UNIVERSITI SAINS MALAYSIA

Peperiksaan Semester Kedua

Sidang 1991/92

Mac/April 1992

MKT261 - Kaedah Statistik Gunaan

Masa: [3 jam]

Jawab **SEMUA** soalan. Semua soalan mesti dijawab dalam Bahasa Malaysia. Satu set lampiran dikepilkan.

1. (a) Hard disk daripada dua pengeluar yang diakui mempunyai laju membaca data yang sama sedang diuji oleh seorang penyelidik. Dua-puluh dua hard disk daripada pengeluar, Seagate and 25 daripada pengeluar, Conners Peripherals dipilih secara rawak dan diuji pada suhu yang sama. Data diperolehi (dalam milisaat) dianalisiskan melalui prosedur SPSS, T-TEST.

Output daripada SPSS ditunjukkan di bawah.

Independent samples of MFG pengeluar hard disk

Group 1: MFG EQ 1.00 Group 2: MFG EQ 2.00

t-test for: SPEED laju data dibaca

	Number of Cases	Mean	Standard Deviation	Standard Error
Group 1	22	13.3136	1.884	.402
Group 2	25	14.5280	2.155	.431

		Pooled Variance Estimate			Separate Variance Estimate		
F Value	2-Tail Prob.	t Value	Degrees of Freedom	2-Tail Prob.	t Value	Degrees of Freedom	2-Tail Prob.
1.31	.537	-2.04	45	.047	-2.06	45.00	.045

.../2

Huraikan kesimpulan anda. Gunakan α = .05. Berikan anggapan-anggapan yang diperlu bagi prosedur yang digunakan.

(b) Di dalam pengeluaran kad litaran tercetak, pengurus pengeluaran baru-baru ini membeli dua buah mesin penguji, A dan B untuk ujian kad litaran tercetak. Mesin-mesin tersebut digunakan untuk mengukurkan prestasi kad-kad ini. Pengurus tersebut ingin menentukan sama ada terdapat perbezaan di antara dua mesin penguji itu. Untuk tujuan ini, beliau pun telah memutuskan untuk menjalankan suatu eksperimen terpasang dengan menjalankan sampel-sampel kad melalui kedua-dua mesin dan menilaikan hasil-hasil diperolehi.

Output daripada prosedur T-TEST ditunjukkan di bawah:

Paired samples t-test: TESTER1 prestasi daripada Tester 1
TESTER2 prestasi daripada Tester 2

Variable	Number of Cases	Mean	Standard Deviation	Standard Error
TESTER1	12	5.7583	.287	.083
TESTER2	12	5.3833	.532	.154

(Difference) Mean	Standard Deviation	Standard Error	2-Tail Corr.	2-Tail Prob.	t Value	Deg. of Freedom	2-Tail Prob.
.3750	.447	.12	.542	.069	2.90	11	.014

Huraikan kesimpulan-kesimpulan yang boleh diperolehi daripada kajian ini. Gunakan α = .05.
Nyatakan anggapan-anggapan yang telah anda gunakan.

(c) Masahayat komponen-komponen daripada dua pengeluar yang berbeza (A) diuji pada empat suhu pengoperasian (B) dan dua kadar kuasa (C). Tiga komponen diuji di bawah setiap gabungan rawatan. Data dikutip diproses melalui prosedur ANOVA daripada SPSS.

Output diperolehi ditunjukkan seperti berikut:

.../3

* * * A N A L Y S I S O F V A R I A N C E * * *

	HAYAT	masahayat komponen
BY	A	pengeluar
	B	suhu pengoperasian
	C	kadar kuasa

Source of Variation	Sum of Squares	DF	Mean Square	F	Signif of F
Main Effects	6399615.000	5	1279923.000	7.230	.000
A	107920.333	1	107920.333	.610	.441
B	1925974.333	3	641991.444	3.627	.023
C	4365720.333	1	4365720.333	24.661	.000
2-way Interactions	3856479.667	7	550925.667	3.112	.013
A B	1348593.000	3	449531.000	2.539	.074
A C	168507.000	1	168507.000	.952	.337
B C	2339379.667	3	779793.222	4.405	.011
3-way Interactions	168475.667	3	56158.556	.317	.813
A B C	168475.667	3	56158.556	.317	.813
Explained	10424570.333	15	694971.356	3.926	.001
Residual	5664853.333	32	177026.667		
Total	16089423.667	47	342328.163		

48 Cases were processed.
0 Cases (.0 PCT) were missing.

Huraikan kesimpulan-kesimpulan yang anda boleh perolehi daripada kajian ini. Gunakan α = .05. Nyatakan anggapan-anggapan yang telah anda gunakan.

(d) Sukatan-sukatan sifat daripada dua belas sampel bahan asphalt telah diperolehi. Pembolehubah-pembolehubah yang berkaitan adalah:

.../4

Y : penetration pada suhu 115 darjah Fahrenheit
X1: softening point (darjah Fahrenheit)
X2: penetration pada suhu 32 darjah Fahrenheit
X3: penetration pada suhu 77 darjah Fahrenheit
X4: peratusan insoluble n-pentane
X5: flash point (darjah Fahrenheit)

Data yang dikutip telah diproses dengan menggunakan prosedur REGRESSION daripada SPSS dengan kaedah BACKWARD.

Output diperolehi adalah seperti ditunjukkan di bawah:

* * * * M U L T I P L E R E G R E S S I O N * * * *

Beginning Block Number 1. Method: Enter

Equation Number 1 Dependent Variable.. Y penetration at 115 degrees Fahr

Variable(s) Entered on Step Number

1..	X5	flash point (degrees Fahrenheit)
2..	X2	penetration at 32 degrees Fahrenheit
3..	X4	percentage of insoluble n-pentane
4..	X3	penetration at 77 degrees Fahrenheit
5..	X1	softening point (degrees Fahrenheit)

Multiple R	.95797
R Square	.91771
Adjusted R Square	.84913
Standard Error	12.54555

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	5	10531.32217	2106.26443
Residual	6	944.34450	157.39075

F = 13.38239 Signif F = .0033

.../5

---------- Variables in the Equation ----------

Variable	B	SE B	Beta	T	Sig T
X5	-.44811	.15762	-.46904	-2.843	.0295
X2	-3.20115	2.06897	-.34028	-1.547	.1728
X4	-3.69954	2.09781	-.31773	-1.764	.1283
X3	4.14139	1.51372	.67847	2.736	.0339
X1	-.27839	.53361	-.13349	-.522	.6206
(Constant)	432.86902	107.09932		4.042	.0068

End Block Number 1 All requested variables entered.

Beginning Block Number 2. Method: Backward

Variable(s) Removed on Step Number
6.. X1 softening point (degrees Fahrenheit)

Multiple R	.95602
R Square	.91398
Adjusted R Square	.86482
Standard Error	11.87544

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	4	10488.48429	2622.12107
Residual	7	987.18238	141.02605

F = 18.59317 Signif F = .0008

---------- Variables in the Equation ----------

Variable	B	SE B	Beta	T	Sig T
X5	-.50048	.11504	-.52386	-4.351	.0034
X2	-3.90057	1.49169	-.41462	-2.615	.0347
X4	-4.43831	1.46507	-.38117	-3.029	.0191
X3	4.69403	1.02355	.76901	4.586	.0025
(Constant)	435.61276	101.25642		4.302	.0036

.../6

---------- Variables not in the Equation ----------

Variable	Beta In	Partial	Min Toler	T	Sig T
X1	-.13349	-.20831	.20948	-.522	.6206

End Block Number 2 POUT = .100 Limits reached.

Huraikan kesimpulan-kesimpulan yang anda boleh perolehi daripada output itu. Gunakan α = .05 jika diperlukan.

(e) Suatu kajian telah dijalankan untuk menentukan kekesanan suhu pada hasil sejenis polimer. Data diperolehi adalah seperti diberikan di bawah:

Suhu	220	230	240	250	260	270
Hasil	60.2	72.6	77.1	80.7	86.4	84.4
	59.2	70.3	77.5	80.7	85.5	86.6
	58.9	72.3	77.5	81.9	85.6	84.1
	57.3	71.2	79.9	83.1	86.5	85.7

Data diperolehi adalah diproses dengan menggunakan prosedur ONEWAY dengan pilihan POLYNOMIAL.

