

STATISTIKA UNTUK KETEKNIKAN

“Teknik Analisis Ragam”

oleh:

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Pengolahan Data dengan Rumus

Rumus Anova Satu Arah

1. RAL untuk Banyak Ulangan Masing-masing Perlakuan Sama

Ulangan	Perlakuan				
	A	B	C	D	E
1	X1	X2	X3	X4	X5
2	X6	X7	X8	X9	X10
3	X11	X12	X13	X14	X15
4	X16	X17	X18	X19	X20
5	X21	X22	X23	X24	Xn
Total	T1	T2	T3	T4	T5

$$FK = \left(\frac{(x_1 + x_2 + \dots + x_n)^2}{\text{Banyaknya Data}} \right)$$

$$JKP = \left(\frac{(T_1^2 + \dots + T_n^2)}{\text{Banyaknya Ulangan}} \right) - FK$$

$$JKT = (x_1^2 + \dots + x_n^2) - FK$$

$$JKG = JKT - JKP$$

Tabel Analisis Ragam (Anova)

Sumber Keragaman	Derajat Bebas	Jumlah Kuadrat	Kuadrat Tengah	F Hitung	F Tabel 5 %	F Tabel 1 %
SK	db	JK	KT	F Hitung	F 5 %	F 1 %
Perlakuan	p-1	JKP	JKP/(p-1)	KTP/KTG	F 0,05 (v1,V2)	F 0,01 (v1,V2)
Galat	p(n-1)	JKG	JKG/p(n-1)			
Total	pn-1	JKP+JKG				

Keterangan :

p = banyaknya perlakuan

n = banyaknya ulangan

v1 = db perlakuan

v2 = db galat

Keputusan :

Tolak Ho : F hitung > F tabel

Terima Ho : F Hitung < F tabel

Contoh Soal: RAL dengan ulangan sama

	Lama Penyimpanan (hari)				
Ulangan	A	B	C	D	E
1	5	9	3	2	7
2	4	7	5	3	6
3	8	8	2	4	9
4	6	6	3	1	4
5	3	9	7	4	7

2. RAL Banyak Ulangan Masing-masing Perlakuan Tidak Sama

Ulangan	Perlakuan				
	A	B	C	D	E
1	X1	X2	X3	X4	X5
2	X6	X7	X8	X9	X10
3	X11	X12	X13	X14	X15
4		X16	X17		X18
5		X19			Xn
Total	T1	T2	T3	T4	Tn

$$FK = \left(\frac{(x_1 + x_2 + \dots + x_n)^2}{\text{BanyaknyaData}} \right) \quad JKP = \left\{ \left(\frac{T_1^2}{BUa} \right) + \left(\frac{T_2^2}{BUb} \right) + \dots + \left(\frac{T_n^2}{BUn} \right) \right\} - FK$$

$$JKT = (x_1^2 + \dots + x_n^2) - FK \quad JKG = JKT - JKP$$

Tabel Analisis Ragam (Anova)

Sumber Keragaman	Derajat Bebas	Jumlah Kuadrat	Kuadrat Tengah	F Hitung	F Tabel 5 %	F Tabel 1 %
SK	db	JK	KT	F Hitung	F 5 %	F 1 %
Perlakuan	p-1	JKP	JKP/(p-1)	KTP/KT G	F 0,05 (v1,v2)	F 0,01 (v1,v2)
Galat	p(s-1)	JKG	JKG/(p(s-1))			
Total	sp-1	JKP+JKG				

Keterangan :

p = banyaknya perlakuan

s = rata-rata banyaknya ulangan

v1 = db perlakuan

v2 = db galat

Keputusan :

Tolak H_0 : F hitung > F tabel

Terima H_0 : F Hitung < F tabel

Contoh Soal: RAL dengan ulangan tidak sama

	Lama Penyimpanan (hari)		
Ulangan	A	B	C
1	4	5	8
2	7	1	6
3	6	3	8
4	6	5	9
5		3	5
6		4	

3. Rancangan Acak Kelompok

Perlakuan	Kelompok			Total
	I	II	III	
	(ton/ha)			
A	X1	X2	X3	Y1
B				Y2
C				Y3
D				
E			Xn	Yn
Total	T1	T2	Tn	

$$FK = \left(\frac{(x_1 + x_2 + \dots + x_n)^2}{\text{Banyaknya Data}} \right)$$

$$JKT = (x_1^2 + \dots + x_n^2) - FK$$

$$JKK = \left(\frac{(T_1^2 + \dots + T_n^2)}{\text{Banyaknya Perlakuan}} \right) - FK$$

$$JKP = \left(\frac{(Y_1^2 + \dots + Y_n^2)}{\text{Banyaknya Kelompok}} \right) - FK$$

$$JKG = JKT - (JKK + JKP)$$

Tabel Analisis Ragam (Anova)

Sumber Keragaman	Derajat Bebas	Jumlah Kuadrat	Kuadrat Tengah	F Hitung	F Tabel 5 %	F Tabel 1 %
SK	db	JK	KT	F Hitung	F 5 %	F 1 %
Kelompok	k-1	JKK	JKK/(k-1)	KTK/KTG	F 0,05 (v1,v3)	F 0,01 (v1,v3)
Perlakuan	p-1	JKP	JKP/(p-1)	KTP/KTG	F 0,05 (v2,V3)	F 0,01 (v2,V3)
Galat	(k-1).(p-1)	JKG	JKG/(k-1).(p-1)			
Total	kp-1	JKT				

Keterangan :

k = banyaknya kelompok

p = banyaknya perlakuan

v1 = db kelompok

v2 = db perlakuan

v3 = db galat

Keputusan :

Tolak H_0 : F hitung > F tabel

Terima H_0 : F Hitung < F tabel

Contoh Soal : Rancangan Acak Kelompok (RAK)

Perlakuan	Kelompok		
	I	II	III
	(ton/ha)		
A	0.825	0.750	0.815
B	1.335	1.300	1.355
C	1.357	1.325	1.405
D	1.500	1.555	1.575
E	1.495	1.600	1.625
F	1.650	1.675	1.700
G	1.725	1.690	1.750

Rumus Anova Dua Arah

1. RAL dengan Faktorial

Kriteria 1	Kriteria 2			Total
	v1	v2	v3	
t1	X1	X4	X7	Y1
	X2	X5	X8	
	X3	X6	X9	
t2				Y2
t3				Y3
t4				Yn
			Xn	
Total	T1	T2	Tn	

$$FK = \left(\frac{(x_1 + x_2 + \dots + x_n)^2}{\text{BanyaknyaData}} \right)$$

$$JKT = (x_1^2 + \dots + x_n^2) - FK$$

$$JKP = \left(\frac{(X_1 + X_2 + X_3)^2 + (X_4 + X_5 + X_6)^2 + \dots + (X_{34} + X_{35} + X_n)^2}{\text{JumlahUlangan}} \right) - FK$$

$$JKB = \left(\frac{(Y_1^2 + \dots + Y_n^2)}{\text{Jumlah kolom x banyaknya ulangan}} \right) - FK$$

$$JKK = \left(\frac{(T_1^2 + \dots + T_n^2)}{\text{Jumlah baris x banyaknya ulangan}} \right) - FK$$

$$JK(BK) = JKP - JKB - JKK$$

$$JKG = JKT - JKP$$

Tabel Analisis Ragam (Anova)

Sumber Keragaman	Derajat Bebas	Jumlah Kuadrat	Kuadrat Tengah	F Hitung	F Tabel 5 %	F Tabel 1 %
SK	db	JK	KT	F Hitung	F 5 %	F 1 %
Perlakuan	$(r.k) - 1$	JKP	$JKP/(r.k) - 1$	KTP/KTG	F 0,05 (v1,v5)	F 0,01 (v1,v5)
Baris	r-1	JKB	$JKB/(r-1)$	KTb/KTG	F 0,05 (v2,V5)	F 0,01 (v2,V5)
Kolom	k-1	JKK	$JKK/(k-1)$	KTK/KTG	F 0,05 (v3,V5)	F 0,01 (v3,V5)
Interaksi	$(r-1).(k-1)$	JK(BK)	$JK(BK)/\{(r-1).(k-1)\}$	KTI/KTG	F 0,05 (v4,v5)	F 0,01 (v4,v5)
Galat	rk(n-1)	JKG	$JKG/\{rk(n-1)\}$			
Total	rkn-1	JKT				

Keterangan :

r = banyaknya baris

k = banyaknya kolom

n = banyak ulangan

v_1 = db perlakuan

v_2 = db baris

v_3 = db kolom

v_4 = db interaksi

v_5 = db galat

Keputusan :

Tolak H_0' : Jika $F_{hitung}(\text{baris}) > F_{tabel}(\text{baris})$

Terima H_0' : Jika $F_{hitung}(\text{baris}) < F_{tabel}(\text{baris})$

Tolak H_0'' : Jika $F_{hitung}(\text{kolom}) > F_{tabel}(\text{kolom})$

Terima H_0'' : Jika $F_{hitung}(\text{kolom}) < F_{tabel}(\text{kolom})$

Tolak H_0''' : Jika $F_{hitung}(\text{interaksi}) > F_{tabel}(\text{interaksi})$

Terima H_0''' : Jika $F_{hitung}(\text{interaksi}) < F_{tabel}(\text{interaksi})$

Contoh Soal: RAL Faktorial

Jenis Pupuk	Varietas		
	v1	v2	v3
t1	64	72	74
	66	81	51
	70	64	65
t2	65	57	47
	63	43	58
	58	52	67
t3	59	66	58
	68	71	39
	65	59	42
t4	58	57	53
	41	61	59
	46	53	38

2. RAK dengan Faktorial

Kriteria 1	Kriteria 2	Kelompok				Total
		1	2	3	4	
0	1	X1	X4			Y1
	2	X2	X5			Y2
	3	X3	X6			Y3
1	1					Y4
	2					Y5
	3					Y6
2	1					Y7
	2					Y8
	3					Y9
3	1					Y10
	2					Y11
	3					Y12
4	1					Y13
	2					Y14
	3				Xn	Y15
	Total	T1	T2	T3	T4	

$$FK = \left(\frac{(x_1 + x_2 + \dots + x_n)^2}{BanyaknyaData} \right)$$

$$JKT = (x_1^2 + \dots + x_n^2) - FK$$

$$JKP \left(\frac{(Y_1^2 + \dots + Y_n^2)}{JumlahKelompok} \right) - FK$$

$$JKKel = \left(\frac{(T_1^2 + \dots + T_n^2)}{Jumlahbaris \times Jumlahkolom} \right) - FK$$

$$JKG = JKT - JKP - JKKel$$

Baris	Kolom			Total
	1	2	3	
0	Y1	Y2	Y3	A1
1	Y4	Y5	Y6	A2
2	Y7	Y8	Y9	A3
3	Y10	Y11	Y12	A4
4	Y13	Y14	Yn	An
Total	B1	B2	B3	

$$JKB = \left(\frac{(A_1^2 + \dots + A_n^2)}{\text{Jumlahkelompok} \times \text{Jumlahkolom}} \right) - FK$$

$$JKK = \left(\frac{(B_1^2 + \dots + B_n^2)}{\text{Jumlahkelompok} \times \text{Jumlahbaris}} \right) - FK$$

$$JK(BK) = JKP - JKB - JKK$$

Tabel Analisis Ragam (Anova)

Sumber Keragaman	Derajat Bebas	Jumlah Kuadrat	Kuadrat Tengah	F Hitung	F Tabel 5 %	F Tabel 1 %
SK	Db	JK	KT	F Hitung	F 5 %	F 1 %
Kelompok	g-1	JKKel	JKKel/(g-1)	KTKel/KTG	F 0,05 (v1,v6)	F 0,01 (v1,v6)
Perlakuan	(r.k) -1	JKP	JKP/(r.k)-1	KTP/KTG	F 0,05 (v2,V6)	F 0,01 (v2,V6)
Baris	r-1	JKB	JKB/(r-1)	KTB/KTG	F 0,05 (v3,V6)	F 0,01 (v3,V6)
Kolom	k-1	JKK	JKK/(k-1)	KTK/KTG	F 0,05 (v4,v6)	F 0,01 (v4,v6)
Interaksi	(r-1).(k-1)	JK(BK)	JK(BK)/{(r-1).(k-1)}	KTI/KTG	F 0,05 (v5,v6)	F 0,01 (v5,v6)
Galat	(g-1).(rk-1)	JKG	JKG/{(g-1).(rk-1)}			
Total	(grk)-1	JKT				

Keterangan :

g = banyaknya kelompok

r = banyaknya baris

k = banyaknya kolom

n = banyak ulangan

v1 = db kelompok

v2 = db perlakuan

v3 = db baris

v4 = db kolom

v5 = db interaksi

v6 = db galat

Keputusan :

Tolak H_0' : Jika $F_{hitung}(\text{baris}) > F_{tabel}(\text{baris})$

Terima H_0' : Jika $F_{hitung}(\text{baris}) < F_{tabel}(\text{baris})$

Tolak H_0'' : Jika $F_{hitung}(\text{kolom}) > F_{tabel}(\text{kolom})$

Terima H_0'' : Jika $F_{hitung}(\text{kolom}) < F_{tabel}(\text{kolom})$

Tolak H_0''' : Jika $F_{hitung}(\text{interaksi}) > F_{tabel}(\text{interaksi})$

Terima H_0''' : Jika $F_{hitung}(\text{interaksi}) < F_{tabel}(\text{interaksi})$

