faktor A	Faktor B (Tingkat Kelembaban)			
	B_1 (rendah)		B_2 (Tinggi)	
	Y_{i1k}	X_{i1k}	Y_{i2k}	X_{i2k}
A_1 (Varietas LP)	98	15	71	10
	60	4	80	12
	77	7	86	14
	80	9	82	13
	95	14	46	2
	64	5	55	3
A_2 (varietas WB)	55	4	76	11
	60	5	68	10
	75	8	43	2
	65	7	47	3
	87	13	62	7
	78	11	70	9

Ingat… Penentuan JKT pada anava dua jalan…

$$y_{ijk} = \mu + \tau_i + \beta_j + (\tau\beta)_{ij} + \varepsilon_{ijk}$$

$$\sum_{i=1}^{a}\sum_{j=1}^{b}\sum_{k=1}^{n}\left(y_{ijk} - \bar{y}_{\bullet\bullet\bullet}\right)^2$$

$$= \sum_{i=1}^{a}\sum_{j=1}^{b}\sum_{k=1}^{n}\left[\left(\bar{y}_{i\bullet\bullet} - \bar{y}_{\bullet\bullet\bullet}\right) + \left(\bar{y}_{\bullet j\bullet} - \bar{y}_{\bullet\bullet\bullet}\right) + \left(\bar{y}_{ij\bullet} - \bar{y}_{i\bullet\bullet} - \bar{y}_{\bullet j\bullet} + \bar{y}_{\bullet\bullet\bullet}\right) + \left(y_{ijk} - \bar{y}_{ij\bullet}\right)\right]^2$$

$$= \underbrace{bn\sum_{i=1}^{a}\left(\bar{y}_{i\bullet\bullet} - \bar{y}_{\bullet\bullet\bullet}\right)^2}_{JK_A} + \underbrace{an\sum_{j=1}^{b}\left(\bar{y}_{\bullet j\bullet} - \bar{y}_{\bullet\bullet\bullet}\right)^2}_{JK_B} + \underbrace{n\sum_{i=1}^{a}\sum_{j=1}^{b}\left(\bar{y}_{ij\bullet} - \bar{y}_{i\bullet\bullet} - \bar{y}_{\bullet j\bullet} + \bar{y}_{\bullet\bullet\bullet}\right)^2}_{JK_{AB}} + \underbrace{\sum_{i=1}^{a}\sum_{j=1}^{b}\sum_{k=1}^{n}\left(y_{ijk} - \bar{y}_{ij\bullet}\right)^2}_{JK_S}$$

$$JK_T = JK_A + JK_B + JK_{AB} + JK_S$$

jadi…Penentuan Analisis Variansi untuk Y

$$\mathrm{JK}_{\mathrm{A-Y}} = nb\sum_{i}\left(\overline{Y}i.. - \overline{Y}...\right)^2$$

$$\mathrm{JK}_{\mathrm{B\_Y}} = na\sum_{j}\left(\overline{Y}._{j}. - \overline{Y}...\right)^2$$

$$\mathrm{JK}_{\mathrm{AB\_Y}} = n\sum_{i}\sum_{j}\left(\overline{Y}_{ij}. - \overline{Y}_{i}.. - \overline{Y}._{j}. + \overline{Y}...\right)^2$$

$$\mathrm{JK}_{\mathrm{T\_Y}} = \sum_{i}\sum_{j}\sum_{k}\left(Y_{ijk} - \overline{Y}...\right)^2$$

$$\mathrm{JK}_{\mathrm{S\_Y}} = JK_{T\_Y} - JK_{A\_Y} - JK_{B\_Y} - JK_{AB\_Y}$$

Analog untuk penentuan Anava untuk penentuan X

ANAVA untuk XY

$$\mathrm{JK}_{\mathrm{T\_XY}} = \sum_i \sum_j \sum_k \left(X_{ijk} - \bar{X}...\right)\left(Y_{ijk} - \bar{Y}...\right) = \sum_i \sum_j \sum_k X_{ijk} Y_{ijk} - \frac{X...Y...}{abn}$$