Output diperolehi diberikan di bawah:

- - - - - - - - - - O N E W A Y - - - - - - - - - -

Variable HASIL hasil polimer
By Variable SUHU suhu proses

.../7

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	5	2108.3533	421.6707	354.0146	.0000
Linear Term	1	1816.6223	1816.6223	1525.1493	.0000
Deviation from Linear	4	291.7310	72.9328	61.2309	.0000
Quad. Term	1	271.4405	271.4405	227.8885	.0000
Deviation from Quad.	3	20.2906	6.7635	5.6783	.0064
Cubic Term	1	5.9042	5.9042	4.9569	.0390
Deviation from Cubic	2	14.3863	7.1932	6.0390	.0098
Quartic Term	1	12.8929	12.8929	10.8242	.0041
Deviation from Quartic	1	1.4935	1.4935	1.2539	.2775
Within Groups	18	21.4400	1.1911		
Total	23	2129.7933			

Berikan kesimpulan-kesimpulan yang anda boleh perolehi daripada output itu. Gunakan $\alpha = .05$.

(100/100)

2. Lima helai wafer yang dibuat di bawah keadaan-keadaan yang berbeza dibandingkan terhadap ketebalan. Lima sukatan diambil pada setiap wafer. Data dikutip ditunjukkan di bawah:

Wafer	Ketebalan					Jumlah
A	1736	1725	1726	1730	1659	8576
B	1665	1657	1674	1693	1637	8326
C	1623	1647	1685	1721	1738	8414
D	1696	1725	1735	1735	1735	8626
E	1711	1712	1742	1744	1701	8610
						42552

$\Sigma\Sigma y_{ij}^2 = 72,458,876$

.../8

(a) Dapatkan jadual analisis varians bagi masalah ini.

(b) Adakah terdapat perbezaan yang bererti di antara lima wafer yang dikaji? Gunakan $\alpha = .05$.
Nyatakan semua anggapan yang anda telah gunakan.

(c) Jika terdapat perbezaan yang bererti dalam (b), gunakan ujian Duncan dengan $\alpha = .05$ untuk memperolehi wafer-wafer yang berbeza secara bererti.

(d) Dapatkan suatu selang keyakinan 95% bagi min ketebalan untuk wafer A.

(e) Dapatkan suatu selang keyakinan 95% bagi beza min ketebalan antara wafer A dan wafer C.

(100/100)

3. (a) Di dalam suatu kajian oktan minyak kereta, seorang jurutera ingin membandingkan lima jenis minyak kereta. Jurutera tersebut mengambil lima buah kereta dan membuat satu penentuan nombor oktan (semasa kereta dipandu pada jalanraya) bagi setiap minyak kereta dalam setiap kereta. Data diperolehi adalah seperti diberikan di bawah:

Minyak Kereta	Jenis Kereta I	II	III	IV	V	Jumlah
A	88.2	86.6	88.1	86.7	87.5	437.1
B	86.6	87.6	86.8	89.0	88.6	438.6
C	86.9	86.1	87.3	86.9	87.0	434.2
D	86.1	86.2	86.8	86.6	87.5	433.2
E	85.7	85.9	86.1	86.0	85.6	429.3
Jumlah	433.5	432.4	435.1	435.2	436.2	2172.5

$$\Sigma\Sigma y_{ij}^2 = 188,792.36$$

(i) Binakan suatu jadual analisis varians.

.../9

(ii) Adakah terdapat perbezaan di antara lima minyak kereta dikaji? Gunakan $\alpha = .05$.

Nyatakan semua anggapan yang telah anda menggunakan.

(b) Suatu tinjauan dijalankan untuk mengkaji hubungan di antara warna rambut dan warna mata seseorang. Data daripada tinjauan tersebut pun telah diproses melalui prosedur CROSSTABS daripada SPSS dan output adalah seperti diberikan di bawah:

Crosstabulation: RAMBUT warna rambut
By MATA warna mata

Count / MATA >	brown 1.00	green/grey 2.00	blue 3.00	Row Total
RAMBUT				
1.00 black	50	54	41	145 / 36.3
2.00 brown	38	46	48	132 / 33.0
3.00 fair	22	30	31	83 / 20.8
4.00 ginger	10	10	20	40 / 10.0
Column Total	120 / 30.0	140 / 35.0	140 / 35.0	400 / 100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F.< 5
7.73552	6	.2581	12.000	None

Number of Missing Observations = 0

Huraikan kesimpulan-kesimpulan yang anda boleh perolehi daripada output itu. Gunakan $\alpha = .05$.

(100/100)

.../10

4. (a) Apakah prinsip-prinsip asas daripada rekabentuk eksperimen? Bincangkan.

(b) Sebuah syarikat ingin mempertimbangkan pertukaran cara membuat satu daripada bahan-bahan yang syarikat tersebut gunakan dalam proses pembuatannya. Dua kontraktor dijemput membuat lima sampel bahan disediakan melalui kaedah lama dan lima sampel bahan disediakan melalui kaedah baru. Maklumbalas ialah suatu sukatan kekuatan tensil bahan itu dan suatu nilai yang lebih tinggi adalah dikehendaki. Data diperolehi diberikan di bawah:

	Kontraktor	
Kaedah	A	B
Lama	130	125
	124	129
	128	127
	125	127
	122	126
Baru	128	135
	127	137
	133	134
	126	136
	129	128

(i) Adakah wujud tindakan bersaling yang bererti? Tunjukkan secara bergraf dan kemudian gunakan suatu ujian keertian. Gunakan α = .05.

(ii) Adakah wujud perbezaan yang bererti diantara kaedah-kaedah pembuatan? Di antara kontraktor-kontraktor. Gunakan α = .05.

(iii) Nyatakan sebarang anggapan yang anda telah menggunakan.

Perhatian: Jumlah nilai di dalam setiap sel ditunjukkan seperti berikut.

.../11

Kaedah	Kontraktor A	Kontraktor B	Jumlah
Lama	629	634	1263
Baru	643	670	1313
Jumlah	1272	1304	2576

$$\Sigma\Sigma\Sigma y_{ijk}^2 = 332,118$$

(100/100)

5. (a) Berikan tindakan-tindakan mencegah (precautions) yang patut kita ambil kira apabila kita menggunakan kaedah-kaedah korelasi dan regresi.

(b) Dua ahli sains ingin mengembangkan suatu rumus untuk meramalkan tinggi suatu pokok aspen (Y) di sebuah hutan daripada diameternya pada tinggi dada (X). Sukatan dalam meter bagi 32 pokok diberikan di bawah.

X =	0.90	1.20	1.45	1.80	2.00	2.20	3.40	3.40	3.50	7.30
Y =	2.20	2.80	3.20	3.78	4.60	3.10	5.35	5.70	5.35	9.20
	9.10	10.50	13.00	13.70	15.10	15.40	15.80	17.30	19.40	
	9.40	11.50	16.10	15.90	16.70	17.40	15.60	15.50	23.00	
	19.50	21.50	22.50	22.60	22.80	23.00	25.10	25.20	27.80	
	19.35	23.10	22.50	18.10	22.40	22.50	23.80	22.50	23.50	
	30.20	32.10	32.40	35.40						
	23.50	23.80	23.50	22.50						

$$\Sigma x_i = 496.55 \qquad \Sigma y_i = 477.43$$

$$\Sigma x_i^2 = 11,236.91 \qquad \Sigma y_i^2 = 9,121.28$$

$$\Sigma x_i y_i = 9,937.40$$

.../12

(i) Dapatkan suatu garis regresi mudah, $Y = \beta_0 + \beta_1 x$ bagi data itu dan berikan komen terhadap hasil diperolehi.

(ii) Diusulkan bahawa mereka sepatutnya menggunakan $x1 = \sqrt{x}$ dan bukan x sebagai peramal. Dapatkan model itu dan bandingkan kebaikan model itu dengan model yang diperolehi dalam (i).

Anda boleh menganggap:

$$\Sigma x1_i = 115.89 \qquad \Sigma x1_i^2 = 496.55$$

$$\Sigma y_i x1_i = 2111.81$$

(iii) Dapatkan nilai koefisien korelasi Pearson bagi Y dengan X1, di mana $X1 = \sqrt{X}$.

(iv) Dapatkan suatu selang keyakinan 95% bagi ρ, koefisien korelasi sebenar di antara Y dan X1.