Contoh Soal: RAK Faktorial

Pupuk N	Varietas	Kelompok			
(kg/ha)		1	2	3	4
0	1	3.582	2.606	3.144	2.894
	2	2.864	3.794	4.108	3.444
	3	4.192	3.754	3.738	3.428
1	1	4.788	4.936	4.562	4.608
	2	4.956	5.128	4.150	4.990
	3	5.250	4.582	4.896	4.286
2	1	4.576	4.454	4.884	3.924
	2	5.928	5.698	5.810	4.308
	3	5.522	4.848	5.678	4.932
3	1	6.034	5.276	5.906	5.652
	2	5.664	5.362	6.458	5.474
	3	5.888	5.524	6.042	4.756
4	1	5.874	5.916	5.984	5.518
	2	5.458	5.546	5.786	5.932
	3	5.864	6.264	6.056	5.362

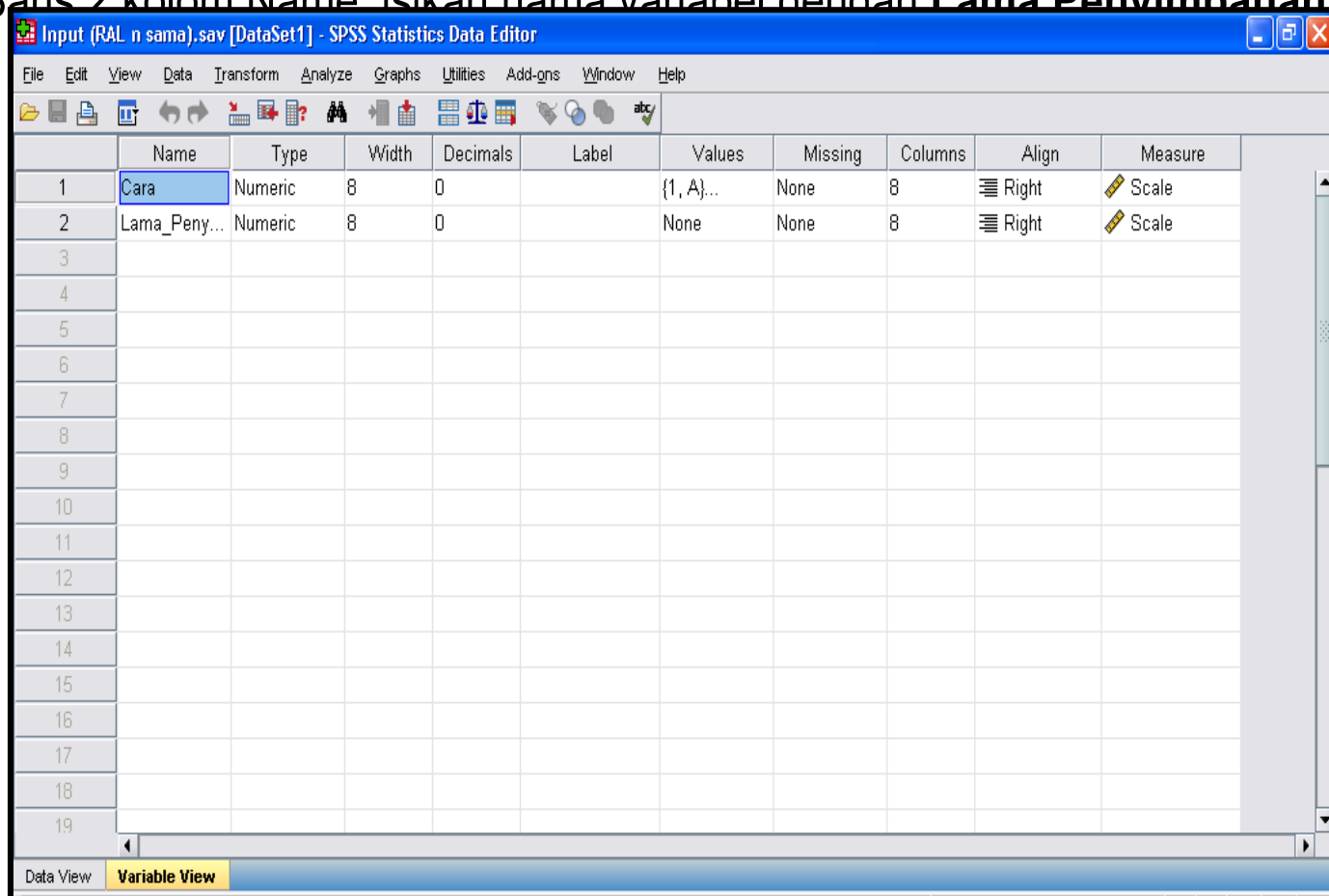
Pengolahan Data dengan SPSS

Anova Satu Arah

1. Rancangan Acak Lengkap (RAL)

	Lama Penyimpanan (hari)				
Ulangan	A	B	C	D	E
1	5	9	3	2	7
2	4	7	5	3	6
3	8	8	2	4	9
4	6	6	3	1	4
5	3	9	7	4	7

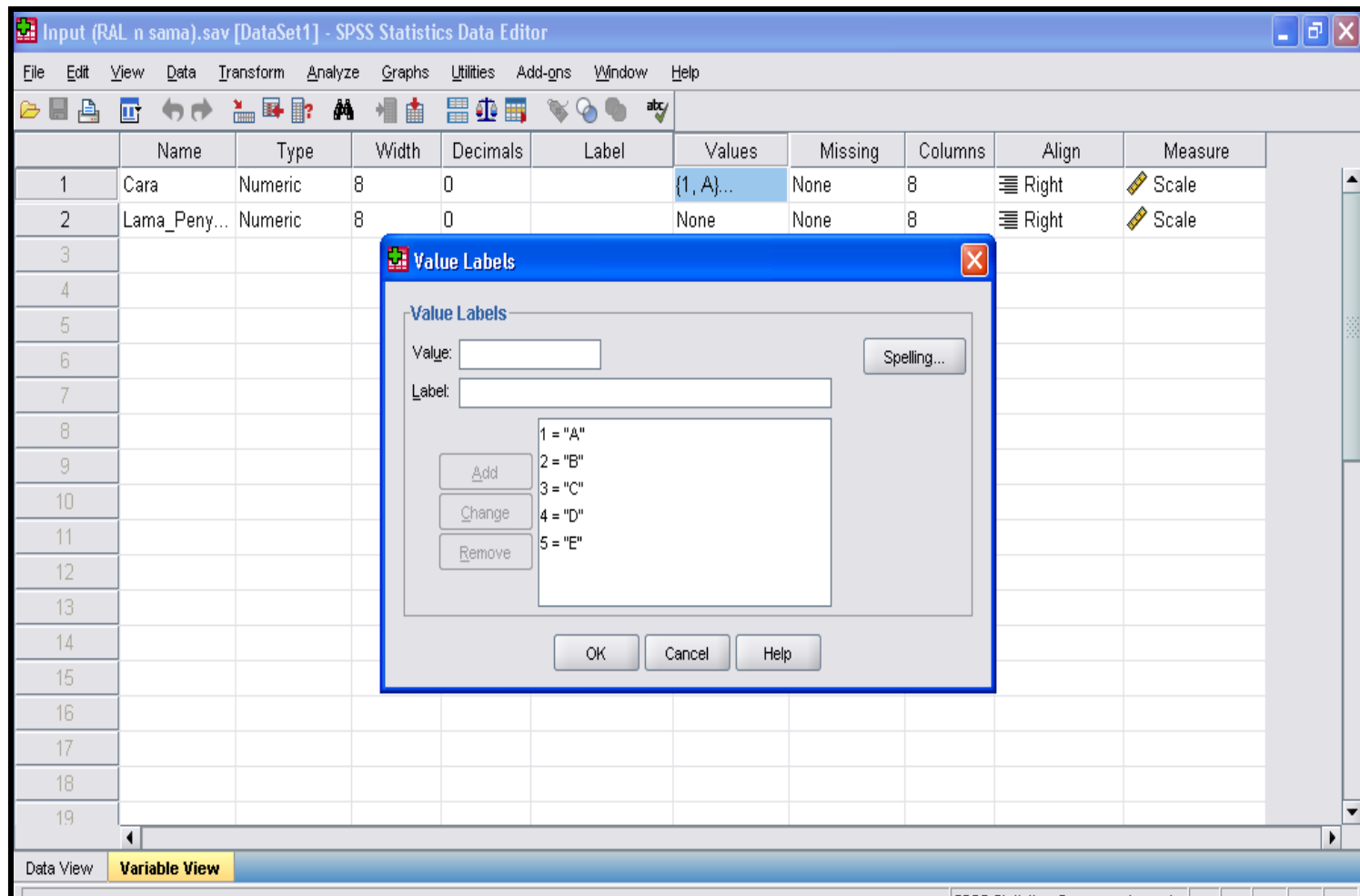
1. Buka SPSS, pilih Type in data, klik ok sehingga muncul data editor.
2. Klik Commands window **Variable View** pada bagian bawah, isi name,type, dan decimals.
 - Klik baris 1 kolom Name, isikan nama variabel dengan **Cara Penyimpanan**
 - Baris 2 kolom Name isikan nama variabel dengan **Lama Penyimpanan**



3. Klik Value, pada variabel

Cara Penyimpanan, isikan :

- Value 1, Label A
- Value 2, Label B
- Value 3, Label C
- Value 4, Label D
- Value 5, Label E



4. Klik Commands window **Data View** pada bagian bawah, masukkan data sesuai dengan nama variable dan jumlahnya. Setelah data selesai dientri, maka lakukan pengolahan.

Input (RAL n sama).sav [DataSet1] - SPSS Statistics Data Editor

File Edit View Data Transform Analyze Graphs Utilities Add-ons Window Help

1: Cara 1.0 Visible: 2 of 2 Variables

	Cara	Lama_Penyimpanan	var	var	var	var	var	var	var	var	var	var
1	1	5										
2	1	4										
3	1	8										
4	1	6										
5	1	3										
6	2	9										
7	2	7										
8	2	8										
9	2	6										
10	2	9										
11	3	3										
12	3	5										
13	3	2										
14	3	3										
15	3	7										
16	4	2										

Data View Variable View

5. Pilih **Analyze**, ambil **Compare Means**, klik **One-Way ANOVA**

The screenshot shows the SPSS Statistics Data Editor window with the file 'Input (RAL n sama).sav [DataSet1]'. The 'Data View' tab is active, displaying a dataset with 16 rows and 3 columns: 'Cara', 'Lama_F', and 'mpan'. The 'Cara' column contains values 1, 1, 1, 1, 1, 2, 2, 2, 2, 2, 3, 3, 3, 3, 3, 4. The 'Lama_F' column contains values 1.0, 1.0, 1.0, 1.0, 1.0, 2.0, 2.0, 2.0, 2.0, 2.0, 3.0, 3.0, 3.0, 3.0, 3.0, 4.0. The 'mpan' column is empty.

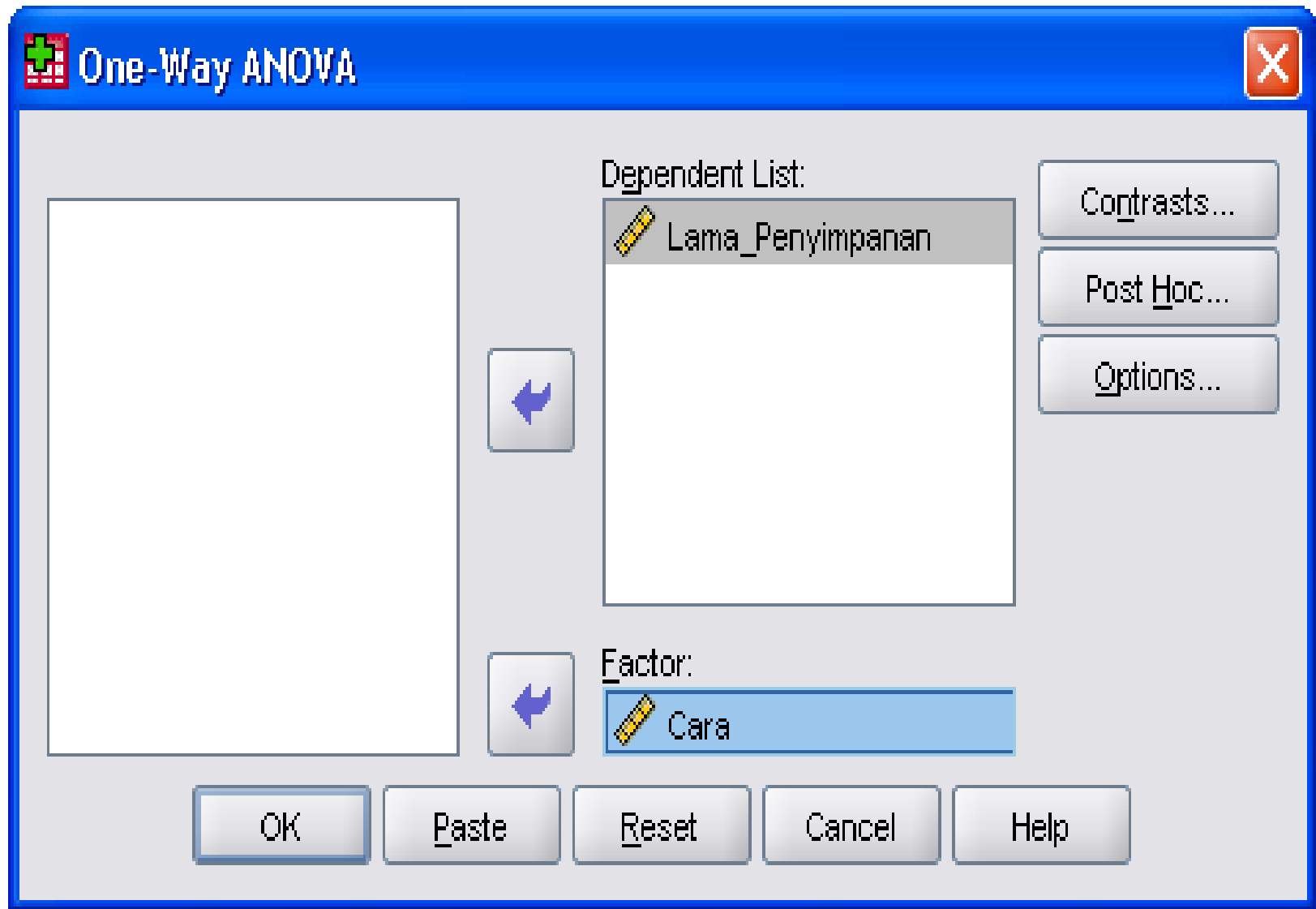
The 'Analyze' menu is open, and the 'Compare Means' option is selected. The 'Compare Means' submenu is also open, showing the following options:

- Means...
- One-Sample T Test...
- Independent-Samples T Test...
- Paired-Samples T Test...
- One-Way ANOVA...

