Data Sheet of weight of Boys of 2-0 to 3-0 age-range for Trend Analysis

APPENDIX 6

›cts	Age-points 2-0	2-3	2-6	2-9	3-0	ΣX_s	$(\Sigma X_s)^2$	P_1	P_1^2	P_2	P_2^2	P_3	P_3^2	P_4	P_4^2
1	12.5	12.5	13.5	14.0	14.5	67	1489.0	5.5	30.25	0.5	00.25	-1.0	1.00	2.0	04.00
2	11.0	11.5	12.5	13.0	13.5	61.5	3782.25	6.5	42.25	-0.5	00.25	-0.5	0.25	1.5	02.25
3	9.0	9.5	10.5	9.5	10.5	49.0	2401.0	3.0	09.00	-1.0	1.00	1.5	2.25	6.5	42.25
4	9.0	9.5	10.0	10.5	11.0	50.0	2500.0	7.0	49.00	0.00	0.00	0.00	0.00	0.00	0.00
5	10.5	11.0	11.5	12.0	13.0	58	3364.0	6.0	36.00	1.0	1.00	0.5	0.25	0.5	0.25
6	11.5	11.5	12.0	12.5	13.0	60.5	3660.25	4.0	16.00	1.0	1.00	-0.5	0.25	0.5	0.25
7	9.5	9.5	11.0	10.5	11.0	51.5	2652.25	4.0	16.00	-1.0	1.00	-0.5	0.25	6.5	42.25
8	6.5	8.5	8.5	8.5	9.5	41.5	1722.25	6.0	36.00	-2.0	4.00	3.0	9.00	-1.0	1.00
9	9.0	10.0	10.0	11.0	10.5	50.5	2550.25	4.0	16.00	-2.0	4.00	-0.5	0.25	-4.5	20.25
10	10.5	10.5	11.5	11.5	12.0	56	3136.0	4.0	16.00	0.0	0.00	-0.5	0.25	3.5	12.25
11	9.5	10.0	10.5	10.5	11.0	51.5	2652.25	3.5	12.25	-0.5	0.25	0.5	0.25	1.5	2.25
12	10.5	11.5	11.5	12.0	12.0	57.5	3306.25	3.5	12.25	-1.5	2.25	0.5	0.25	-2.5	6.25
13	12.5	13.5	13.5	14.0	14.5	68	4624.0	4.5	20.25	-0.5	0.25	1.0	1.00	-2.0	4.00
14	7.5	8.5	9.0	9.0	10.0	44	1936.0	5.5	30.25	-0.5	0.25	1.5	2.25	1.5	2.25
15	9.5	10.5	11.0	11.0	11.5	54 0	2916.0	4.5	20.26	-1.5	2.25	1.0	1.00	1.0	1.00
16	9.0	9.5	9.5	10.0	10.5	48.5	2352.25	3.5	12.25	0.5	0.25	0.5	0.25	-1.5	2.25
17	10.5	10.8	11.1	11.9	12.5	56.8	3226.24	5.1	26.01	1.1	1.21	-0.2	0.04	-1.2	1.44
18	12.5	13.0	13.5	14.0	14.0	67.0	4489.0	4.0	16.00	-1.0	1.00	-0.5	0.25	-0.5	0.25
19	11.0	11.5	11.5	12.0	12.5	58.5	3422.25	3.5	12.25	0.5	0.25	0.5	0.25	-1.5	2.25
20	10.5	11.5	12.0	12.5	13.5	60.0	3600.0	7.0	49.00	0.0	0.0	1.0	1.00	0.0	0.0
21	9.5	12.0	11.0	12.0	13.0	57.5	3306.25	7.0	49.00	1.0	1.00	3.5	12.25	-7.5	56.25
22	9.5	10.0	10.5	11.5	11.5	53.0	2809.0	5.5	30.25	-0.5	0.25	-1.0	1.00	-2.0	4.00
23	11.5	12.0	12.0	12.0	12.0	59.5	3540.25	1.0	1.00	1.0	1.00	0.5	0.25	-0.5	0.25
24	11.5	11.5	11.5	13.0	12.5	60.0	3600	3.5	12.25	0.5	0.25	-2.0	4.00	-5.0	25.00
25	9.5	10.0	10.5	11.5	11.5	53	2809.0	5.5	30.25	-0.5	0.25	-1.0	1.00	-2.0	4.00
26	11.0	11.5	11.5	12.0	12.0	58	3364.0	2.5	6.25	-0.5	0.25	0.0	0.0	-2.0	4.00
27	10.5	10.0	11.0	10.5	12.0	54	2916.0	3.5	12.25	2.5	6.25	0.5	0.25	6.5	42.25
28	11.0	11.5	11.0	11.5	12.0	57	3249.0	2.0	4.0	1.0	1.00	1.0	1.00	-3.0	9.0
29	9.5	9.5	11.0	11.5	12.0	53.5	2862.25	7.0	49.0	0.0	0.0	-1.5	2.25	3.5	12.25
Total	295.5	31[illegible]	324.1	334.9	349.0	1615.8	91237.24	132.[illegible]	671.51	-2.9	30.71	7.3	42.29	-1.7	303.69
	ΣX_{A1}	ΣX_{A2}	ΣX_{A3}	ΣX_{A4}	ΣX_{A5}	ΣX	$\Sigma(\Sigma X_s)^2$	ΣP_1	$\Sigma(\Sigma P_1)^2$	ΣP_2	$\Sigma(\Sigma P_2)^2$	ΣP_3	$\Sigma(\Sigma P_3)^2$	ΣP_4	$\Sigma(\Sigma P_4)^2$