(100/100)

- oooOooo -

BERBAGAI RUMUS (Tatatanda seperti di dalam nota kuliah)

1. Dua sampel tak bersandar ($n_1 < 25$ atau $n_2 < 25$)

$$s_p^2 = \frac{\sum_i (x_i - \bar{x})^2 + \sum_j (y_j - \bar{y})^2}{n_1 + n_2 - 2}$$

$$= \frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2}$$

2. Sampel berpasangan

$$s_d^2 = \frac{\sum_i (d_i - \bar{d})^2}{n - 1}$$

$$= \frac{\sum_i d_i^2 - \frac{(\sum d_i)^2}{n}}{n - 1}$$

3. Analisis varian satu hala

$$SST = \sum_i \sum_j y_{ij}^2 - \frac{y_{..}^2}{N}$$

$$SSA = \sum_i \frac{y_{i.}^2}{n_i} - \frac{y_{..}^2}{N}$$

$$SSE = SST - SSA$$

Bagi sebarang kontras $L = \sum_i c_i y_{i.}$,

$$SSL = (\sum_i c_i y_{i.})^2 / (n \sum_i c_i^2)$$

4. Rekabentuk blok rawakan

$$SST = \sum_i \sum_j y_{ij}^2 - \frac{y_{..}^2}{N}$$

$$SSA = \sum_i \frac{y_{i.}^2}{b} - \frac{y_{..}^2}{N}$$

$$SSB = \sum_j \frac{y_{.j}^2}{a} - \frac{y_{..}^2}{N}$$

$$SSE = SST - SSA - SSB$$

5. Rekabentuk segiempat sama Latin

$$SST = \sum_i \sum_j y_{ijk}^2 - \frac{y_{...}^2}{N}$$

$$SSR = \sum_i \frac{y_{i..}^2}{P} - \frac{y_{...}^2}{N}$$

$$SSC = \sum_k \frac{y_{..k}^2}{P} - \frac{y_{...}^2}{N}$$

$$SSA = \sum_j \frac{y_{.j.}^2}{P} - \frac{y_{...}^2}{N}$$

$$SSE = SST - SSR - SSC - SSA$$

6. Rekabentuk faktorial (dua faktor)

$$SST = \sum_i \sum_j \sum_k y_{ijk}^2 - \frac{y_{...}^2}{N}$$

$$SSA = \sum_i \frac{y_{i..}^2}{bn} - \frac{y_{...}^2}{N}$$

.../3

$$SSB = \sum_j \frac{y_{.j.}^2}{an} - \frac{y_{...}^2}{N}$$

$$SS_{\text{sub-jumlah}} = \sum_i \sum_j \frac{y_{ij.}^2}{n} - \frac{y_{...}^2}{N}$$

$$SSAB = SS_{\text{sub-jumlah}} - SSA - SSB$$

$$SSE = SST - SS_{\text{sub-jumlah}}$$

7. Korelasi dan regresi linear mudah

$$r^2 = \frac{\left(\sum_i x_i y_i - (\sum_i x_i)(\sum_i y_i)/n\right)^2}{[\sum_i x_i^2 - (\sum_i x_i)^2/n][\sum_i y_i^2 - (\sum_i y_i)^2/n]}$$

$$\hat{\beta}_1 = \frac{\sum_i x_i y_i - (\sum_i x_i)(\sum_i y_i)/n}{\sum_i x_i^2 - (\sum_i x_i)^2/n}$$

$$\hat{\beta}_0 = \bar{y} - \hat{\beta}_1 \bar{x}$$

$$SSE = S_{yy} - \hat{\beta}_1^2 S_{xx}$$

$$= S_{yy} - \hat{\beta}_1 S_{xy}$$

$$S_{Y \cdot X}^2 = \frac{SSE}{n-2}$$

Anggaran ralat piawai bagi $\hat{\beta}_0$ ialah

$$\sqrt{MSE\left(\frac{1}{n} + \frac{\bar{x}^2}{S_{xx}}\right)}$$

Anggaran ralat piawai bagi $\hat{\beta}_1$ ialah

$$\sqrt{MSE/S_{xx}}$$

.../4

Selang peramalan $100(1 - \alpha)\%$ pada $x = x_0$:

$$\hat{y} \pm t_{\alpha/2} \sqrt{MSE\left(1 + \frac{1}{n} + \frac{(x_0 - \bar{x})^2}{S_{xx}}\right)}$$

Selang keyakinan $100(1 - \alpha)\%$ pada $x = x_0$ bagi $\mu_{Y.X_0}$ ialah

$$\hat{y} \pm t_{\alpha/2} \sqrt{MSE\left(\frac{1}{n} + \frac{(x_0 - \bar{x})^2}{S_{xx}}\right)}$$

8. Regresi linear berganda

$$\underset{\sim}{y} = \begin{pmatrix} y_1 \\ y_2 \\ \vdots \\ y_n \end{pmatrix} , \quad \underset{\sim}{x} = \begin{pmatrix} 1 & x_{11} & x_{12} & \cdots & x_{1k} \\ 1 & x_{21} & x_{22} & \cdots & x_{2k} \\ \vdots & \vdots & \vdots & & \vdots \\ 1 & x_{n1} & x_{n2} & \cdots & x_{nk} \end{pmatrix}$$

$$\underset{\sim}{\beta} = \begin{pmatrix} \beta_0 \\ \beta_1 \\ \vdots \\ \beta_k \end{pmatrix} , \quad \underset{\sim}{\varepsilon} = \begin{pmatrix} \varepsilon_1 \\ \varepsilon_2 \\ \vdots \\ \varepsilon_n \end{pmatrix}$$

$$\hat{\underset{\sim}{\beta}} = (\underset{\sim}{X}'\underset{\sim}{X})^{-1}\underset{\sim}{X}'\underset{\sim}{y}$$

$$SSE = \underset{\sim}{y}'\underset{\sim}{y} - \hat{\underset{\sim}{\beta}}'\underset{\sim}{X}'\underset{\sim}{y}$$

$$SSR = \hat{\underset{\sim}{\beta}}'\underset{\sim}{X}'\underset{\sim}{y} - (\Sigma y_i)^2/n$$

$$r^2_{12.3} = \frac{(r_{12} - r_{13}\, r_{23})^2}{(1 - r^2_{13})(1 - r^2_{23})} .$$

$$MSE = \frac{SSE}{n-p} , \quad p = k+1 .$$

.../5

9. Polinomial ortogon

$$P_0(x) = 1$$

$$P_1(x) = \lambda_1 \left[\frac{x-\bar{x}}{d}\right]$$

$$P_2(x) = \lambda_2 \left[\left(\frac{x-\bar{x}}{d}\right)^2 - \left(\frac{n^2-1}{12}\right)\right]$$

$$P_3(x) = \lambda_3 \left[\left(\frac{x-\bar{x}}{d}\right)^3 - \left(\frac{x-\bar{x}}{d}\right)\left(\frac{3n^2-7}{20}\right)\right]$$

$$P_4(x) = \lambda_4 \left[\left(\frac{x-\bar{x}}{d}\right)^4 - \left(\frac{x-\bar{x}}{d}\right)^2\left(\frac{3n^2-13}{14}\right) + \frac{3(n^2-1)(n^2-9)}{560}\right]$$

$$\hat{\alpha}_j = \frac{\sum_{i=1}^{n} P_j(x_i)y_i}{\sum_{i=1}^{n} P_j^2(x_i)}, \quad j = 0, 1, \ldots, k$$

$$SSR(\alpha_j) = \hat{\alpha}_j \sum_{i=1}^{n} P_j(x_i)y_i$$

$$SSE(k) = S_{yy} - \sum_{j=1}^{k} \hat{\alpha}_j \left[\sum_{i=1}^{n} P_j(x_i)y_i\right]$$

10. Pemilihan pembolehubah dan pembangunan model dalam regresi

$$R_p^2 = \frac{SSR(p)}{S_{yy}} = 1 - \frac{SSE(p)}{S_{yy}}$$

$$\overline{R_p^2} = 1 - \left(\frac{n-1}{n-p}\right)(1 - R_p^2)$$

$$MSE(p) = \frac{SSE(p)}{n-p}$$

$C_p = \frac{SSE(p)}{\hat{\sigma}^2} - (n-2p)$, di mana $\hat{\sigma}^2$ adalah suatu anggaran σ^2 .