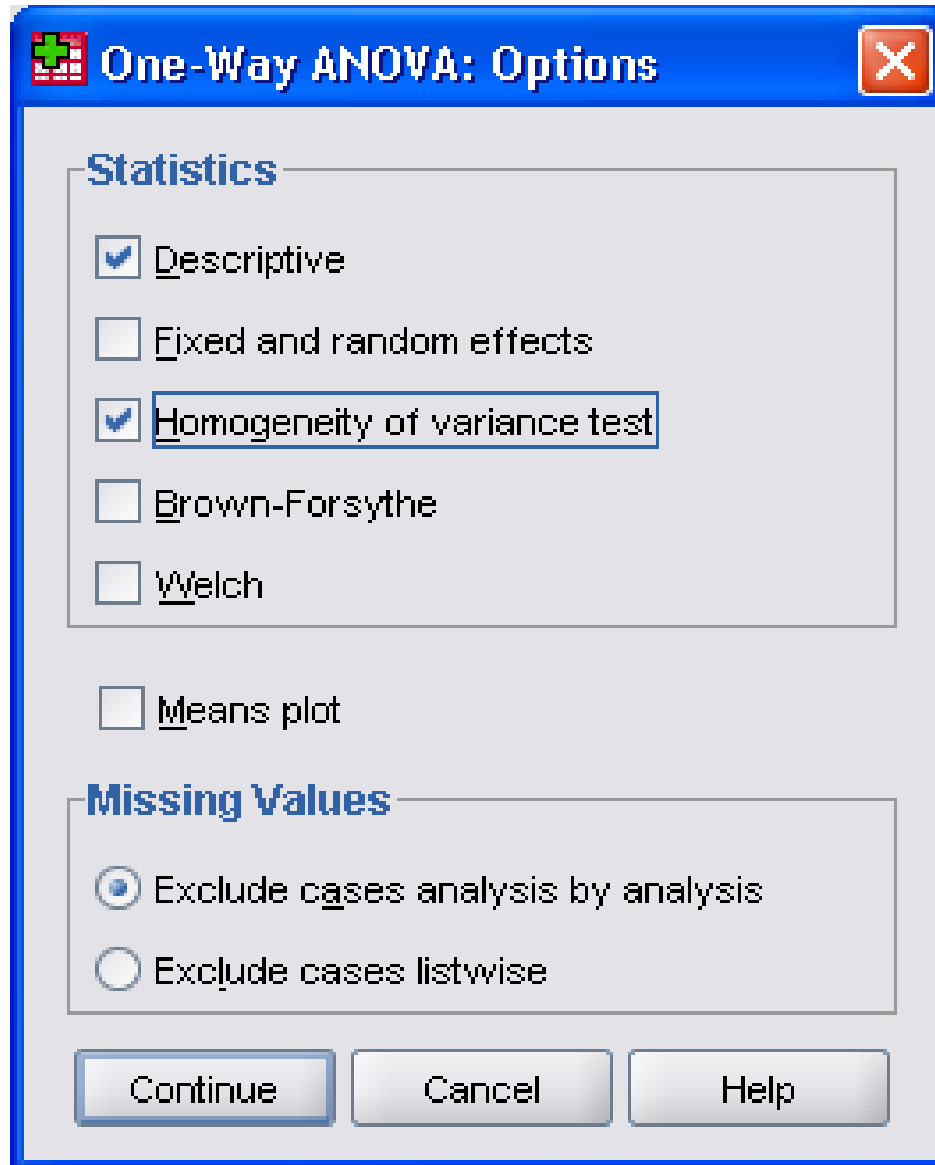
The 'One-Way ANOVA...' option is highlighted in blue.

	Cara	Lama_F	mpan
1	1	1.0	
2	1	1.0	
3	1	1.0	
4	1	1.0	
5	1	1.0	
6	2	2.0	
7	2	2.0	
8	2	2.0	
9	2	2.0	
10	2	2.0	
11	3	3.0	
12	3	3.0	
13	3	3.0	
14	3	3.0	
15	3	3.0	
16	4	4.0	

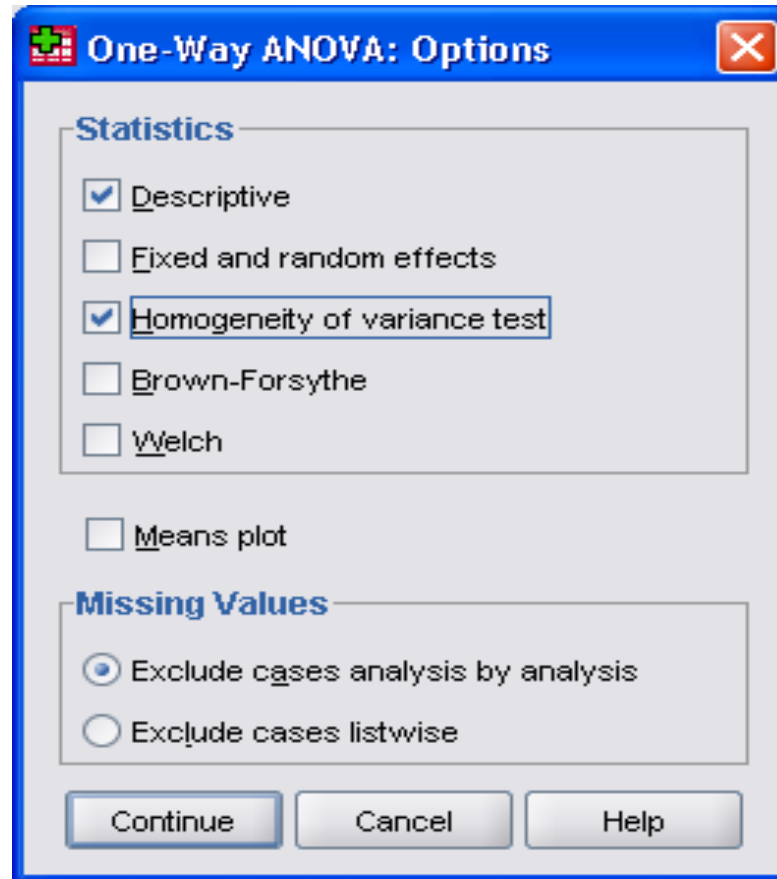
6. Klik **Variabel Cara Penyimpanan** kedalam **kolom Factor**, dan **Lama Penyimpanan** ke kolom **Dependent List**, kemudian pilih **Options**.



7. Centang pilihan **Descriptive** dan **Homogeneity of Variance test**, kemudian klik continue



7. Centang pilihan **Descriptive** dan **Homogeneity of Variance test**, kemudian klik continue.

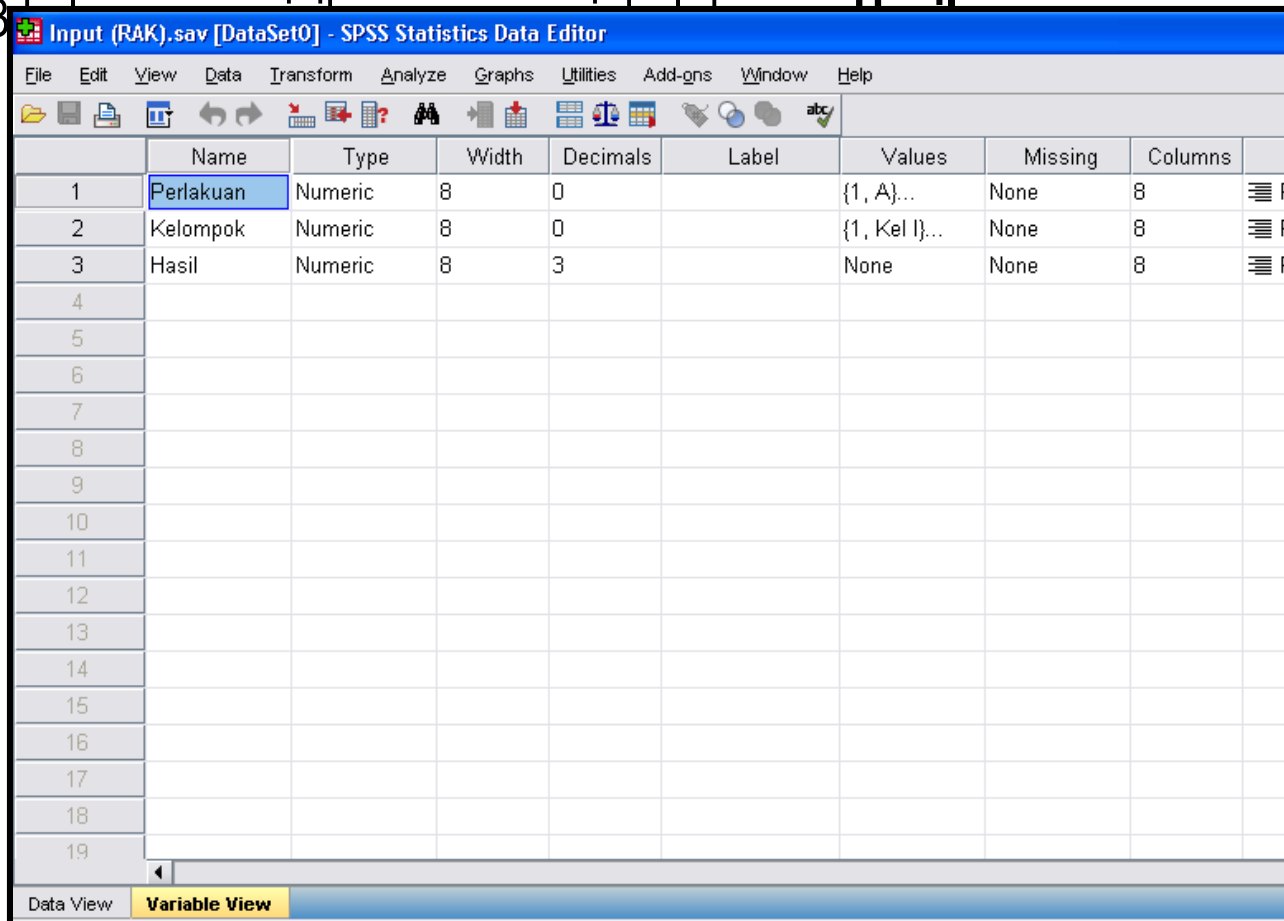


8. Untuk melakukan uji lanjut, maka pilih **Post Hoc**, pindahkan variabel **Lama Penyimpanan** dari kolom **Factors** ke **Post Hoc Tests for**, kemudian centang **Descriptive**, kemudian centang **Post Hoc Tests for**, kemudian klik **Continue**.

2. Rancangan Acak Kelompok (RAK)

Perlakuan	Kelompok		
	I	II	III
	(ton/ha)		
A	0.825	0.750	0.815
B	1.335	1.300	1.355
C	1.357	1.325	1.405
D	1.500	1.555	1.575
E	1.495	1.600	1.625
F	1.650	1.675	1.700
G	1.725	1.690	1.750

1. Buka SPSS, pilih Type in data, klik ok sehingga muncul data editor.
2. Klik Commands window **Variable View** pada bagian bawah, isi name,type, dan decimals.
 - Klik baris 1 kolom Name, isikan nama variabel dengan **Perlakuan**
 - Baris 2 kolom Name, isikan nama variabel dengan **Kelompok**
 - Baris 3 kolom Name, isikan nama variabel dengan **Hasil**