$(\Sigma X_{A1})^2 = 87320.25$; $(\Sigma X_{A2})^2 = 97531.29$; $(\Sigma X_{A3})^2 = 105040.81$; $(\Sigma X_{A4})^2 = 112158.01$;

$(\Sigma X_{A5})^2 = 121801.00$.

$N = 145$ $n_s = 29$ $N_A = 5$ $\Sigma X = 1615.8$ $(\Sigma X)^2 = 2610809.64$ $\Sigma X^2 = 18420.00$

$\Sigma(\Sigma X_s)^2 = 91237.24$ $\Sigma(\Sigma X_A)^2 = 523851.36$

Values of Orthogonal Polynomials (ϕ) for Trend Analysis

Poly. Coef.	Age stages 2 - 0	2 - 3	2 - 6	2 - 9	3 - 0	$\Sigma\phi^2$
1	-2	-1	0	1	2	10
2	2	-1	-2	-1	2	14
3	-1	2	0	-2	1	10
4	1	-4	6	-4	1	70

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Appendix - 6 Contd.

Procedure for Analysis

(1) First treat the above data as if in a 5 x 29 factorial design : age-points x Subjects, each score of one observation forming a cell i.e. with a total N = 5 x 29 = 145 and subject these data to the statistical technique of analysis of variance. Thus, the following values would be computed as per procedure of analysis of variance.

(i) $\Sigma X = 1615.80$

(ii) $C = (\Sigma X)^2/N = 1615.8^2/145 = 18005.51$

(iii) $\Sigma X^2 = 18420.00$

(iv) SS Total $= \Sigma X^2 - C = 18420.00 - 18005.51 = 414.49$

(v) SS Age $= (\Sigma X_{A1})^2 + \ldots\ldots + (\Sigma A_s)^2 - C$

$= (295.5)^2 + \ldots\ldots + (349.0)^2 - 18005.51$

$= 18063.84 - 18005.51$

$= 58.33$

(vi) SS Sub. $= (\Sigma X_{S1})^2 + \ldots\ldots + (\Sigma X_{S29})^2 - C$

$= (67.0)^2 + \ldots\ldots + (53.5)^2 - 18005.51$

$= 18247.45 - 18005.51$

$= 241.94$

(vii) $SS_{A \times S} = SS_T - SS_A - SS_s$

(error term in this case) $= 414.49 - 58.33 - 241.94$

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(2) Next, compute the following values of polynomials :

(i) P1, P2, P3, P4 where $P_1 = (\Sigma X_i \phi_i)$

i.e. multiply each of five scores of a subject by respective value of ϕ at that stage and summate these five products e.g. separately for each subject.

e.g.