.../6

VII. Significant Ranges for Duncan's Multiple Range Test (*continued*)

$r_{.05}(p, f)$

	p											
f	2	3	4	5	6	7	8	9	10	20	50	100
1	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0
2	6.09	6.09	6.09	6.09	6.09	6.09	6.09	6.09	6.09	6.09	6.09	6.09
3	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50
4	3.93	4.01	4.02	4.02	4.02	4.02	4.02	4.02	4.02	4.02	4.02	4.02
5	3.64	3.74	3.79	3.83	3.83	3.83	3.83	3.83	3.83	3.83	3.83	3.83
6	3.46	3.58	3.64	3.68	3.68	3.68	3.68	3.68	3.68	3.68	3.68	3.68
7	3.35	3.47	3.54	3.58	3.60	3.61	3.61	3.61	3.61	3.61	3.61	3.61
8	3.26	3.39	3.47	3.52	3.55	3.56	3.56	3.56	3.56	3.56	3.56	3.56
9	3.20	3.34	3.41	3.47	3.50	3.52	3.52	3.52	3.52	3.52	3.52	3.52
10	3.15	3.30	3.37	3.43	3.46	3.47	3.47	3.47	3.47	3.48	3.48	3.48
11	3.11	3.27	3.35	3.39	3.43	3.44	3.45	3.46	3.46	3.48	3.48	3.48
12	3.08	3.23	3.33	3.36	3.40	3.42	3.44	3.44	3.46	3.48	3.48	3.48
13	3.06	3.21	3.30	3.35	3.38	3.41	3.42	3.44	3.45	3.47	3.47	3.47
14	3.03	3.18	3.27	3.33	3.37	3.39	3.41	3.42	3.44	3.47	3.47	3.47
15	3.01	3.16	3.25	3.31	3.36	3.38	3.40	3.42	3.43	3.47	3.47	3.47
16	3.00	3.15	3.23	3.30	3.34	3.37	3.39	3.41	3.43	3.47	3.47	3.47
17	2.98	3.13	3.22	3.28	3.33	3.36	3.38	3.40	3.42	3.47	3.47	3.47
18	2.97	3.12	3.21	3.27	3.32	3.35	3.37	3.39	3.41	3.47	3.47	3.47
19	2.96	3.11	3.19	3.26	3.31	3.35	3.37	3.39	3.41	3.47	3.47	3.47
20	2.95	3.10	3.18	3.25	3.30	3.34	3.36	3.38	3.40	3.47	3.47	3.47
30	2.89	3.04	3.12	3.20	3.25	3.29	3.32	3.35	3.37	3.47	3.47	3.47
40	2.86	3.01	3.10	3.17	3.22	3.27	3.30	3.33	3.35	3.47	3.47	3.47
60	2.83	2.98	3.08	3.14	3.20	3.24	3.28	3.31	3.33	3.47	3.48	3.48
100	2.80	2.95	3.05	3.12	3.18	3.22	3.26	3.29	3.32	3.47	3.53	3.53
∞	2.77	2.92	3.02	3.09	3.15	3.19	3.23	3.26	3.29	3.47	3.61	3.67

f = degrees of freedom.

VII. Significant Ranges for Duncan's Multiple Range Test[a]

$r_{.01}(p, f)$

	p											
f	2	3	4	5	6	7	8	9	10	20	50	100
1	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0
2	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0
3	8.26	8.5	8.6	8.7	8.8	8.9	8.9	9.0	9.0	9.3	9.3	9.3
4	6.51	6.8	6.9	7.0	7.1	7.1	7.2	7.2	7.3	7.5	7.5	7.5
5	5.70	5.96	6.11	6.18	6.26	6.33	6.40	6.44	6.5	6.8	6.8	6.8
6	5.24	5.51	5.65	5.73	5.81	5.88	5.95	6.00	6.0	6.3	6.3	6.3
7	4.95	5.22	5.37	5.45	5.53	5.61	5.69	5.73	5.8	6.0	6.0	6.0
8	4.74	5.00	5.14	5.23	5.32	5.40	5.47	5.51	5.5	5.8	5.8	5.8
9	4.60	4.86	4.99	5.08	5.17	5.25	5.32	5.36	5.4	5.7	5.7	5.7
10	4.48	4.73	4.88	4.96	5.06	5.13	5.20	5.24	5.28	5.55	5.55	5.55
11	4.39	4.63	4.77	4.86	4.94	5.01	5.06	5.12	5.15	5.39	5.39	5.39
12	4.32	4.55	4.68	4.76	4.84	4.92	4.96	5.02	5.07	5.26	5.26	5.26
13	4.26	4.48	4.62	4.69	4.74	4.84	4.88	4.94	4.98	5.15	5.15	5.15
14	4.21	4.42	4.55	4.63	4.70	4.78	4.83	4.87	4.91	5.07	5.07	5.07
15	4.17	4.37	4.50	4.58	4.64	4.72	4.77	4.81	4.84	5.00	5.00	5.00
16	4.13	4.34	4.45	4.54	4.60	4.67	4.72	4.76	4.79	4.94	4.94	4.94
17	4.10	4.30	4.41	4.50	4.56	4.63	4.68	4.73	4.75	4.89	4.89	4.89
18	4.07	4.27	4.38	4.46	4.53	4.59	4.64	4.68	4.71	4.85	4.85	4.85
19	4.05	4.24	4.35	4.43	4.50	4.56	4.61	4.64	4.67	4.82	4.82	4.82
20	4.02	4.22	4.33	4.40	4.47	4.53	4.58	4.61	4.65	4.79	4.79	4.79
30	3.89	4.06	4.16	4.22	4.32	4.36	4.41	4.45	4.48	4.65	4.71	4.71
40	3.82	3.99	4.10	4.17	4.24	4.30	4.34	4.37	4.41	4.59	4.69	4.69
60	3.76	3.92	4.03	4.12	4.17	4.23	4.27	4.31	4.34	4.53	4.66	4.66
100	3.71	3.86	3.98	4.06	4.11	4.17	4.21	4.25	4.29	4.48	4.64	4.65
∞	3.64	3.80	3.90	3.98	4.04	4.09	4.14	4.17	4.20	4.41	4.60	4.68

f = degrees of freedom.

[a] Reproduced with permission from "Multiple Range and Multiple F Tests," by D. B. Duncan, *Biometrics*, Vol. 1, No. 1, pp. 1–42, 1955.

LAMPIRAN 8

(MKT261)

TABLE III

Transformation of r to Z $\left(\text{i.e., } Z = \frac{1}{2} \log_e \frac{1+r}{1-r}\right)$

r	Z	r	Z	r	Z
.00	.000				
.01	.010	.36	.377	.71	.887
.02	.020	.37	.388	.72	.908
.03	.030	.38	.400	.73	.929
.04	.040	.39	.412	.74	.950
.05	.050	.40	.424	.75	.973
.06	.060	.41	.436	.76	.996
.07	.070	.42	.448	.77	1.020
.08	.080	.43	.460	.78	1.045
.09	.090	.44	.472	.79	1.071
.10	.100	.45	.485	.80	1.099
.11	.110	.46	.497	.81	1.127
.12	.121	.47	.510	.82	1.157
.13	.131	.48	.523	.83	1.188
.14	.141	.49	.536	.84	1.221
.15	.151	.50	.549	.85	1.256
.16	.161	.51	.563	.86	1.293
.17	.172	.52	.576	.87	1.333
.18	.182	.53	.590	.88	1.376
.19	.192	.54	.604	.89	1.422
.20	.203	.55	.618	.90	1.472
.21	.213	.56	.633	.91	1.528
.22	.224	.57	.648	.92	1.589
.23	.234	.58	.662	.93	1.658
.24	.245	.59	.678	.94	1.738
.25	.255	.60	.693	.95	1.832
.26	.266	.61	.709	.96	1.946
.27	.277	.62	.725	.97	2.092
.28	.288	.63	.741	.98	2.298
.29	.299	.64	.758	.99	2.647
.30	.310	.65	.775		
.31	.321	.66	.793		
.32	.332	.67	.811		
.33	.343	.68	.829		
.34	.354	.69	.848		
.35	.365	.70	.867		

Table III is abridged from Table VII of Fisher and Yates *Statistical Tables for Biological, Agricultural, and Medical Research*, published by Oliver and Boyd Limited, Edinburgh, by permission of the authors and publishers.