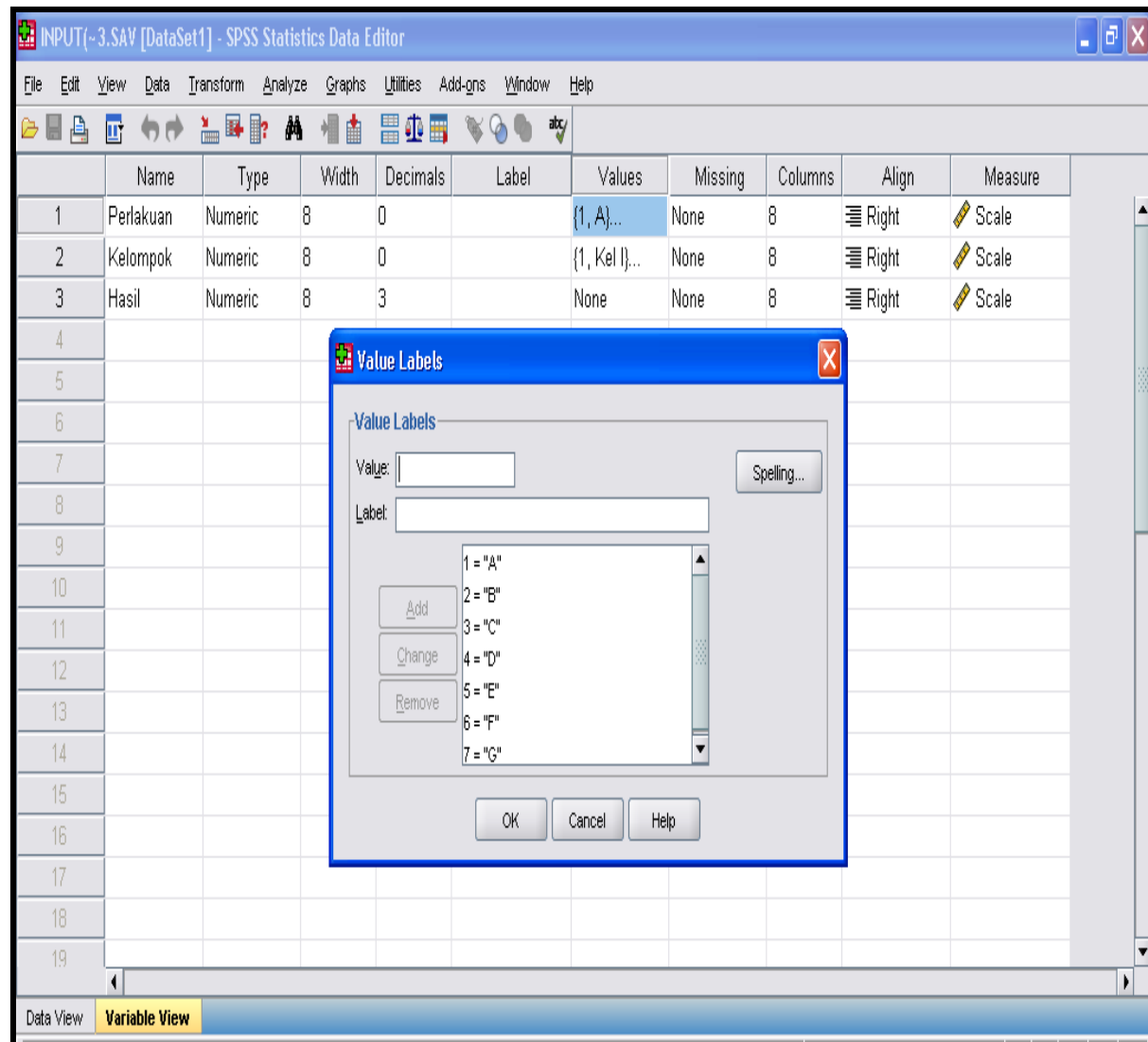
3. Klik Value, pada variabel **Perlakuan**,

isikan :

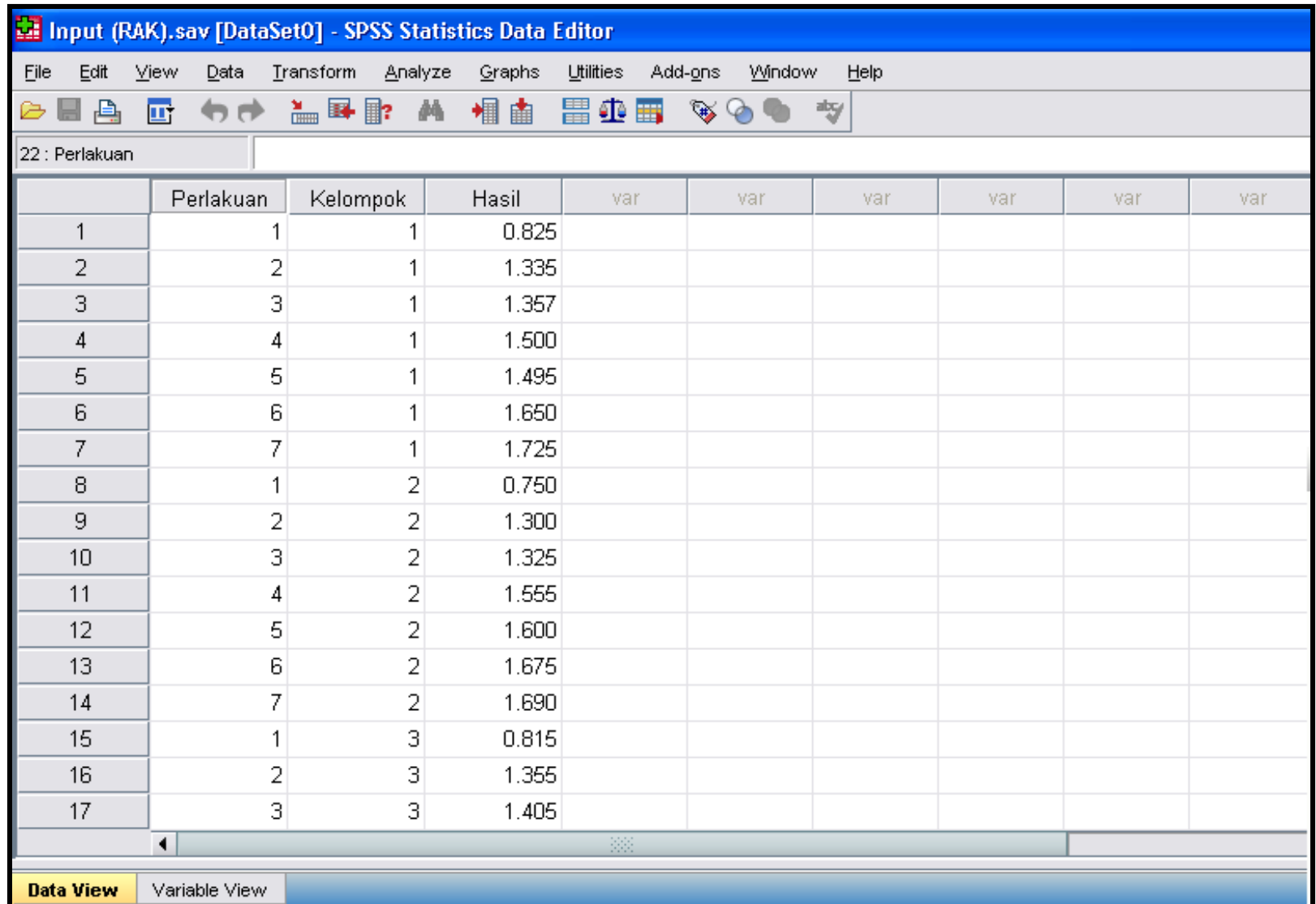
- Value 1, Label A
- Value 2, Label B
- Value 3, Label C
- Value 4, Label D
- Value 5, Label E
- Value 6, Label F
- Value 7, Label G

Klik Value, pada variabel **Kelompok**, isikan

- Value 1, Label Kelompok 1
- Value 2, Label Kelompok 2
- Value 3, Label Kelompok 3



4. Klik Commands window **Data View** pada bagian bawah, masukkan data sesuai dengan nama variable dan jumlahnya. Setelah data selesai dientri, maka lakukan pengolahan.



Input (RAK).sav [DataSet0] - SPSS Statistics Data Editor

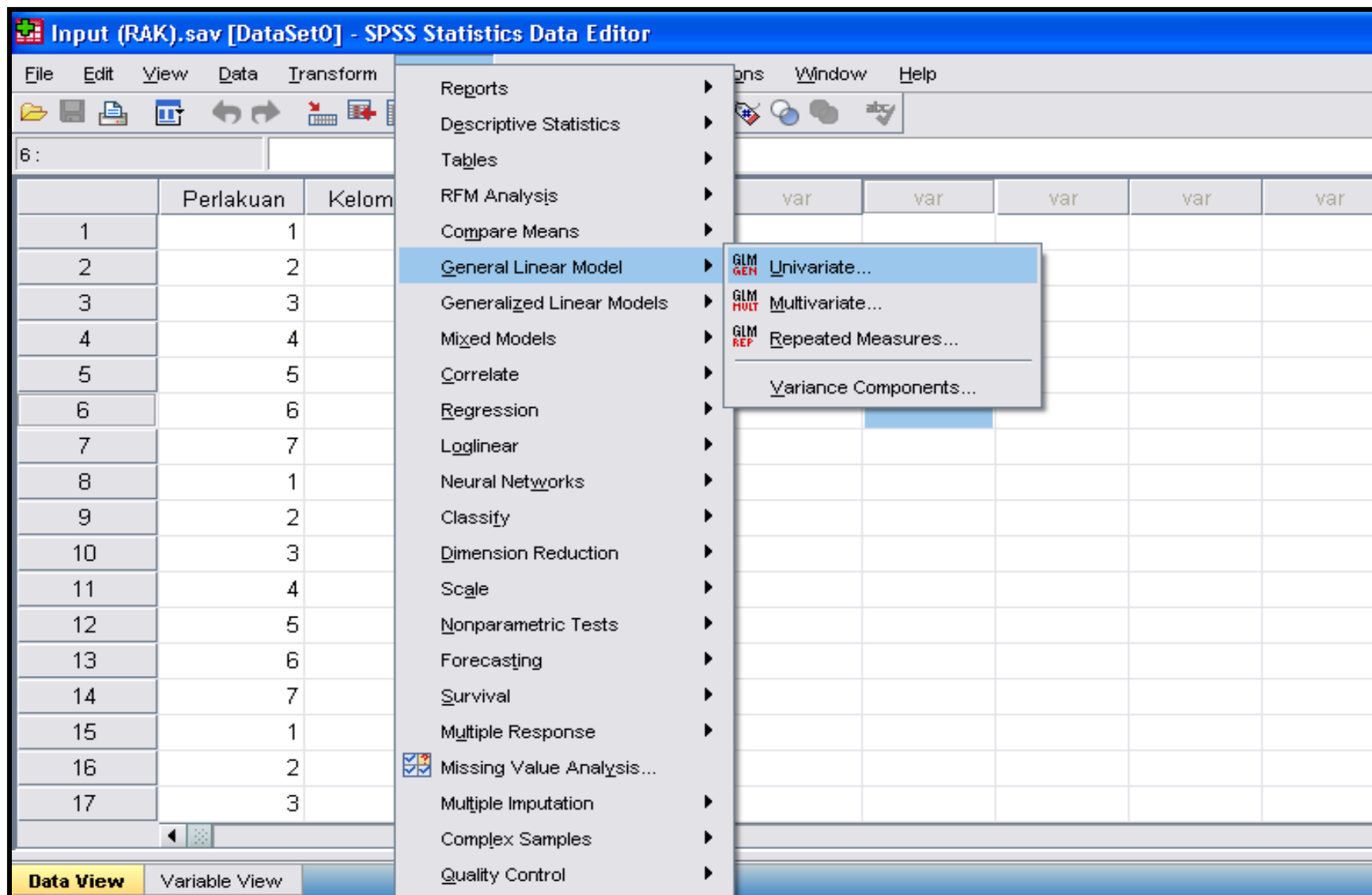
File Edit View Data Transform Analyze Graphs Utilities Add-ons Window Help

22 : Perlakuan

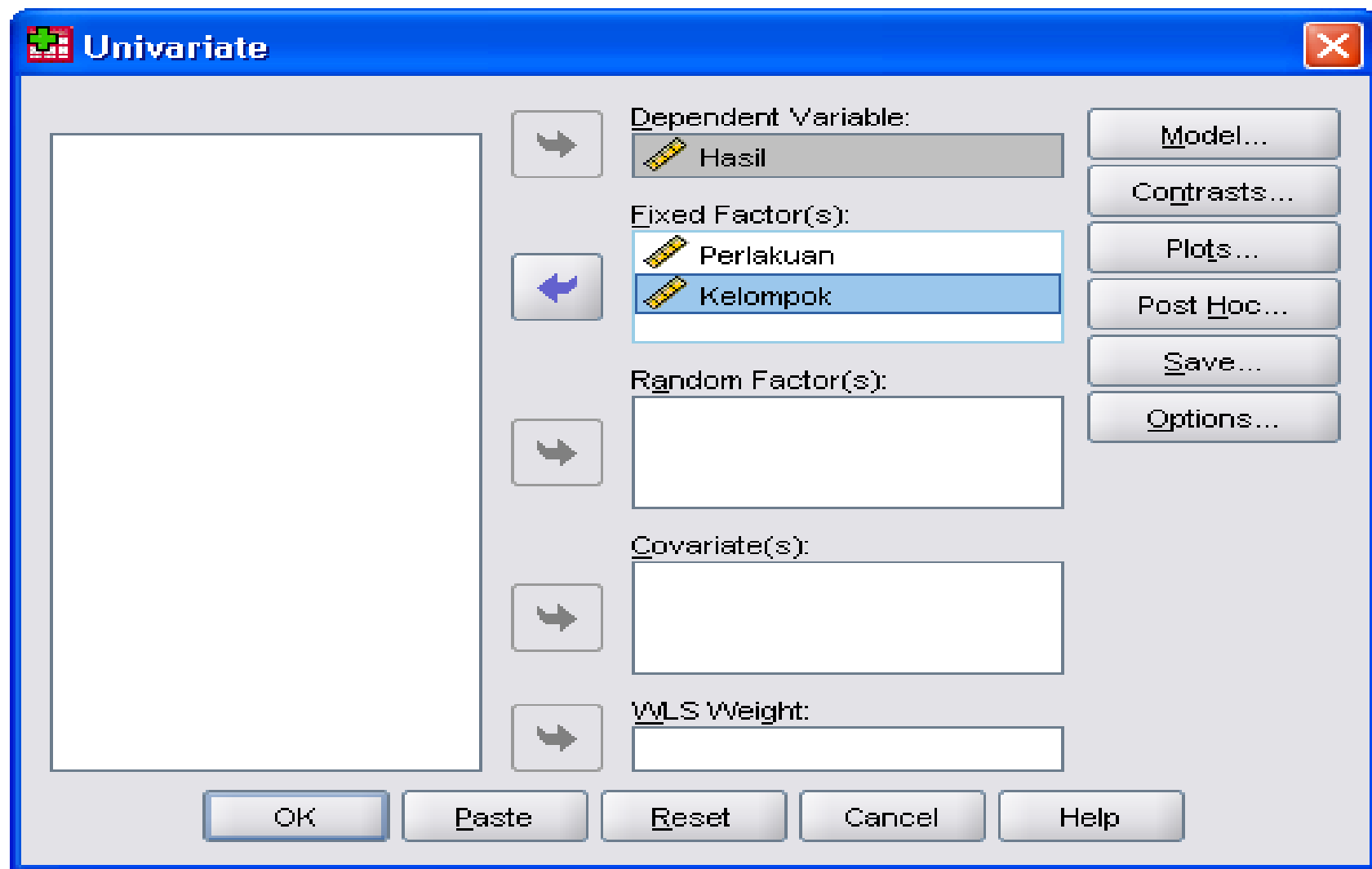
	Perlakuan	Kelompok	Hasil	var	var	var	var	var	var
1	1	1	0.825						
2	2	1	1.335						
3	3	1	1.357						
4	4	1	1.500						
5	5	1	1.495						
6	6	1	1.650						
7	7	1	1.725						
8	1	2	0.750						
9	2	2	1.300						
10	3	2	1.325						
11	4	2	1.555						
12	5	2	1.600						
13	6	2	1.675						
14	7	2	1.690						
15	1	3	0.815						
16	2	3	1.355						
17	3	3	1.405						