$$\mathrm{JK}_{\mathrm{A\_XY}} = bn \sum_i \left(\bar{X}_{i..} - \bar{X}...\right)\left(\bar{Y}_{i..} - \bar{Y}...\right) = \sum_i \frac{X_{i..}Y_{i..}}{bn} - \frac{X...Y...}{abn}$$

$$\mathrm{JK}_{\mathrm{B\_XY}} = an \sum_j \left(\bar{X}_{.j.} - \bar{X}...\right)\left(\bar{Y}_{.j.} - \bar{Y}...\right) = \sum_j \frac{X_{.j.}Y_{.j.}}{an} - \frac{X...Y...}{abn}$$

$$\mathrm{JK}_{\mathrm{S\_XY}} = \sum_i \sum_j \sum_k \left(X_{ijk} - \bar{X}_{ij..}\right)\left(Y_{ijk} - \bar{Y}_{ij.}\right) = \mathrm{JK}_{\mathrm{T\_XY}} - \mathrm{JK}_{\mathrm{P\_XY}}$$

$$\mathrm{JK}_{\mathrm{P\_XY}} = n \sum_i \sum_j \left(X_{ij.} - \bar{X}_{...}\right)\left(\bar{Y}_{ij.} - \bar{Y}_{...}\right) = \frac{\sum_i \sum_j X_{ij.}Y_{ij.}}{n} - \frac{X...Y...}{abn}$$

$$\mathrm{JK}_{\mathrm{AB\_XY}} = \mathrm{JK}_{\mathrm{P\_XY}} - \mathrm{JK}_{\mathrm{A\_XY}} - \mathrm{JK}_{\mathrm{B\_XY}}$$

ANAVA untuk X, Y dan XY

SV	Y	X	XY	db
A	JKA_Y	JKA_X	JKA_XY	a-1
B	JKB_Y	JKB_X	JKB_XY	b-1
AB	JKAB_Y	JKAB_X	JKAB_XY	(a-1)(b-1)
Sesatan	JKS_Y	JKS_X	JKS_XY	ab(n-1)
Total	JKT_Y	JKT_X	JKT_XY	abn-1

Uji efek Pengaruh A

i. $\mathrm{H}_0 : \tau_i = 0, \forall i$

$\mathrm{H}_1 : \tau_i \neq 0, \exists i, i = 1,2,\ldots t$

ii. dipilih α

iii. Statistika Uji :

$$\mathrm{F}_{\text{rasio}} = \frac{RK_{A_{(adj)}}}{RK_{S_{(adj)}}}$$

iv. DK : H_0 ditolak jika $\mathrm{F}_{\text{rasio}} > F_{(\alpha, a-1, ab(n-1)-1)}$

SV	Y	X	XY	db
A	JKA_Y	JKA_X	JKA_XY	a-1
B	JKB_Y	JKB_X	JKB_XY	b-1
AB	JKAB_Y	JKAB_X	JKAB_XY	(a-1)(b-1)
Sesatan	JKS_Y	JKS_X	JKS_XY	ab(n-1)
Total	JKT_Y	JKT_X	JKT_XY	abn-1

$$JK_{A-E(dip)} = \left(JK_{A\_Y} + JK_{S\_Y}\right) - \frac{\left(JK_{A\_XY} + JK_{S\_XY}\right)^2}{\left(JK_{A\_X} + JK_{S\_X}\right)}$$

$$JK_{SA(dip)} = JK_{S\_Y} - \frac{(JK_{S\_XY})^2}{JK_{S\_X}}$$

$$JK_{A(dip)} = JK_{A-E(dip)} - JK_{SA(dip)}$$

Tabel anava

SV	Y	X	XY	db
A	JKA_Y	JKA_X	JKA_XY	a-1
Sesatan	JKS_Y	JKS_X	JKS_XY	ab(n-1)
Total	JKT_Y	JKT_X	JKT_XY	abn-1
	=JKA_Y+JKS_Y	=JKA_X+JKS_X	=JKA_XY+JKS_XY	=a-1+ab(n-1)

Tabel anakova A

SV	JK	db	RK(Adj)
A	JKA(dip)	a-1	RKA(dip)
Sesatan	JKS_A(dip)	ab(n-1)-1	RKS(dip)
Total	JKA-E(dip)	a+ab(n-1)-2