X. Coefficients of Orthogonal Polynomials[a]

	$n = 3$		$n = 4$			$n = 5$				$n = 6$					$n = 7$					
X_j	P_1	P_2	P_1	P_2	P_3	P_1	P_2	P_3	P_4	P_1	P_2	P_3	P_4	P_5	P_1	P_2	P_3	P_4	P_5	P_6
1	−1	1	−3	1	−1	−2	2	−1	1	−5	5	−5	1	−1	−3	5	−1	3	−1	1
2	0	−2	−1	−1	3	−1	−1	2	−4	−3	−1	7	−3	5	−2	0	1	−7	4	−6
3	1	1	1	−1	−3	0	−2	0	6	−1	−4	4	2	−10	−1	−3	1	1	−5	15
4			3	1	1	1	−1	−2	−4	1	−4	−4	2	10	0	−4	0	6	0	−20
5						2	2	1	1	3	−1	−7	−3	−5	1	−3	−1	1	5	15
6										5	5	5	1	1	2	0	−1	−7	−4	−6
7															3	5	1	3	1	1
$\sum_{j=1}^{n} \{P_i(X_j)\}^2$	2	6	20	4	20	10	14	10	70	70	84	180	28	252	28	84	6	154	84	924
λ	1	3	8	1	$\frac{10}{3}$	1	1	$\frac{5}{6}$	$\frac{35}{12}$	2	$\frac{1}{2}$	$\frac{5}{3}$	$\frac{7}{12}$	$\frac{21}{10}$	1	1	$\frac{1}{6}$	$\frac{7}{12}$	$\frac{7}{20}$	$\frac{33}{20}$

	$n = 8$						$n = 9$						$n = 10$					
X_j	P_1	P_2	P_3	P_4	P_5	P_6	P_1	P_2	P_3	P_4	P_5	P_6	P_1	P_2	P_3	P_4	P_5	P_6
1	−7	7	−7	7	−7	1	−4	28	−14	14	−4	4	−9	6	−42	18	−6	3
2	−5	1	5	−13	23	−5	−3	7	7	−21	11	−17	−7	2	14	−22	14	−11
3	−3	−3	7	−3	−17	9	−2	−8	13	−11	−4	22	−5	−1	35	−17	−1	10
4	−1	−5	3	9	−15	−5	−1	−17	9	9	−9	1	−3	−3	31	3	−11	6
5	1	−5	−3	9	15	−5	0	−20	0	18	0	−20	−1	−4	12	18	−6	−8
6	3	−3	−7	−3	17	9	1	−17	−9	9	9	1	1	−4	−12	18	6	−8
7	5	1	−5	−13	−23	−5	2	−8	−13	−11	4	22	3	−3	−31	3	11	6
8	7	7	7	7	7	1	3	7	−7	−21	−11	−17	5	−1	−35	−17	1	10
9							4	28	14	14	4	4	7	2	−14	−22	−14	−11
10													9	6	42	18	6	3
$\sum_{j=1}^{n} \{P_i(X_j)\}^2$	168	168	264	616	2184	264	60	2772	990	2002	468	1980	330	132	8580	2860	780	660
λ	2	1	$\frac{3}{5}$	$\frac{7}{12}$	$\frac{7}{10}$	$\frac{11}{60}$	1	3	$\frac{5}{6}$	$\frac{7}{12}$	$\frac{3}{20}$	$\frac{11}{60}$	2	$\frac{1}{2}$	$\frac{5}{3}$	$\frac{5}{17}$	$\frac{1}{10}$	$\frac{11}{240}$

[a] Adapted with permission from *Biometrika Tables For Statisticians*, Vol. 1, 3rd edition by E. S. Pearson and H. O. Hartley, Cambridge University Press, Cambridge, 1966.

Table VI VALUES OF THE EXPONENTIAL FUNCTION $e^{-\lambda}$

λ	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.00	1.000	0.990	0.980	0.970	0.961	0.951	0.942	0.932	0.923	0.914
0.10	0.905	0.896	0.887	0.878	0.869	0.861	0.852	0.844	0.835	0.827
0.20	0.819	0.811	0.803	0.795	0.787	0.779	0.771	0.763	0.756	0.748
0.30	0.741	0.733	0.726	0.719	0.712	0.705	0.698	0.691	0.684	0.677
0.40	0.670	0.664	0.657	0.651	0.644	0.638	0.631	0.625	0.619	0.613
0.50	0.607	0.600	0.595	0.589	0.583	0.577	0.571	0.566	0.560	0.554
0.60	0.549	0.543	0.538	0.533	0.527	0.522	0.517	0.512	0.507	0.502
0.70	0.497	0.492	0.487	0.482	0.477	0.472	0.468	0.463	0.458	0.454
0.80	0.449	0.445	0.440	0.436	0.432	0.427	0.423	0.419	0.415	0.411
0.90	0.407	0.403	0.399	0.395	0.391	0.387	0.383	0.379	0.375	0.372
1.00	0.368	0.364	0.361	0.357	0.353	0.350	0.346	0.343	0.340	0.336
1.10	0.333	0.330	0.326	0.323	0.320	0.317	0.313	0.310	0.307	0.304
1.20	0.301	0.298	0.295	0.292	0.289	0.287	0.284	0.281	0.278	0.275
1.30	0.273	0.270	0.267	0.264	0.262	0.259	0.257	0.254	0.252	0.249
1.40	0.247	0.244	0.242	0.239	0.237	0.235	0.232	0.230	0.228	0.225
1.50	0.223	0.221	0.219	0.217	0.214	0.212	0.210	0.208	0.206	0.204
1.60	0.202	0.200	0.198	0.196	0.194	0.192	0.190	0.188	0.186	0.185
1.70	0.183	0.181	0.179	0.177	0.176	0.174	0.172	0.170	0.169	0.167
1.80	0.165	0.164	0.162	0.160	0.159	0.157	0.156	0.154	0.153	0.151
1.90	0.150	0.148	0.147	0.145	0.144	0.142	0.141	0.139	0.138	0.137
2.00	0.135	0.134	0.133	0.131	0.130	0.129	0.127	0.126	0.125	0.124
2.10	0.122	0.121	0.120	0.119	0.118	0.116	0.115	0.114	0.113	0.112
2.20	0.111	0.110	0.109	0.108	0.106	0.105	0.104	0.103	0.102	0.101
2.30	0.100	0.0992	0.0983	0.0973	0.0963	0.0953	0.0944	0.0935	0.0926	0.0916
2.40	0.0907	0.0898	0.0889	0.0880	0.0872	0.0863	0.0854	0.0846	0.0837	0.0829
2.50	0.0821	0.0813	0.0805	0.0797	0.0789	0.0781	0.0773	0.0765	0.0758	0.0750
2.60	0.0743	0.0735	0.0728	0.0721	0.0714	0.0707	0.0699	0.0693	0.0686	0.0679
2.70	0.0672	0.0665	0.0659	0.0652	0.0646	0.0639	0.0633	0.0627	0.0620	0.0614
2.80	0.0608	0.0602	0.0596	0.0590	0.0584	0.0578	0.0573	0.0567	0.0561	0.0556
2.90	0.0550	0.0545	0.0539	0.0534	0.0529	0.0523	0.0518	0.0513	0.0508	0.0503

From Avram Goldstein, *Biostatistics*. New York: Macmillan, 1964. Reprinted by permission.

SPSS/PC+™ Reference Card

This card provides a convenient reference to the SPSS/PC+™ System for the IBM PC/XT and PC/AT. Command diagrams appear in alphabetical order and are constructed according to the following conventions:

Square brackets enclose optional specifications not necessary to the correct completion of the command. **Braces** enclose alternative specifications. One of these specifications must be entered in order to complete the command. The brackets and braces themselves are not part of the specification.

Ellipses indicate that an element may be repeated.

Uppercase elements must be entered as they appear in the diagrams.

Lowercase elements describe information to be filled in by the user, such as the word "varlist" to indicate a list of user-specified variables.

Boldface elements are defaults. Two asterisks (**) indicate that a specification is a default when its associated subcommand is not specified.