Data View Variable View

5. Pilih **Analyze**, ambil **General Linear Model**, klik **Univariate**



6. Klik Variabel **Perlakuan dan Kelompok** kedalam kolom **Fixed Factor**, dan **Hasil** ke kolom **Dependent Variable**, kemudian pilih **Options** untuk melihat deskripsi data, kemudian klik continue



The image shows the 'Univariate' dialog box in SPSS. The 'Dependent Variable' field contains 'Hasil'. The 'Fixed Factor(s)' field contains 'Perlakuan' and 'Kelompok'. The 'Random Factor(s)', 'Covariate(s)', and 'WLS Weight' fields are empty. On the right, there are buttons for 'Model...', 'Contrasts...', 'Plots...', 'Post Hoc...', 'Save...', and 'Options...'. At the bottom, there are buttons for 'OK', 'Paste', 'Reset', 'Cancel', and 'Help'. A large empty box is on the left side of the dialog.

Univariate

Dependent Variable:
Hasil

Fixed Factor(s):
Perlakuan
Kelompok

Random Factor(s):

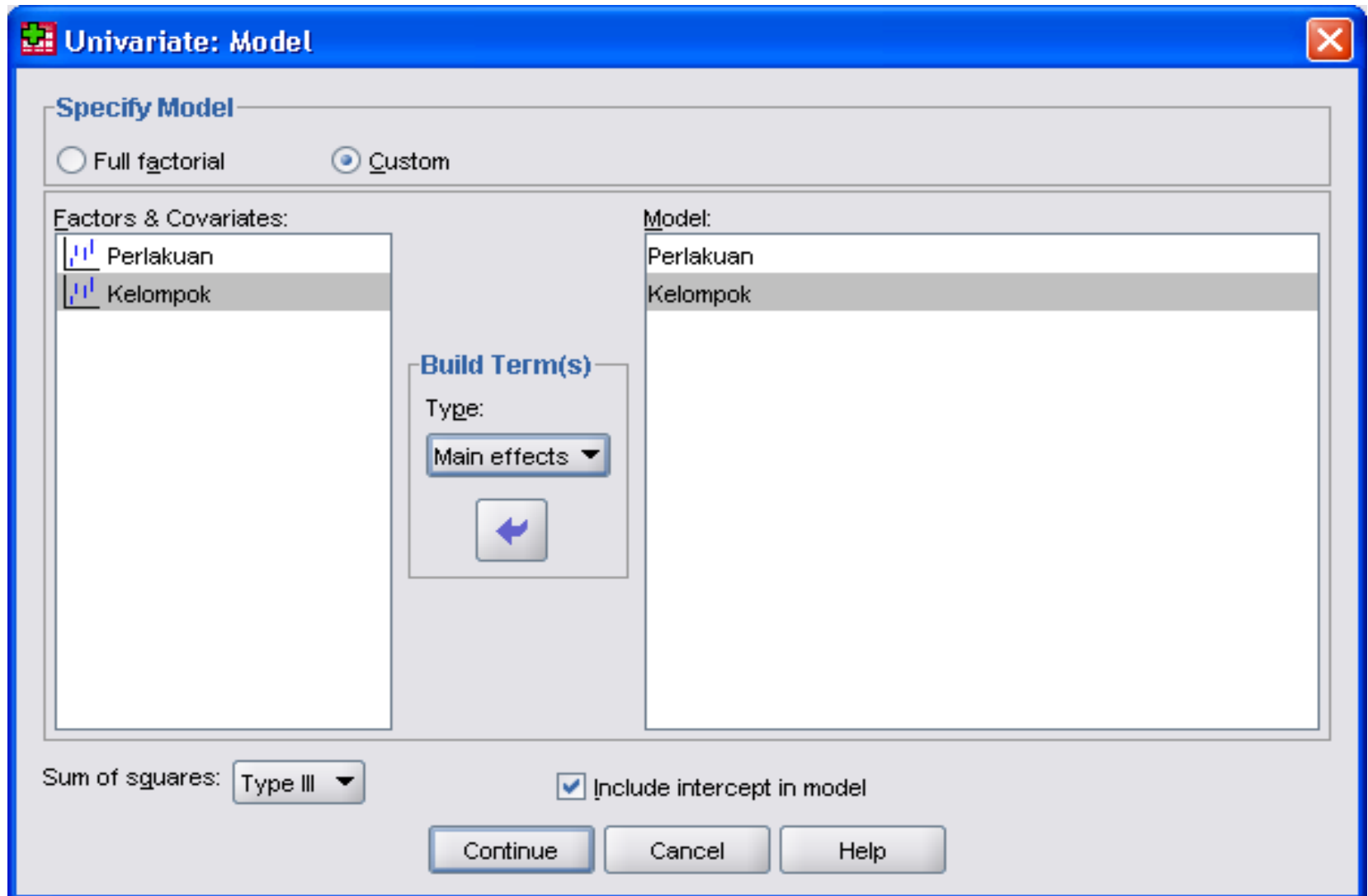
Covariate(s):

WLS Weight:

Model...
Contrasts...
Plots...
Post Hoc...
Save...
Options...

OK Paste Reset Cancel Help

7. Pilih **Model**, klik **Custom**, kemudian pindahkan variabel **perlakuan** dan **kelompok** dari kolom **Factors & Covariates** ke kolom **Model**, dan pilih Type **Main effects**, kemudian klik continue.



The image shows the 'Univariate: Model' dialog box in SPSS. The 'Specify Model' section has the 'Custom' radio button selected. The 'Factors & Covariates' list on the left contains 'Perlakuan' and 'Kelompok'. The 'Model' list on the right also contains 'Perlakuan' and 'Kelompok'. In the 'Build Term(s)' section, the 'Type' dropdown is set to 'Main effects'. At the bottom, 'Sum of squares' is set to 'Type III', and the 'Include intercept in model' checkbox is checked. The 'Continue', 'Cancel', and 'Help' buttons are at the bottom right.

Univariate: Model

Specify Model

☐ Full factorial ☒ Custom

Factors & Covariates:

- Perlakuan
- Kelompok

Model:

- Perlakuan
- Kelompok

Build Term(s)

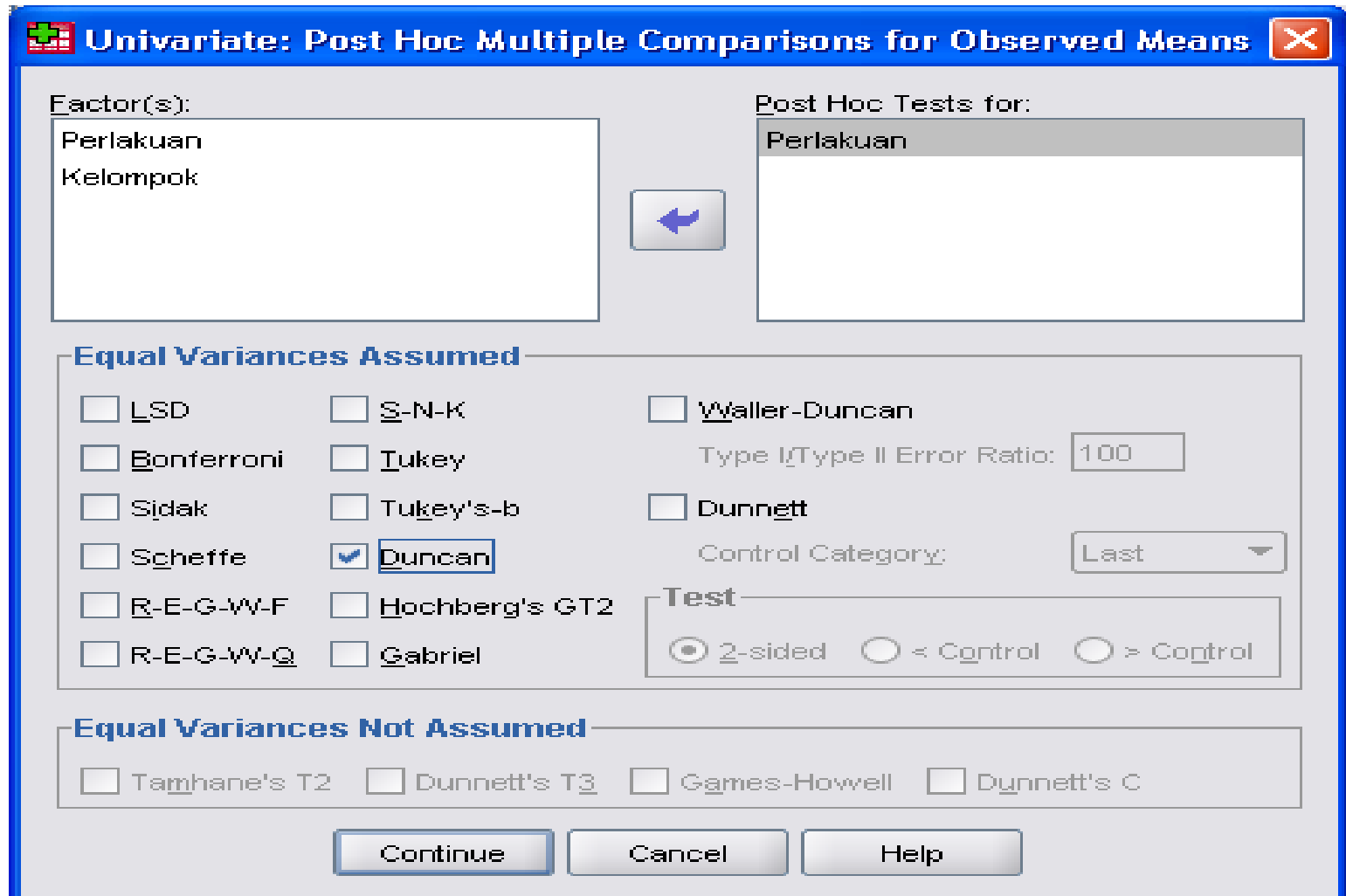
Type: Main effects ▼

Sum of squares: Type III ▼

☒ Include intercept in model

Continue Cancel Help

8. Untuk melakukan uji lanjut, maka pilih **Post Hoc**, pindahkan variabel **Perlakuan** dari kolom **Factors** ke **Post Hoc Tests for**, kemudian centang **Duncan**, kemudian continue, setelah selesai maka klik **Ok**



The image shows the 'Univariate: Post Hoc Multiple Comparisons for Observed Means' dialog box in SPSS. The 'Factor(s):' list contains 'Perlakuan' and 'Kelompok'. The 'Post Hoc Tests for:' list contains 'Perlakuan'. Under 'Equal Variances Assumed', the 'Duncan' checkbox is checked. The 'Type I/Type II Error Ratio' is set to 100. The 'Control Category' is set to 'Last'. Under 'Test', the '2-sided' radio button is selected. Under 'Equal Variances Not Assumed', no checkboxes are selected. The 'Continue', 'Cancel', and 'Help' buttons are at the bottom.

Univariate: Post Hoc Multiple Comparisons for Observed Means

Factor(s):
Perlakuan
Kelompok

Post Hoc Tests for:
Perlakuan

Equal Variances Assumed

☐ LSD ☐ S-N-K ☐ Waller-Duncan
☐ Bonferroni ☐ Tukey Type I/Type II Error Ratio: 100
☐ Sidak ☐ Tukey's-b ☐ Dunnett
☐ Scheffe ☒ **Duncan** Control Category: Last
☐ R-E-G-W-F ☐ Hochberg's GT2
☐ R-E-G-W-Q ☐ Gabriel

Test
☒ 2-sided ☐ < Control ☐ > Control

Equal Variances Not Assumed

☐ Tamhane's T2 ☐ Dunnett's T3 ☐ Games-Howell ☐ Dunnett's C

Continue Cancel Help

Anova Dua Arah

1. RAL Faktorial

Jenis Pupuk	Varietas		
	v1	v2	v3
t1	64	72	74
	66	81	51
	70	64	65
t2	65	57	47
	63	43	58
	58	52	67
t3	59	66	58
	68	71	39
	65	59	42
t4	58	57	53
	41	61	59
	46	53	38

1. Buka SPSS, pilih Type in data, klik ok sehingga muncul data editor.
2. Klik Commands window **Variable View** pada bagian bawah, isi name,type, dan decimals.