P_1 for subject no. 1 =

$(-2)(12.5)+(-1)(12.5)+(0)(13.5)+(+\frac{1}{2})(14.0)+(+2)(14.5)$

$= -25.0 - 12.5 + 0 + 14.0 + 29.0 = 5.5$

and so on for other subjects.

Similarly, P_2 for subject no. 1 =

$(+2)(12.5)+(-1)(12.5)+(-2)(13.5)+(-1)(14.0)+(+2)(14.5)$

$= 25.0 - 12.5 - 27.0 - 14.0 + 29.0 = 0.5$

and so on for other subjects.

P_3 for subject no. 1 =

$(-1)(12.5)+(+2)(12.5)+(0)(13.5)+(-2)(14.0)+(+1)(14.5)$

$= -12.5 + 15.0 + 0 - 28.0 + 14.5 = 1.0$

and so on for other subjects.

P_4 for subject no. 1 =

$(+1)(12.5)+(-4)(12.5)+(+6)(13.5)+(-4)(14.0)+(+1)(14.5)$

$= 12.5 - 50.0 + 81.0 - 56.0 + 14.5 = 2.0$

and similarly for other subjects.

All these values are entered into column under P_1, P_2, P_3,

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and P_4 in data sheet for each subject. These values for each subject are squared and entered under respective columns P_1^2, P_2^2, P_3^2, and P_4^2 in data sheet. Values in each of columns are summated and entered under appropriate row at end. Thus, is prepared the whole data sheet.

(3) Next the following values for trend analysis are computed thus :

(i) $U_y = \Sigma X^2 = 18420.00$ ....(as in SS_{Tot})

(ii) $U_I = (\Sigma X_{S1})^2 + \ldots\ldots + (\Sigma X_{S29})^2 / n_s$

$= (67.0)^2 + \ldots\ldots + (53.5)^2 / 5$

$= 18247.45$ ......(As in SS_{sub}).

(iii) $U_{P_1} = (P_{1.1})^2 + (P_{1.2})^2 + \ldots\ldots + (P_{1.29})^2 / \phi_1^2$

$= (5.5)^2 + \ldots\ldots (7.0)^2 / 10 = 671.51/10 = 67.151$

(iv) $U_{P_2} = (P_{2.1})^2 + (P_{2.2})^2 + \ldots\ldots (P_{2.29}) / \phi_2^2$

$= (0.5)^2 + \ldots\ldots + (0.0)^2 / 14 = 30.71/14 = 2.19$

(v) $U_{P_3} = (P_{3.1})^2 + (P_{3.2})^2 + \ldots (P_{3.29})^2 / \phi_3^2$

$= 42.19/10 = 4.219$

(vi) $U_{P_4} = (P_{4.1})^2 + (P_{4.2})^2 + \ldots (P_{4.29})^2 / \phi_4^2$

$= 303.69/70 = 4.338$

(vii) $W_y = (\Sigma X_{A_1})^2 + \ldots\ldots (\Sigma X_{A_s})^2 / n_a$

$= (295.5)^2 + \ldots\ldots (349.0)^2 / 29$

$= 523851.36/29 = 18063.84$ ...(as in SS_{Age})

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(viii) $W_I = (\Sigma X)^2/N = (1615.8)^2/145 = 2610809.64/145$
$= 18005.51$ .....(Same as correction term).

(ix) $W_{P_1} = (\Sigma P_1)^2/n_s \phi_1^2 = (132.1)^2/29 \times 10$
$= 17450.41/290 = 60.17.$

(x) $W_{P_2} = (\Sigma P_2)^2/n_s \phi_2^2 = (-2.9)^2/29 \times 14$
$= 8.41/406 = 0.21.$

(xi) $W_{P_3} = (\Sigma P_3)^2/n_s \phi_3^2 = (7.3)^2/29 \times 10$
$= 53.29/290 = 0.13.$

(xii) $W_{P_4} = (\Sigma P_4)^2/n_s \phi_4^2 = (-1.7)^2 \times 29 \times 70$
$= 1.89/2030 = 0.001.$

(4) Finally, on the basis of the above values, prepare a table showing a summary of results of enalysis of variance (including significance of trend) (see Table 5.7).