AGGREGATE

```
AGGREGATE OUTFILE={'filename'}
                  {*        }
 [/PRESORTED]
  /BREAK=varlist [{(A)}] [varlist [{(A)}]] ...
                 {(D)}             {(D)}
 [/MISSING=COLUMNWISE]
  /aggvar ['label'] aggvar ['label'] ...
       =function(varlist[,arguments])
 [/aggvar ...]
```

ANOVA

```
ANOVA [VARIABLES=] varlist BY varlist(min,max) [WITH varlist]
      [/[VARIABLES=] varlist ...]
      [/OPTIONS=option numbers]
      [/STATISTICS={statistic numbers}]
                   {ALL              }
```

Options:

1 Include user-missing values
2 Suppress labels
3 Suppress all interaction terms
4 Suppress three-way terms
5 Suppress four-way terms
6 Suppress five-way terms
7 Covariates with main effects
8 Covariates after main effects
9 Regression approach
10 Hierarchical approach
11 Narrow format

Statistics:

1 MCA table
2 Unstandardized regression coefficients for covariates
3 Display cell means and counts

BEGIN DATA—END DATA

```
BEGIN DATA
lines of data
END DATA
```

COMMENT

```
* text
```

COMPUTE

```
COMPUTE target variable=expression
```

Arithmetic Operators:

\+ Addition
\- Subtraction
* Multiplication
/ Division
** Exponentiation

Numeric Functions:

ABS	Absolute value	RND	Round
TRUNC	Truncate	MOD10	Modulus
SQRT	Square root	EXP	Exponential
LG10	Base 10 logarithm	LN	Natural logarithm
SIN	Sine	COS	Cosine
ATAN	Arctangent		

Missing-Value Functions:

VALUE	Treat user-missing as valid
SYSMIS	Return 1 if system-missing
MISSING	Return 1 if missing

Cross-case Function:

LAG Lag

Random-Number Functions:

UNIFORM	Uniform pseudo-random number
NORMAL	Normal pseudo-random number

Date Function:

YRMODA Date function

CORRELATION

```
CORRELATION [VARIABLES=] {varlist} [WITH varlist] [/varlist ...]
                         {ALL    }
            [/OPTIONS=option numbers]
            [/STATISTICS={statistic numbers}]
                         {ALL              }
```

Options:

1 Include user-missing values
2 Exclude missing values pairwise
3 Two-tailed probability
4 Write count and correlation matrix
5 Display count and probability

Statistics:

1 Univariate mean, standard deviation, and count
2 Cross-product deviations and covariance

COUNT

```
COUNT varname=varlist (value list) varlist (value list)
      [/varname=...]
```

Keywords available for numeric value lists:

LO LOWEST HI HIGHEST THRU SYSMIS MISSING

CROSSTABS

```
CROSSTABS [TABLES=] {varlist} BY varlist [BY...]
                    {ALL    }
          [/[TABLES=] varlist...]
          [/OPTIONS=option numbers]
          [/STATISTICS={statistic numbers}]
                       {ALL              }
```

Options:

1 Include user-missing values
2 Suppress all labels
3 Display row percentages
4 Display column percentages
5 Display two way table total percentages
6 Suppress value labels
8 Order rows by descending value
12 Suppress tables
13 Suppress cell counts
14 Display expected frequencies
15 Display chi-square residuals
16 Display standardized chi-square residuals
17 Display adjusted standardized chi-square residuals
18 Display all cell information
19 Suppress values

Statistics:

1 Chi-square
2 Phi for 2 × 2 tables, Cramér's V for larger tables
3 Contingency coefficient
4 Lambda
5 Uncertainty coefficient
6 Kendall's tau-b
7 Kendall's tau-c
8 Gamma
9 Somers' d
10 Eta
11 Pearson's r

DATA LIST: Fixed Format

```
DATA LIST [FILE='filename'] [FIXED] [TABLE]
 /varlist columns [{(0)}] [varlist columns ...] [/ ...] [/ ...]
                  {(n)}
                  {(A)}
```

Format	*Meaning*
(n)	Implied decimal places for numeric variables
(A)	String variable

DATA LIST: Freefield Format

```
DATA LIST [FILE='filename'] FREE
      /variable [({A })] varlist
                 {Aw}
```

Format	*Meaning*
(Aw)	String of width w

DATA LIST: Matrix Materials

```
DATA LIST [FILE='filename'] MATRIX [{FIXED}] /varlist
                                   {FREE }
```

DESCRIPTIVES

```
DESCRIPTIVES [VARIABLES=] {varlist}
                          {ALL    }
             [/OPTIONS=option numbers]
             [/STATISTICS={statistic numbers}]
                          {ALL              }
```

Options:

1 Include user-missing values
2 Suppress variable labels
3 Save Z scores on active file
5 Exclude missing values listwise
6 Serial format
7 Narrow format
8 Suppress variable names

Statistics:

1 Mean
2 Standard error of mean
5 Standard deviation
6 Variance
7 Kurtosis
8 Skewness
9 Range
10 Minimum
11 Maximum
12 Sum
13 Mean, standard deviation, minimum, and maximum

DISPLAY

```
DISPLAY [{varlist}]
         {ALL    }
```

EXECUTE

```
EXECUTE {path\filename[.ext]} ['parameters']
        {DOS          [.EXE]}
```

EXPORT

```
EXPORT OUTFILE='filename' [/KEEP={ALL    }] [/DROP=varlist]
                               {varlist}
    [/RENAME=(old varlist=new varlist)...] [/MAP]
    [/DIGITS=number]
```

FINISH

```
FINISH
```

FORMATS

```
FORMATS variable (format) [variable ...]
```

Format	*Meaning*
Fw.d	Numeric of width w and d decimal places
COMMAw.d	Numeric with commas and decimal places
DOLLARw.d	Numeric with dollar sign, commas, and decimal places

FREQUENCIES

```
FREQUENCIES [VARIABLES=]{varlist}
                        {ALL    }
[/FORMAT=[{CONDENSE}] [{NOTABLE  }] [NOLABELS]
          {ONEPAGE }  {LIMIT(n)}
         [{DVALUE}] [DOUBLE] [NEWPAGE]]
          {AFREQ }
          {DFREQ }
[/MISSING=INCLUDE]
[/BARCHART=[MINIMUM(n)] [MAXIMUM(n)] [{FREQ(n)   }]]
                                      {PERCENT(n)}
[/HISTOGRAM=[MINIMUM(n)] [MAXIMUM(n)] [{FREQ(n)   }]]
                                       {PERCENT(n)}
          [{NONORMAL}] [INCREMENT(n)]]
           {NORMAL  }
[/HBAR=same keywords as HISTOGRAM]
[/NTILES=n]  [/PERCENTILES=value list]
[/STATISTICS={DEFAULT] [MEAN] [STDDEV] [MINIMUM] [MAXIMUM]
             {SEMEAN] [VARIANCE] [SKEWNESS] [SESKEW] [RANGE] [MODE]
             {KURTOSIS] [SEKURT] [MEDIAN] [SUM] [ALL] [NONE]]
```

GET

```
GET [FILE={'SPSS.SYS'**}] [/DROP=varlist]
          {'filename'  }
```

HELP

```
HELP [ALL] [TOPICS] [NEWS]
     [command] [subcommand] [topic]
```

IF

```
IF (logical expression) target variable=assignment expression
```

Relational Operators:

EQ or =	Equal to	NE or ~= or <>	Not equal to
LT or <	Less than	LE or <=	Less than or equal to
GT or >	Greater than	GE or >=	Greater than or equal to

Logical Operators:

AND or & OR or | NOT or ~

Missing-Value Functions:

SYSMIS	Returns 1 (true) if value is system-missing
MISSING	Returns 1 (true) if value is system- or user-missing
VALUE	Returns the value itself, ignoring user-missing flags

IMPORT

```
IMPORT FILE='filename' [/KEEP={ALL    }] [/DROP=varlist]
                              {varlist}
    [/RENAME=(old varlist=new varlist)...] [/MAP]
```

INCLUDE

```
{INCLUDE 'filename'}
{@filename         }
```

JOIN

```
[JOIN]  {MATCH}
        {ADD  }
  /{FILE }={file specification}
   {TABLE}{*                  }
 [/KEEP=varlist ] [/DROP=varlist ]
 [/RENAME (old varlist=new varlist) [(old varlist=...)]]
  /FILE=...
    ...
 [/FILE=...  ]
    ...
 [/MAP] [/BY=varlist]
```