- Klik baris 1 kolom Name, isikan nama variabel dengan **Jenis Pupuk**
- Baris 2 kolom Name, isikan nama variabel dengan **Varietas**
- Baris 3 kolom name, isikan nama variabel dengan **Hasil**

3. Klik Value, pada variabel **Jenis Pupuk**, isikan :

- Value 1, Label T1
- Value 2, Label T2
- Value 3, Label T3
- Value 4, Label T4

Klik Value, pada variabel **Varietas**, isikan :

- Value 1, Label V1
- Value 2, Label V2
- Value 3, Label V3

SPSS Statistics Data Editor window titled "Untitled1 [DataSet0]". The interface shows the menu bar (File, Edit, View, Data, Transform, Analyze, Graphs, Utilities, Add-ons, Window, Help) and the toolbar. The main data grid is in Variable View, showing two variables: "Jenis_Pupuk" and "Varietas", both Numeric, with Width 8 and Decimals 0. The "Values" column shows labels {1, T1}... and {1, V1}... respectively. The "Measure" column shows Scale for both.

A "Value Labels" dialog box is open, allowing the user to define value labels for a variable. The dialog includes fields for "Value:" and "Label:", a list of defined labels, and buttons for "Add", "Change", "Remove", "Spelling...", "OK", "Cancel", and "Help".

Value Labels

Value:

Label:

Spelling...

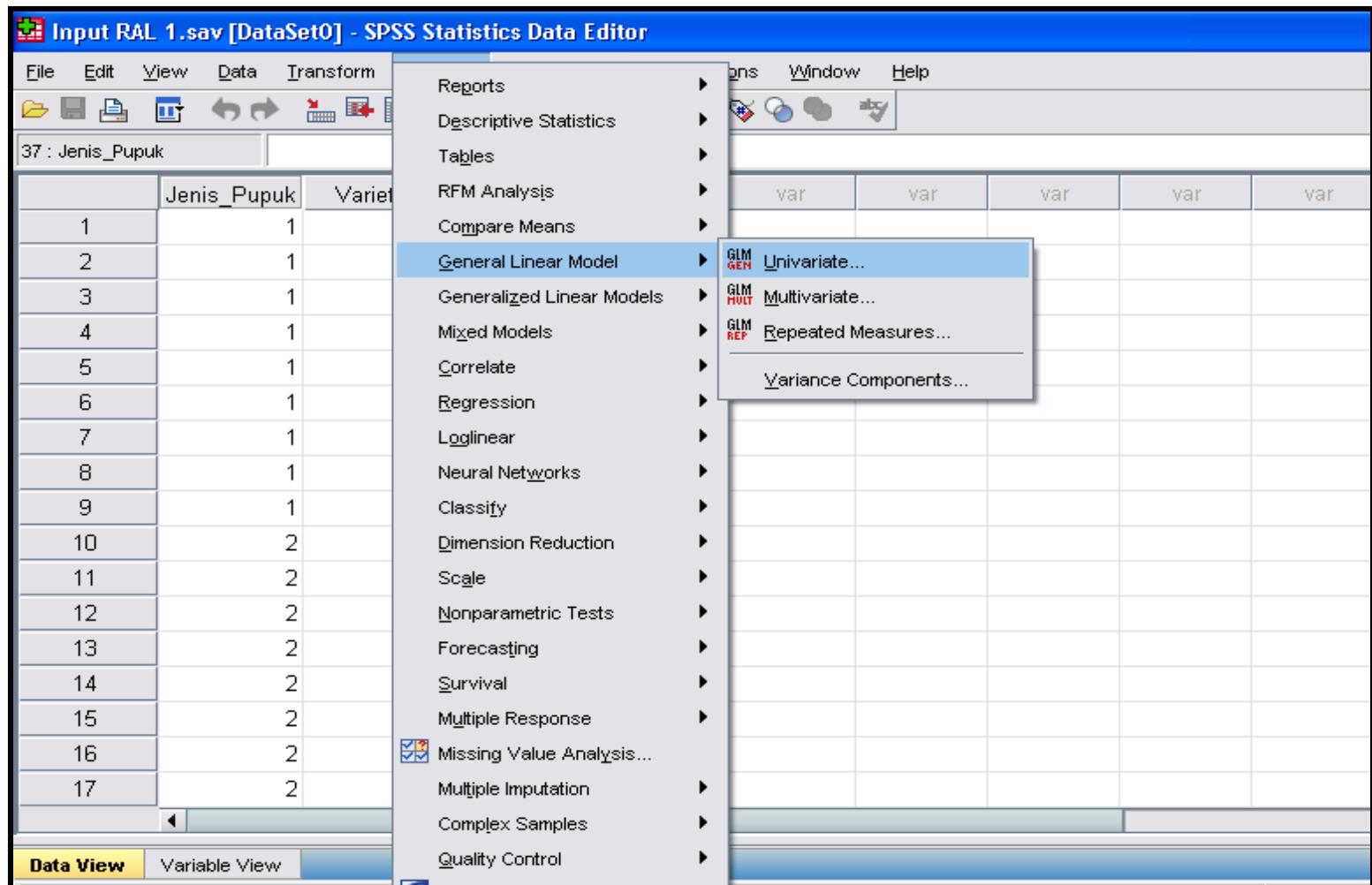
1 = "T1"
2 = "T2"
3 = "T3"
4 = "T4"

Add Change Remove

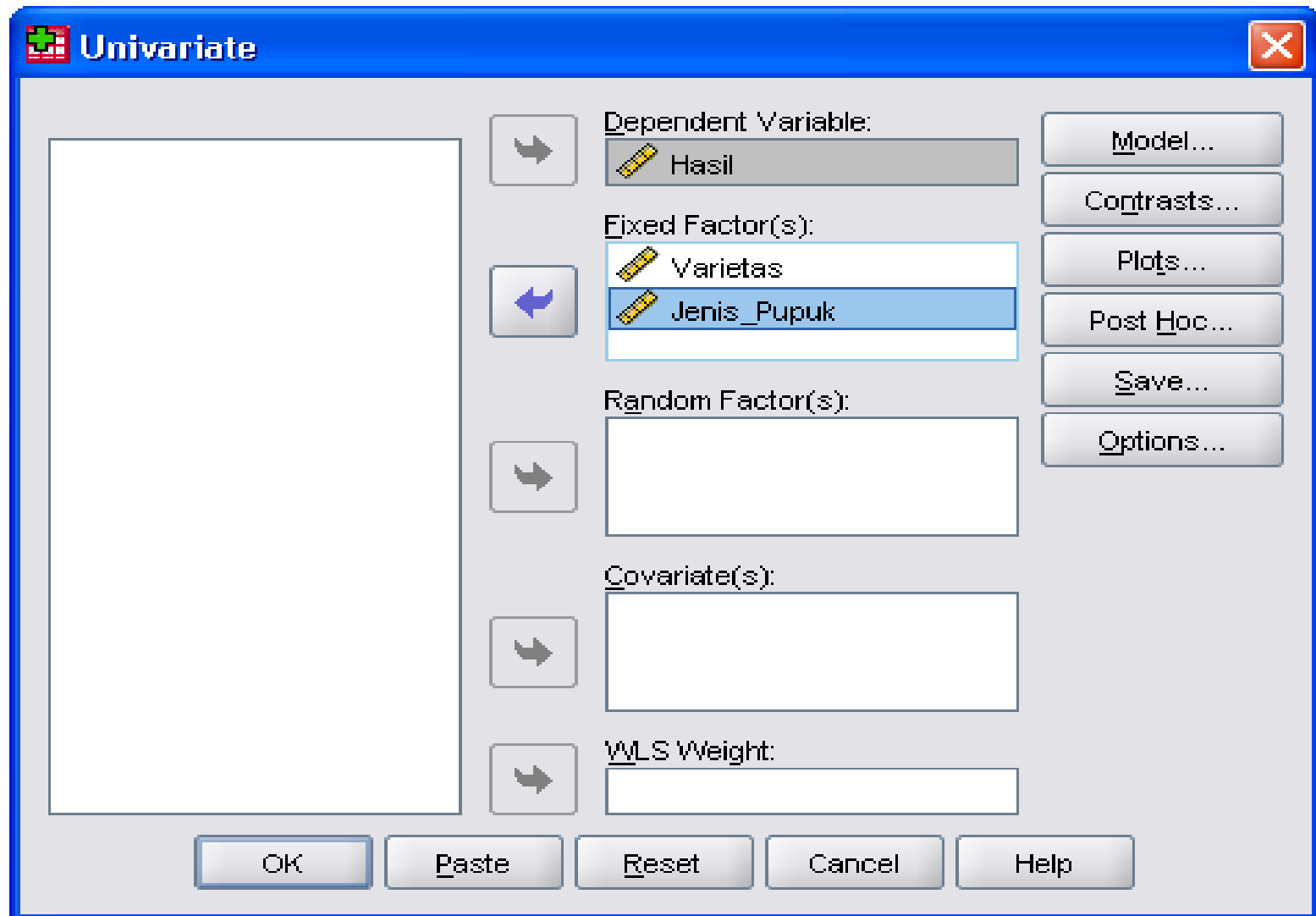
OK Cancel Help

Data View **Variable View**

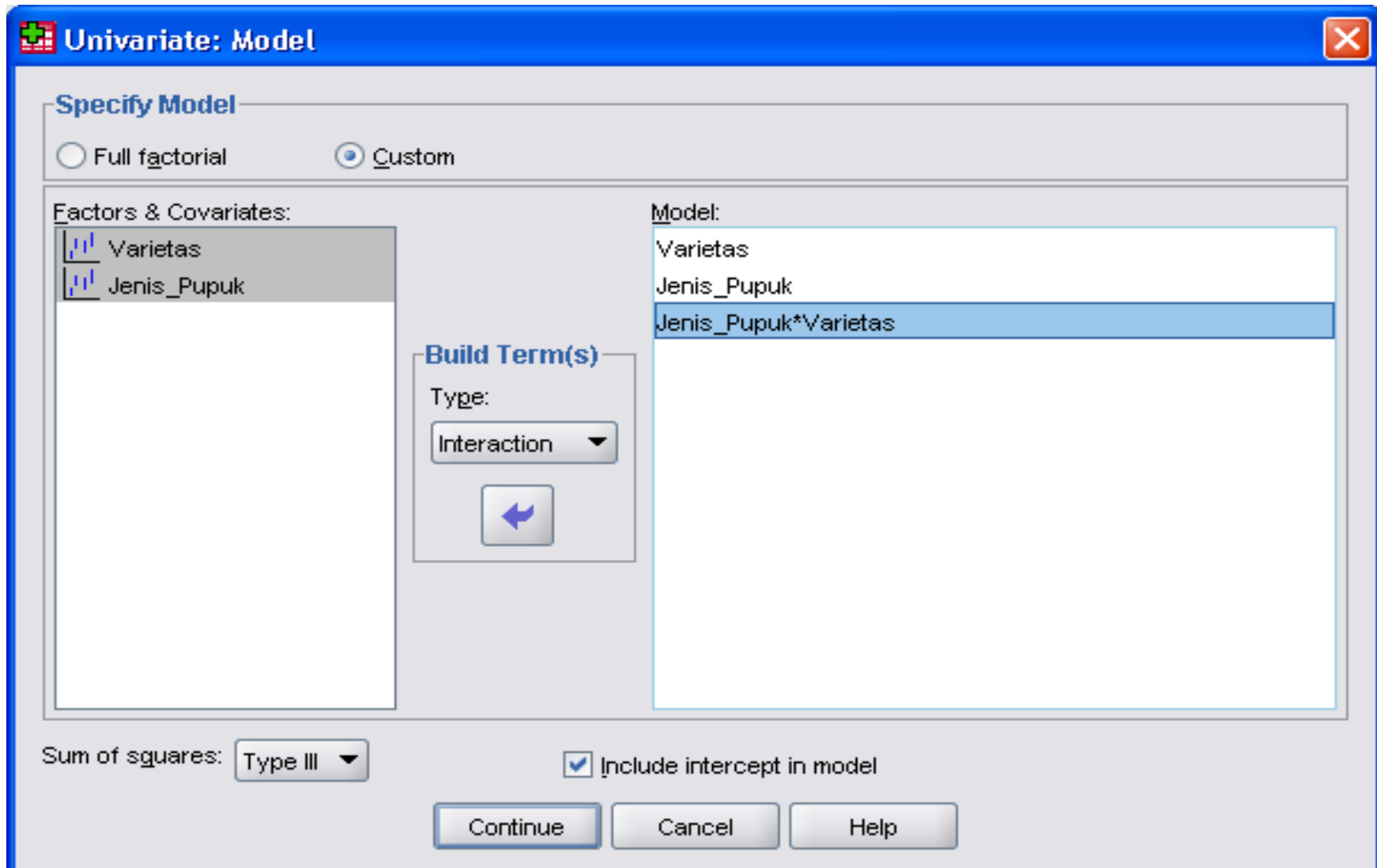
4. Klik Commands window **Data View** pada bagian bawah, masukkan data sesuai dengan nama variable dan jumlahnya. Setelah data selesai dientri, maka lakukan pengolahan.
5. Pilih **Analyze**, ambil **General Linear Model**, klik **Univariate**



6. Klik Variabel **Varietas** dan **Jenis Pupuk** kedalam kolom **Fixed Factor**, dan **Hasil** ke kolom **Dependent Variable**, kemudian pilih **Options** untuk melihat deskripsi data, kemudian klik continue



7. Pilih **Model**, klik **Custom**, kemudian pindahkan variabel **Varietas**, **Jenis Pupuk** dan **Varietas*Jenis Pupuk** dari kolom **Factors & Convariates** ke kolom **Model**, dan pilih Type **Interaction**, kemudian klik continue.