LIST

```
LIST [[VARIABLES=]{ALL**  }]
                  {varlist}
  [/CASES=[FROM {1**}] [TO {eof**}] [BY {1**}] ]
                {n   }     {n   }     {n   }
  [/FORMAT=({UNNUMBERED**}] [{WRAP**}] [WEIGHT] ]
            {NUMBERED    }  {SINGLE}
```

MEANS

```
MEANS [TABLES=] {varlist} BY varlist [BY varlist ...]
                {ALL    }
                [/varlist...]
      [/OPTIONS=option numbers]
      [/STATISTICS={statistic numbers}]
                   {ALL              }
```

Options:

1 Include user-missing values	8 Suppress value labels
2 Exclude cases with user-missing dependent values	9 Suppress independent variable names
3 Suppress all labels	10 Suppress independent variable values
5 Suppress group counts	11 Suppress group means
6 Display group sums	12 Display group variances
7 Suppress group standard deviations	

Statistics:

1 One-way analysis of variance
2 Test of linearity

MISSING VALUE

```
MISSING VALUE  {varlist}({value]) [[/]varlist ...]
               {ALL   }
```

N

```
N n [ESTIMATED]
```

NPAR TESTS

```
NPAR TESTS  [CHISQUARE=varlist [(lo,hi)]]
   [/EXPECTED={EQUAL**    }]
              {f1,f2, ...fn}
   [/K-S ({UNIFORM [,lo,hi]}]=varlist]
          {NORMAL [,m,sd]  }
          {POISSON [,m]    }
   [/RUNS ({MEAN  }]=varlist]
           {MEDIAN}
           {MODE  }
           {value }
   [/BINOMIAL [({.5}]=varlist ({value1,value2}]
               {p  }          {value       }
   [/MCNEMAR=varlist] [WITH varlist]
   [/SIGN=varlist] [WITH varlist]
   [/WILCOXON=varlist] [WITH varlist ]
   [/COCHRAN=varlist]
   [/FRIEDMAN=varlist]
   [/KENDALL=varlist]
   [/MEDIAN [(value)]=varlist BY var (value1,value2)]
   [/M-W=varlist BY var (value1,value2)]
   [/K-S=varlist BY var (value1,value2)]
   [/W-W=varlist BY var (value1,value2)]
   [/MOSES[(n)]=varlist BY var (value1,value2)]
   [/K-W=varlist BY var (value1,value2)]
   [/OPTIONS=option numbers]
   [/STATISTICS=statistic numbers]
```

Options:

1 Include user-missing values	3 Sequential pairing of variables for two related samples
2 Exclude missing values listwise	4 Random sampling

Statistics:

1 Mean, *maximum, minimum,* standard deviation, and count
2 Quartiles and count

ONEWAY

```
ONEWAY [VARIABLES=]varlist BY varname(min,max)
   [/POLYNOMIAL=n]
   [/CONTRAST=coefficient list] [/CONTRAST=...]
   [/RANGES={SNK           }] [RANGES=...]
            {BTUKEY        }
            {TUKEY         }
            {ranges values }
            {LSD           } [({.05  })]
            {DUNCAN        }  {alpha}
            {MODLSD        }
            {SCHEFFE       }
   [/OPTIONS=option numbers]
   [/STATISTICS={statistic numbers}]
                {ALL              }
```

Options:

1 Include user-missing values	7 Read matrix of counts, means, and standard deviations
2 Exclude missing values listwise	8 Read matrix of counts, means, pooled variance, and degrees of freedom
3 Suppress variable labels	10 Harmonic mean of all group sizes as sample sizes in range tests
4 Write matrix of counts, means, and standard deviations	
6 Use value labels as group labels	

Statistics:

1 Group descriptive statistics
2 Fixed- and random-effects statistics
3 Homogeneity-of-variance tests

PLOT

```
PLOT [MISSING=({PLOTWISE**} ) [INCLUDE]]
             {LISTWISE   }
  [/H$IZE={38**}]  [/VSIZE={16**}]
          {n   }          {n   }
  [/CUTPOINT={EVERY({1**})}]
             {      {n  }}
             {value list }
  [/SYMBOLS={ALPHAMUMERIC**                    }]
            {NUMERIC                           }
            {'symbols'[,'overplot symbols']    }
            {X'hexsymbs'[,'overplot hexsymbs'] }
  [/HORIZONTAL=['title'] [STANDARDIZE] [REFERENCE(vector)]]
                {MIN(min)] [MAX(max)]
                {UNIFORM]
  [/VERTICAL=['title'] [STANDARDIZE] [REFERENCE(vector)]]
              {MIN(min)] [MAX(max)]
              {UNIFORM]
  [/FORMAT={DEFAULT**       }]
           {CONTOUR[({10})]}
           {      {n  }    }
           {OVERLAY         }
           {REGRESSION      }
  [/TITLE='title']
  /PLOT={varlist} [WITH varlist [(PAIR)] [BY varname] [;varlist...]]
        {ALL    }
  [/PLOT=...]
```

PROCESS IF

```
PROCESS IF [(]variable (relational operator) value[)]
```

Relational Operators:

EQ or = NE or ~= or <>
LT or < LE or <=
GT or > GE or >=

RECODE

Numeric Recodes:

```
RECODE varlist (value list=value)...(value list=value)
       [/varlist...]
```

Input keywords available for numeric recodes are:

LO LOWEST HI HIGHEST THRU MISSING SYSMIS ELSE

Output keywords available for numeric recodes are:

SYSMIS

String Recodes:

```
RECODE varlist ('string',['string'...]='string')
      [varlist...]
```

Input keywords available for string recodes are:

ELSE

REGRESSION

```
REGRESSION VARIABLES={varlist  }
                     {ALL      }
                     {(COLLECT)}
  [/STATISTICS=[DEFAULTS**] [R] [COEFF] [ANOVA] [OUTS]
               [ZPP] [CHA] [CI] [F] [BCOV] [SES] [TOL]
               [COND] [XTX] [HISTORY] [END] [LINE] [ALL]]
  [/CRITERIA=[DEFAULTS**] [TOLERANCE({0.01 })] [MAXSTEPS({2v})]
                                     {value}            {n }
            [{PIN({0.05 })}]     [{POUT({0.1  })}]
             {    {value }}      {     {value }}
             {FIN({3.84  })}     {FOUT({2.71  })}
             {    {value }}      {     {value }}
  [/{NOORIGIN**}]
    {ORIGIN    }
  /DEPENDENT=varlist
  /[METHOD=]{STEPWISE [= varlist]    } [/METHOD=...]
            {FORWARD [=varlist]      }
            {BACKWARD [=varlist]     }
            {ENTER [=varlist]        }
            {REMOVE=varlist          }
            {TEST=(varlist) (varlist)}
  [/DESCRIPTIVES={DEFAULTS} {MEAN] [STDDEV] [CORR]
                 {VARIANCE} {XPROD] [SIG] [N] [BADCORR]
                 {COV]      {ALL]  {NONE**]}
  [/SELECT={ALL**                  }]
           {varname relation value}
  [/MISSING={LISTWISE**      } [INCLUDE]]
            {PAIRWISE        }
            {MEANSUBSTITUTION}
  [/WIDTH={value on SET**}]
          {n             }
```

REGRESSION: Matrix Materials

```
REGRESSION [READ={DEFAULTS} {MEAN] [STDDEV]
                 {VARIANCE} {CORR} [N]]
                            {COV  }
  [/WRITE=[DEFAULTS] [MEAN] [STDDEV]
          [VARIANCE] [CORR] [COV]
          [N] [NONE**]]
 /VARIABLES=varlist/DEPENDENT=varlist/METHOD=method
```

REGRESSION: Residuals

```
REGRESSION  VARIABLES=varlist/ DEPENDENT=varname/ METHOD=method
  [/RESIDUALS=[DEFAULTS] [DURBIN]
       [OUTLIERS({ZRESID   })] [ID (varname)]
                 {tempvarlist}
       [NORMPROB({ZRESID   })] [HISTOGRAM({ZRESID   })]
                 {tempvarlist}            {tempvarlist}
       [SIZE({SMALL})] [{SEPARATE}]]
             {LARGE}   {POOLED  }
  [/CASEWISE=[DEFAULTS] [{OUTLIERS({3    })}]]
                         {       {value}}
                         {ALL           }
            [PLOT({ZRESID })] [{DEPENDENT PRED RESID}]]
                  {tempvar}   {tempvarlist          }
  [/SCATTERPLOT=(varname,*tempvarname)... [SIZE({SMALL})]]
                                               {LARGE}
  [/PARTIALPLOT=[{ALL                 }] [SIZE({SMALL})]]
                 {varname,varname,....}        {LARGE}
  [/SAVE=tempvar(newname) [tempvar(newname)... ]]
```

Temporary residual variables are:

PRED ADJPRED SRESID MAHAL RESID ZPRED SDRESID
COOK DRESID ZRESID SEPRED LEVER

REPORT

```
REPORT
 [FORMAT=[TSPACE({1})] [CHDSPACE({1})]
                 {n}             {n}
       [BRKSPACE({1})] [FTSPACE({1})]
                 {n}             {n}
       [LENGTH({SET length})] [MARGINS({SET width})]
               {n,n         }          {n,n       }
       [{NOLIST   }] [SUMSPACE({1})]
        {LIST[(n)]}            {n}
       [MISSING {'.'}]]
                {'s'}

[/STRING=stringname ([varname] [(width)] [(BLANK)]
        ['string']...)[stringname...]]

/VARIABLES={var          } [({VALUE})] ['col head'] [(width)]
           {var TO var   }   {LABEL}
                             {DUMMY}
            [(OFFSET({0})]] [var...]
                    {n}

[/MISSING={VAR             }]
          {NONE            }
          {LIST(varlist{1})}
                       {n}

[/TITLE='line1' 'line2'...] [/FOOTNOTE='line1' 'line2'...]
        or                          or
[/LTITLE='line1' 'line2'...] [/LFOOTNOTE='line1' 'line2'...]
[/CTITLE='line1' 'line2'...] [/CFOOTNOTE='line1' 'line2'...]
[/RTITLE='line1' 'line2'...] [/RFOOTNOTE='line1' 'line2'...]
/BREAK=varlist [({VALUE})] ['col head'] [(width)]
               {LABEL}

      [OFFSET({0})] [({NOTOTAL})]
              {n}   {TOTAL  }
      [({NONAME})] [({SKIP({1})})]
        {NAME  }   {       {n} }
                   {PAGE       }
```

or

```
/BREAK=(NOBREAK) [(width)] [(OFFSET({0}))][(SKIP({1}))]
                           {n}            {n}

[/SUMMARY=function...['summary title'][(break col #)]

          [SKIP({0})]]
                {n}
```

or

```
[/SUMMARY=PREVIOUS[(n)]]
```

where function is

```
aggregate [(varname[(d)][({PLAIN  })] [varname...])]
                         {DOLLAR}
                         {COMMA  }
```

or

```
composite(agg(varname)...)[(report col[(d)][({PLAIN  })])]
                                           {DOLLAR}
                                           {COMMA  }
```

Aggregate Functions:

VALIDN	VARIANCE	PCGT(n)
SUM	KURTOSIS	PCLT(n)
MIN	SKEWNESS	PCIN(min,max)
MAX	MEDIAN(min,max)	ABFREQ(min,max)
MEAN	MODE(min,max)	RELFREQ(min,max)
STDEV		

Composite Functions:

DIVIDE(agg(varname) agg(varname) [factor])
PCT(agg(varname) agg(varname))
SUBTRACT(agg(varname) agg(varname))
ADD(agg(varname) agg(varname)...)
GREAT(agg(varname) agg(varname)...)
LEAST(agg(varname) agg(varname)...)
AVERAGE(agg(varname) agg(varname)...)
MULTIPLY(agg(varname) agg(varname)...)

REVIEW

```
REVIEW [{LOG                    }]
       {LISTING                 }
       {BOTH                    }
       {'filename' ['filename']}
```

SAMPLE

```
SAMPLE {sampling fraction          }
       {sample size FROM file size}
```

SAVE.

```
SAVE [OUTFILE={SPSS.SYS**}] [/DROP=varlist]
              {'filename'}

 [/{COMPRESSED  }]
   {UNCOMPRESSED}
   {QUICK       }
```

SELECT IF

```
SELECT IF  (logical expression)
```

Relational Operators:

EQ or =	Equal to	NE or ~= or <>	Not equal to
LT or <	Less than	LE or <=	Less than or equal to
GT or >	Greater than	GE or >=	Greater than or equal to

Logical Operators:

AND or & OR or | NOT or ~

Missing-Value Functions:

SYSMIS	Returns 1 (true) if value is system-missing
MISSING	Returns 1 (true) if value is system- or user-missing
VALUE	Returns the value itself, ignoring user-missing flags

SET

```
SET [SCREEN={ON }]/  [PRINTER={OFF}]/  [LISTING={SPSS.LIS  }]/
           {OFF}             {ON }              {ON       }
                                                {OFF      }
                                                {'filename'}

    [LENGTH={24}]/  [WIDTH={79     }]/  [EJECT={OFF}]/
           {n }            {132    }           {ON }
                           {n      }
                           {NARROW }
                           {WIDE   }

    [LOG={SPSS.LOG  }]/  [RESULTS={'SPSS.PRC'}]/
         {ON        }              {'filename'}
         {OFF       }
         {'filename'}

    [HISTOGRAM={'■'   }]/  [BLOCK={'■'   }]/
               {'char'}           {'char'}

    [BOXSTRING={'-+++++++++'}]/  [PTRANSLATE={ON }]/
               {'11 char'   }                {OFF}
               {' 3 char'   }

    [INCLUDE={ON }]/  [ECHO={OFF}]/
             {OFF}          {ON }

    [PROMPT={'SPSS/PC:'}]/  [CPROMPT={'     :'}]/  [MORE={ON }]/
            {'string'  }             {'string' }          {OFF}

    [ENDCMD={'.'   }]/  [NULLINE={ON }]/  [BEEP={ON }]/
            {'char'}             {OFF}           {OFF}

    [COLOR={(7,1,1)  }]/  [RCOLOR={(1,2,4)  }]/
           {ON       }             {(a,b[,c])}
           {OFF      }
           {(a,b[,c])}

    [COMPRESS={OFF}]/  [WORKDEV=device]/
              {ON }

    [BLANKS={'.'     }]/  [SEED={RANDOM}]/
            {real num}          {number}
```

When SCREEN is OFF, the following defaults are in effect:

```
LENGTH=59  EJECT=ON
BOXSTRING='-+++++++++'  HISTOGRAM='X'  BLOCK='X'
```

SHOW

```
SHOW
```

SORT

```
SORT CASES [BY] varlist [({A})] [varlist...]
                          {D}
```

SPSS MANAGER

```
SPSS MANAGER {REMOVE  =procedure-name [;procedure-name...]}
             {INSTALL =procedure-name [;procedure-name...]}
             {STATUS [=procedure-name [;procedure-name...]}]

        [/{CONFIRM  }]
          {NOCONFIRM}
        [/FROM={'device or path specification'}]
               {'A:'                          }
```

SUBTITLE

```
SUBTITLE [{'}] text [{'}]
         {"}        {"}
```

TITLE

```
TITLE [{'}] text [{'}]
      {"}        {"}
```

T-TEST

Independent Samples:

```
T-TEST GROUPS=varname [({1,2       })] /VARIABLES=varlist
                       {value     }
                       {value,value}
      [/OPTIONS=option numbers]
```

Paired Samples:

```
T-TEST PAIRS=varlist [WITH varlist] [/[PAIRS=] varlist ...]
      [/OPTIONS=option numbers]
```

Options:

1	Include user-missing values	3	Suppress variable labels
2	Exclude missing values listwise	5	Special pairing for WITH

VALUE LABELS

```
VALUE LABELS  varlist value 'label' value 'label' ...
             [/varlist ...]
```

VARIABLE LABELS

```
VARIABLE LABELS  varlist 'label' [[/]varname ...]
```

WEIGHT

```
WEIGHT  {BY varname}
        {OFF       }
```

WRITE

```
WRITE [VARIABLES={ALL**  }]
                 {varlist}
  [/CASES={FROM {1**}] [TO {eof**}]
          {n    }        {n    }
        [BY {1**}]]
            {n  }
  [/FORMAT={UNNUMBERED**}] [{WRAP**}] [WEIGHT]]
           {NUMBERED    }  {SINGLE}
```

SPSS inc.
444 N. Michigan Avenue
Chicago, Illinois 60611
312/329-2400