The image shows the 'Univariate: Model' dialog box in SPSS. The 'Specify Model' section has the 'Custom' radio button selected. In the 'Factors & Covariates' list on the left, 'Varietas' and 'Jenis_Pupuk' are listed. The 'Build Term(s)' section shows 'Type' set to 'Interaction' with a left-pointing arrow button. The 'Model' list on the right contains 'Varietas', 'Jenis_Pupuk', and 'Jenis_Pupuk*Varietas', with the interaction term selected. At the bottom, 'Sum of squares' is set to 'Type III' and 'Include intercept in model' is checked. 'Continue', 'Cancel', and 'Help' buttons are at the bottom right.

Univariate: Model

Specify Model

☐ Full factorial ☒ Custom

Factors & Covariates:

- Varietas
- Jenis_Pupuk

Build Term(s)

Type: Interaction

Model:

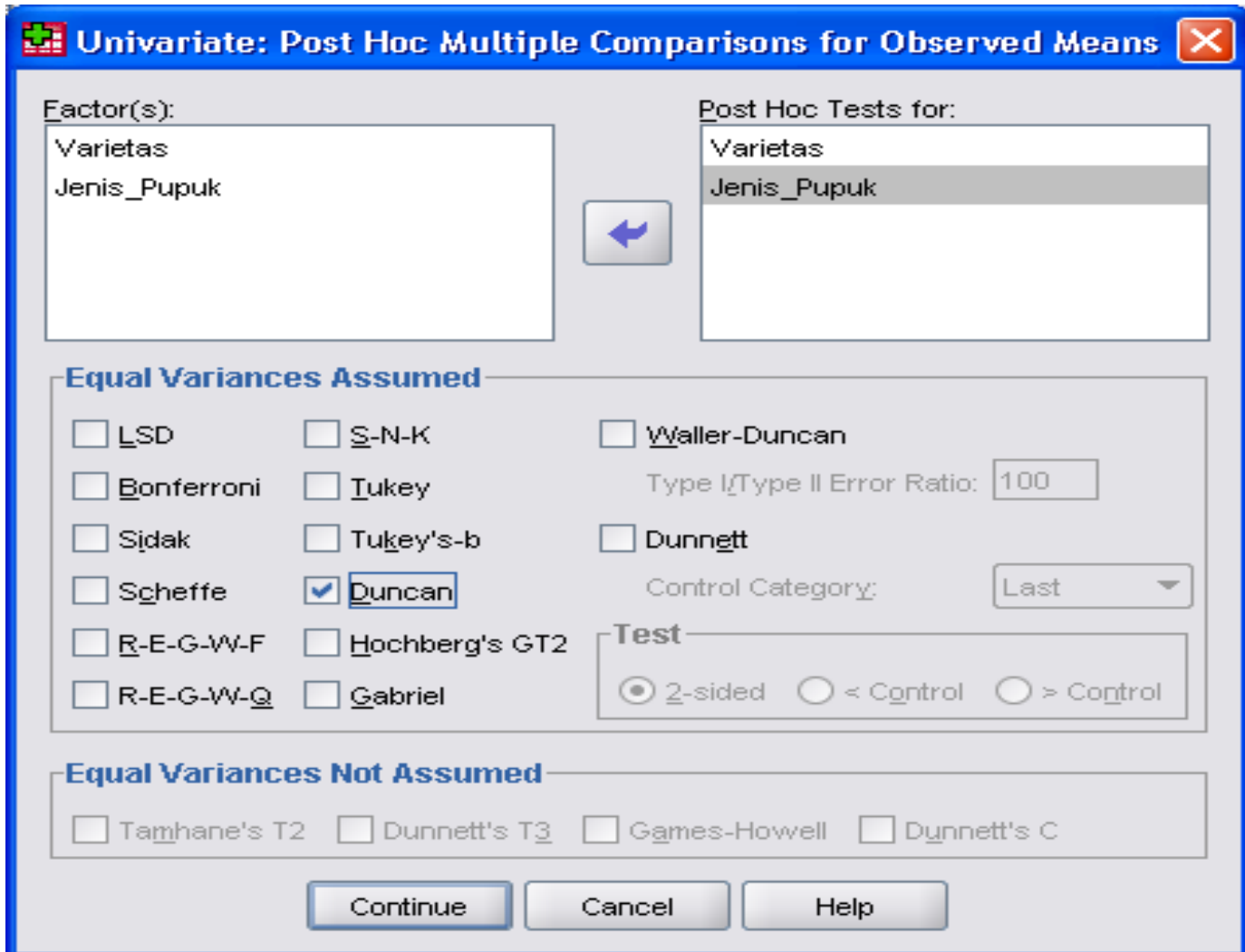
- Varietas
- Jenis_Pupuk
- Jenis_Pupuk*Varietas

Sum of squares: Type III

☒ Include intercept in model

Continue Cancel Help

8. Untuk melakukan uji lanjut, maka pilih **Post Hoc**, pindahkan variabel **Varietas** dan **Jenis Pupuk** dari kolom **Factor (s)** ke **Post Hoc Tests for**, kemudian centang **Duncan**, kemudian continue, setelah selesai maka klik **Ok**



The image shows the 'Univariate: Post Hoc Multiple Comparisons for Observed Means' dialog box in SPSS. The 'Factor(s):' list on the left contains 'Varietas' and 'Jenis_Pupuk'. The 'Post Hoc Tests for:' list on the right also contains 'Varietas' and 'Jenis_Pupuk'. Under the 'Equal Variances Assumed' section, the 'Duncan' checkbox is selected. The 'Type I/Type II Error Ratio' is set to 100, and the 'Control Category' is set to 'Last'. Under the 'Equal Variances Not Assumed' section, no tests are selected. At the bottom, there are 'Continue', 'Cancel', and 'Help' buttons.

Univariate: Post Hoc Multiple Comparisons for Observed Means

Factor(s):
Varietas
Jenis_Pupuk

Post Hoc Tests for:
Varietas
Jenis_Pupuk

Equal Variances Assumed

☐ LSD ☐ S-N-K ☐ Waller-Duncan
☐ Bonferroni ☐ Tukey Type I/Type II Error Ratio: 100
☐ Sidak ☐ Tukey's-b ☐ Dunnett
☐ Scheffe ☒ **Duncan** Control Category: Last
☐ R-E-G-W-F ☐ Hochberg's GT2
☐ R-E-G-W-Q ☐ Gabriel

Test
☒ 2-sided ☐ < Control ☐ > Control

Equal Variances Not Assumed

☐ Tamhane's T2 ☐ Dunnett's T3 ☐ Games-Howell ☐ Dunnett's C

Continue Cancel Help

2. RAK Faktorial

Pupuk N	Varietas	Kelompok			
(kg/ha)		1	2	3	4
0	1	3.582	2.606	3.144	2.894
	2	2.864	3.794	4.108	3.444
	3	4.192	3.754	3.738	3.428
1	1	4.788	4.936	4.562	4.608
	2	4.956	5.128	4.150	4.990
	3	5.250	4.582	4.896	4.286
2	1	4.576	4.454	4.884	3.924
	2	5.928	5.698	5.810	4.308
	3	5.522	4.848	5.678	4.932
3	1	6.034	5.276	5.906	5.652
	2	5.664	5.362	6.458	5.474
	3	5.888	5.524	6.042	4.756
4	1	5.874	5.916	5.984	5.518
	2	5.458	5.546	5.786	5.932
	3	5.864	6.264	6.056	5.362

1. Buka SPSS, pilih Type in data, klik ok sehingga muncul data editor.
2. Klik Commands window **Variable View** pada bagian bawah, isi name, type, dan decimals.
 - Klik baris 1 kolom Name, isikan nama variabel dengan **Pupuk**
 - Baris 2 kolom Name, isikan nama variabel dengan **Varietas**
 - Baris 3 kolom name, isikan nama variabel dengan **Kelompok**
 - Baris 3 kolom name, isikan nama variabel dengan **Hasil**
3. Klik Value, pada variabel **Pupuk, Varietas, Kelompok**, isikan :

Variabel Pupuk	Variabel Varietas	Variabel Kelompok
a. Value 0, Label T0	a. Value 1, Label V1	a. Value 1, Label 1
b. Value 1, Label T1	b. Value 2, Label V2	b. Value 2, Label 2
c. Value 2, Label T2	c. Value 3, Label V3	c. Value 3, Label 3
d. Value 3, Label T3		
e. Value 4, Label T4		

INPUTR~ 3.SAV [DataSet1] - SPSS Statistics Data Editor

File Edit View Data Transform Analyze Graphs Utilities Add-ons Window Help

Value Labels

	Name	Type	Width	Decimals	Label	Values	Missing	Columns	Align	Measure
1	Pupuk	Numeric	8	0		{0, T1}...	None	8	Right	Scale
2	Varietas	Numeric	8	0		{1, V1}...	None	8	Right	Scale
3	Kelompok	Numeric	8	0		{1, 1}...	None	8	Right	Scale
4	Hasil	Numeric	8	3		None	None	8	Right	Scale
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										

Value Labels

Value:

Label:

Spelling...

0 = "T1"
1 = "T2"
3 = "T3"
4 = "T4"

Add
Change
Remove

OK Cancel Help

Data View Variable View

4. Klik Commands window **Data View** pada bagian bawah, masukkan data sesuai dengan nama variable dan jumlahnya. Setelah data selesai dientri, maka lakukan pengolahan.

INPUTR~3.SAV [DataSet1] - SPSS Statistics Data Editor

File Edit View Data Transform Analyze Graphs Utilities Add-ons Window Help

1 : Pupuk 0.0 Visible: 4 of 4 Variables

	Pupuk	Varietas	Kelompok	Hasil	var	var	var	var	var	var	var	var
7	0	2	3	4.108								
8	0	2	4	3.444								
9	0	3	1	4.192								
10	0	3	2	3.754								
11	0	3	2	3.738								
12	0	3	4	3.428								
13	1	1	1	4.788								
14	1	1	2	4.936								
15	1	1	3	4.562								
16	1	1	4	4.608								
17	1	2	1	4.956								
18	1	2	2	5.128								
19	1	2	3	4.150								
20	1	2	4	4.990								
21	1	3	1	5.250								
22	1	3	2	4.582								
23	1	3	3	4.896								

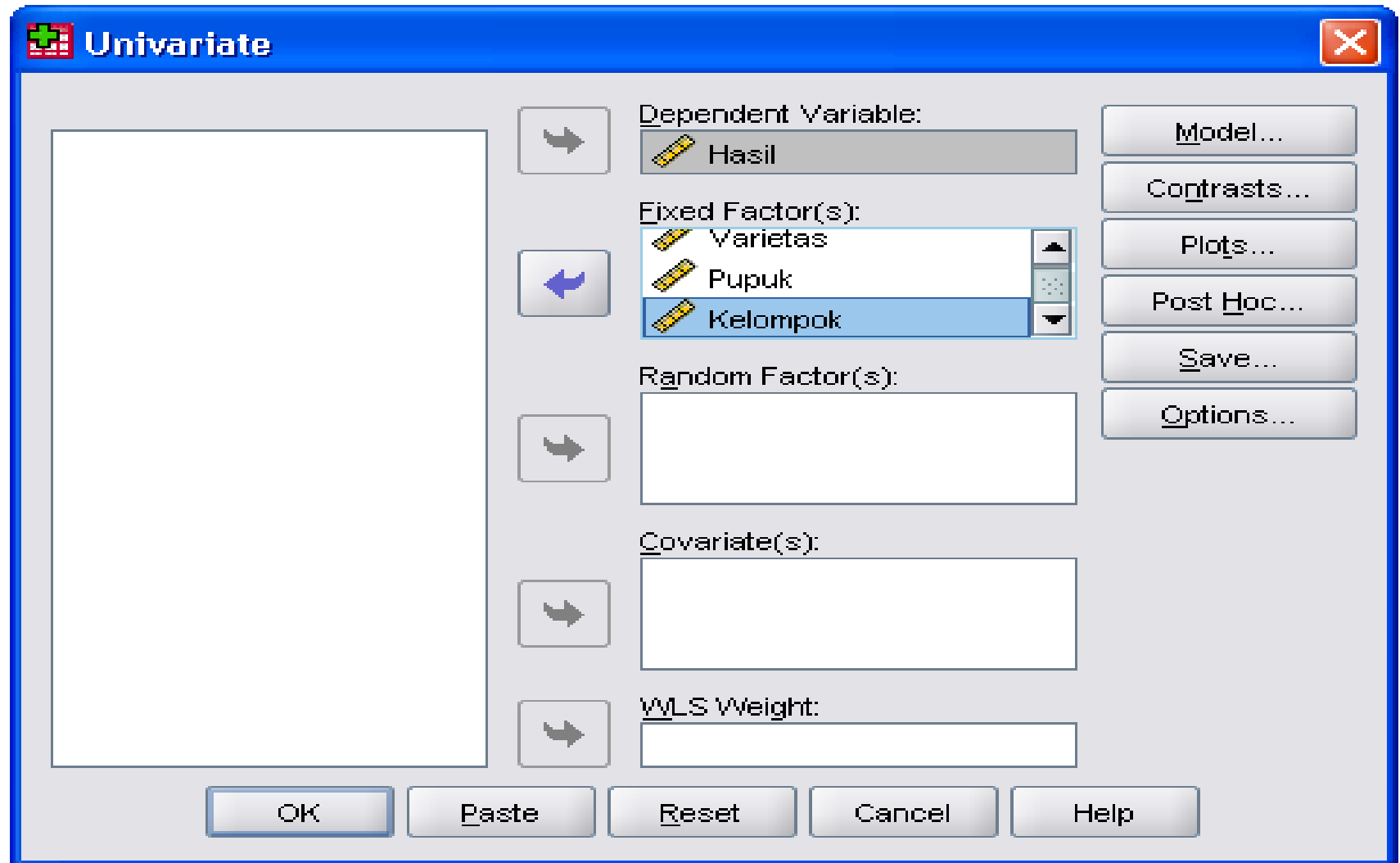
Data View Variable View

5. Pilih **Analyze**, ambil **General Linear Model**, klik Univariate

The screenshot shows the SPSS Statistics Data Editor window titled "INPUTR~3.SAV [DataSet1] - SPSS Statistics Data Editor". The "Data View" tab is active, displaying a dataset with 17 rows and 2 columns: "Pupuk" and "Variet". The "Pupuk" column has values 0 for rows 1-12 and 1 for rows 13-17. The "Variet" column is currently empty. The "Analyze" menu is open, and the path "General Linear Model" > "Univariate..." is selected. The "Univariate..." option is highlighted in blue. The "GLM GEN" icon is visible next to the "Univariate..." option. The "GLM MULT" icon is visible next to the "Multivariate..." option. The "GLM REP" icon is visible next to the "Repeated Measures..." option. The "Variance Components..." option is also visible. The "Data View" tab is selected at the bottom of the window.

	Pupuk	Variet
1	0	
2	0	
3	0	
4	0	
5	0	
6	0	
7	0	
8	0	
9	0	
10	0	
11	0	
12	0	
13	1	
14	1	
15	1	
16	1	
17	1	

6. Klik Variabel **Varietas**, **Pupuk**, dan **Kelompok** kedalam kolom **Fixed Factor**, dan **Hasil** ke kolom **Dependent Variable**, kemudian pilih **Options** untuk melihat deskripsi data, kemudian klik continue



The image shows the SPSS Univariate dialog box. On the left is a large empty list box. To its right are four arrow buttons: a right-pointing arrow, a left-pointing arrow, a right-pointing arrow, and a right-pointing arrow. The main area contains several labeled fields: 'Dependent Variable:' with 'Hasil' in a list box; 'Fixed Factor(s):' with 'Varietas', 'Pupuk', and 'Kelompok' in a list box; 'Random Factor(s):' with an empty list box; 'Covariate(s):' with an empty list box; and 'WLS Weight:' with an empty text box. On the right side of the dialog are five buttons: 'Model...', 'Contrasts...', 'Plots...', 'Post Hoc...', and 'Save...'. At the bottom are five buttons: 'OK', 'Paste', 'Reset', 'Cancel', and 'Help'. The 'Options...' button is also visible on the right side, below 'Save...'.

Univariate

Dependent Variable:
Hasil

Fixed Factor(s):
Varietas
Pupuk
Kelompok

Random Factor(s):

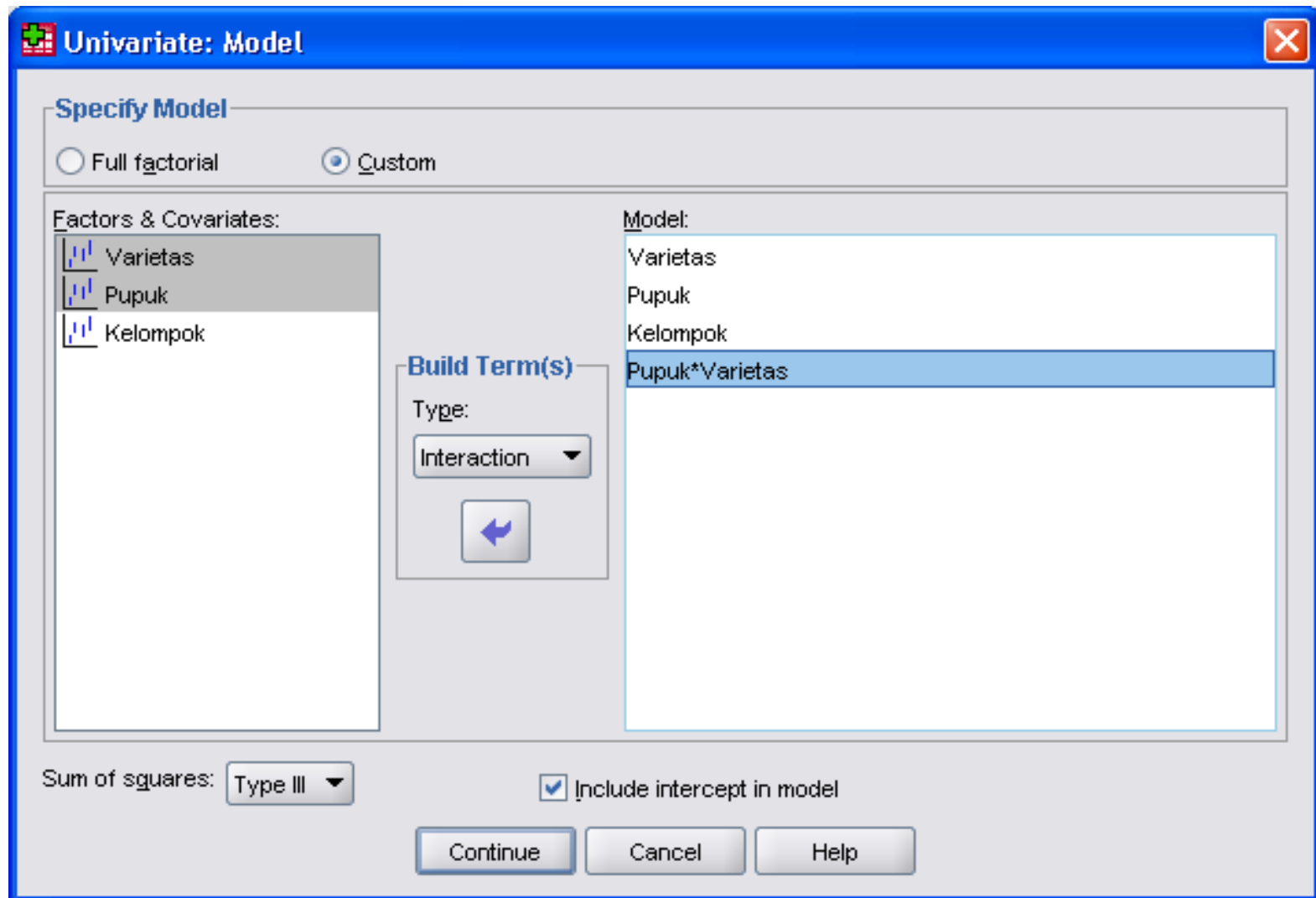
Covariate(s):

WLS Weight:

Model...
Contrasts...
Plots...
Post Hoc...
Save...
Options...

OK Paste Reset Cancel Help

7. Pilih **Model**, klik **Custom**, kemudian pindahkan variabel **Varietas**, **Pupuk**, **Kelompok** dan **Varietas*Pupuk** dari kolom **Factors & Convariates** ke kolom **Model**, dan pilih Type **Interaction**, kemudian klik continue.



The image shows the 'Univariate: Model' dialog box in SPSS. The 'Specify Model' section has the 'Custom' radio button selected. The 'Factors & Covariates' list on the left contains 'Varietas', 'Pupuk', and 'Kelompok'. The 'Build Term(s)' section has 'Type' set to 'Interaction' and a button with a left-pointing arrow. The 'Model' list on the right contains 'Varietas', 'Pupuk', 'Kelompok', and 'Pupuk*Varietas', with the last term selected. At the bottom, 'Sum of squares' is set to 'Type III' and 'Include intercept in model' is checked. The 'Continue', 'Cancel', and 'Help' buttons are at the bottom right.

Univariate: Model

Specify Model

☐ Full factorial ☒ Custom

Factors & Covariates:

- Varietas
- Pupuk
- Kelompok

Build Term(s)

Type: Interaction

Model:

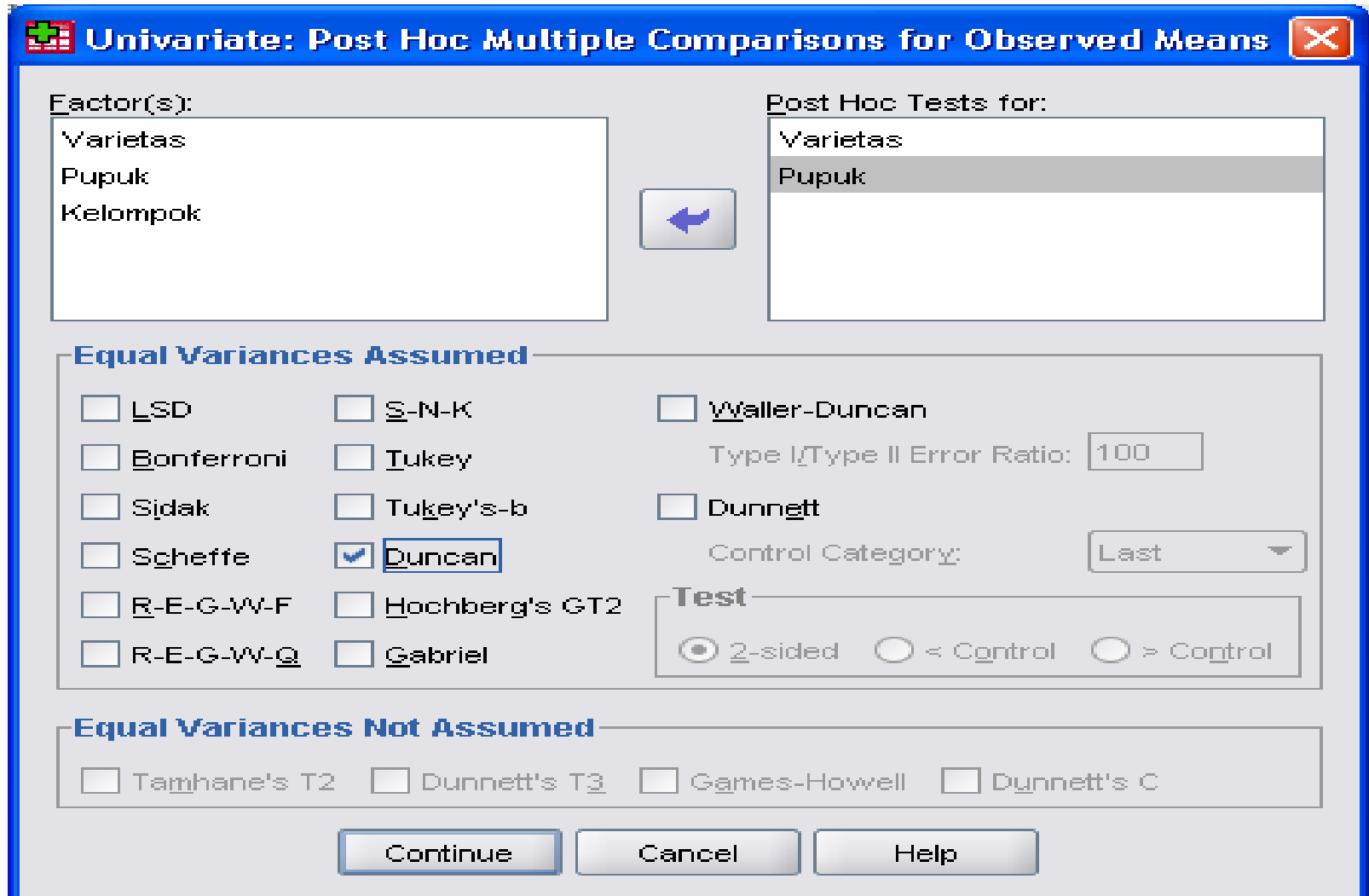
- Varietas
- Pupuk
- Kelompok
- Pupuk*Varietas

Sum of squares: Type III

☒ Include intercept in model

Continue Cancel Help

8. Untuk melakukan uji lanjut, maka pilih **Post Hoc**, pindahkan variabel **Varietas** dan **Pupuk** dari kolom **Factor (s)** ke **Post Hoc Tests for**, kemudian centang **Duncan**, kemudian continue, setelah selesai maka klik **Ok**



The image shows the 'Univariate: Post Hoc Multiple Comparisons for Observed Means' dialog box in SPSS. The 'Factor(s):' list on the left contains 'Varietas', 'Pupuk', and 'Kelompok'. The 'Post Hoc Tests for:' list on the right contains 'Varietas' and 'Pupuk'. Under the 'Equal Variances Assumed' section, the 'Duncan' checkbox is selected. Other options like LSD, Bonferroni, Sidak, Scheffe, R-E-G-W-F, R-E-G-W-Q, S-N-K, Tukey, Tukey's-b, Hochberg's GT2, Gabriel, Waller-Duncan, and Dunnett are unselected. The 'Type I/Type II Error Ratio' is set to 100, and the 'Control Category' is set to 'Last'. Under the 'Equal Variances Not Assumed' section, all options (Tamhane's T2, Dunnett's T3, Games-Howell, Dunnett's C) are unselected. The 'Test' section shows '2-sided' selected. At the bottom are 'Continue', 'Cancel', and 'Help' buttons.

Univariate: Post Hoc Multiple Comparisons for Observed Means

Factor(s):

- Varietas
- Pupuk
- Kelompok

Post Hoc Tests for:

- Varietas
- Pupuk

Equal Variances Assumed

- ☐ LSD
- ☐ Bonferroni
- ☐ Sidak
- ☐ Scheffe
- ☐ R-E-G-W-F
- ☐ R-E-G-W-Q
- ☐ S-N-K
- ☐ Tukey
- ☐ Tukey's-b
- ☒ **Duncan**
- ☐ Hochberg's GT2
- ☐ Gabriel
- ☐ Waller-Duncan
- Type I/Type II Error Ratio: 100
- ☐ Dunnett
- Control Category: Last

Test

- ☒ 2-sided
- ☐ < Control
- ☐ > Control

Equal Variances Not Assumed

- ☐ Tamhane's T2
- ☐ Dunnett's T3
- ☐ Games-Howell
- ☐ Dunnett's C

Continue Cancel Help

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TERIMA KASIH