

Chapter 23 Problems

1. a. From SPSS Output:

Linear trend: $\hat{\Phi} = .707$, $p = .21$

Quadratic trend: $\hat{\Phi} = -1.341$, $p = .02$

There is good evidence of a quadratic trend.

b. Source	R^2	df	\bar{R}^2	F
Linear	.0661	1	.0661	1.71
Quadratic	.2379	1	.2379	6.15*
Error	$1 - R^2_{y, \max} = .6960$	$N - k - 1 = 18$.03867	

Note: R^2 's are from SPSS output; $F_{crit}(1, 18) = 4.41$; * : $p < .05$

c. Summary table is identical to (1b); see SPSS output

2. (a) Source	SS	df	MS	MSF	R^2	df	\bar{R}^2	F	(b)
Linear	117.03	1	117.03	78.99*	.395	1	.395	79.00*	
Quadratic	24.00	1	24.00	6.16*	.0811	1	.0811	6.14*	
Cubic	.06	1	.06	.05	.000190	1	.000190	.05	
Quartic	2.79	1	2.79	1.11	.00943	1	.00943	1.11	
Quintic	.04	1	.04	.01	.000136	1	.000136	.01	
Lin x S	10.37	$(1)(a-1) = 7$	1.48		.0350	7	.00500		
Quad x S	27.27	7	3.90		.0922	7	.0132		
Cub x S	7.18	7	1.03		.0243	7	.00347		
Quert x S	17.60	7	2.51		.0595	7	.00850		
Quint x S	35.32	7	5.05		.119	7	.0170		

Note: SS and R^2 are from SPSS output; $F_{crit}(1, 7) = 5.59$; * : $p < .05$

There is good evidence of linear and quadratic trends.

3. Source	R^2	df	\bar{R}^2	F
Linear	.807	1	.807	115.95*
Quadratic	.00497	1	.00497	0.71
Error	$1 - R_{y, \max}^2 = .188$	$N - k - 1 = 27$.00696	

Note: R_s^2 are from SPSS output; $F_{crit}(1, 27) = 4.23$; * : $p < .05$

There is good evidence of a linear trend.

Univariate Analysis of Variance

Descriptive Statistics

Dependent Variable: Number of errors

Pieces of candy received	Mean	Std. Deviation	N
5	5.00	1.414	7
10	7.14	1.069	7
15	6.00	1.732	7
Total	6.05	1.627	21

Tests of Between-Subjects Effects

Dependent Variable: Number of errors

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	16.095 ^a	2	8.048	3.930	.038	.304
Intercept	768.048	1	768.048	375.093	.000	.954
group	16.095	2	8.048	3.930	.038	.304
Error	36.857	18	2.048			
Total	821.000	21				
Corrected Total	52.952	20				

a. R Squared = .304 (Adjusted R Squared = .227)

Custom Hypothesis Tests

Contrast Results (K Matrix)

		Dependent Variable
Pieces of candy received Polynomial Contrast ^a		Number of errors
Linear	Contrast Estimate	.707
	Hypothesized Value	0
	Difference (Estimate - Hypothesized)	.707
	Std. Error	.541
	Sig.	.208
	95% Confidence Interval for Difference	Lower Bound Upper Bound
Quadratic	Contrast Estimate	-1.341
	Hypothesized Value	0
	Difference (Estimate - Hypothesized)	-1.341
	Std. Error	.541
	Sig.	.023
	95% Confidence Interval for Difference	Lower Bound Upper Bound

a. Metric = 1.000, 2.000, 3.000

Regression - Orthogonal polynomial vectors

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.257 ^a	.066	.017	1.613
2	.551 ^b	.304	.227	1.431

Model Summary

Model	Change Statistics				
	R Square Change	F Change	df1	df2	Sig. F Change
1	.066	1.345	1	19	.261
2	.238	6.151	1	18	.023

a. Predictors: (Constant), v1

b. Predictors: (Constant), v1, v2

Regression - Powered vectors

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.257 ^a	.066	.017	1.613
2	.551 ^b	.304	.227	1.431

Model Summary

Model	Change Statistics				
	R Square Change	F Change	df1	df2	Sig. F Change
1	.066	1.345	1	19	.261
2	.238	6.151	1	18	.023

a. Predictors: (Constant), x

b. Predictors: (Constant), x, x2

General Linear Model

Descriptive Statistics

	Mean	Std. Deviation	N
Test score (Time 1)	6.13	1.458	8
Test score (Time 2)	4.63	2.387	8
Test score (Time 3)	2.50	1.512	8
Test score (Time 4)	1.63	2.669	8
Test score (Time 5)	1.75	1.581	8
Test score (Time 6)	1.63	1.408	8

Tests of Within-Subjects Contrasts

Measure: score

Source	time	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
time	Linear	117.029	1	117.029	78.986	.000	.919
	Quadratic	24.001	1	24.001	6.160	.042	.468
	Cubic	.056	1	.056	.055	.822	.008
	Order 4	2.790	1	2.790	1.110	.327	.137
	Order 5	.040	1	.040	.008	.931	.001
Error(time)	Linear	10.371	7	1.482			
	Quadratic	27.272	7	3.896			
	Cubic	7.183	7	1.026			
	Order 4	17.603	7	2.515			
	Order 5	35.321	7	5.046			

Regression - Linear trend

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.629 ^a	.395	.382	1.972

a. Predictors: (Constant), a1

Regression - Quadratic trend

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.285 ^a	.081	.061	2.431

a. Predictors: (Constant), a2

Regression - Cubic trend

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.014 ^a	.000	-.022	2.536

a. Predictors: (Constant), a3

Regression - Quartic trend

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.097 ^a	.009	-.012	2.524

a. Predictors: (Constant), a4

Regression - Quintic trend

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.012 ^a	.000	-.022	2.536

a. Predictors: (Constant), a5

Regression - Linear x S

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.187 ^a	.035	-.134	2.672

a. Predictors: (Constant), a1s7, a1s4, a1s6, a1s3, a1s1, a1s5, a1s2

Regression - Quadratic x S

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.304 ^a	.092	-.067	2.592

a. Predictors: (Constant), a2s7, a2s6, a2s5, a2s4, a2s1, a2s3, a2s2

Regression - Cubic x S

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.156 ^a	.024	-.146	2.687

a. Predictors: (Constant), a3s7, a3s5, a3s6, a3s4, a3s3, a3s1, a3s2

Regression - Quartic x S

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.244 ^a	.059	-.105	2.638

a. Predictors: (Constant), a4s7, a4s1, a4s6, a4s5, a4s4, a4s3, a4s2

Regression - Quintic x S

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.345 ^a	.119	-.035	2.552

a. Predictors: (Constant), a5s7, a5s6, a5s5, a5s1, a5s4, a5s3, a5s2

Regression - Problem 3

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.899 ^a	.807	.801	.866
2	.901 ^b	.812	.799	.870

Model Summary

Model	Change Statistics				
	R Square Change	F Change	df1	df2	Sig. F Change
1	.807	117.413	1	28	.000
2	.005	.715	1	27	.405

a. Predictors: (Constant), Spelling test score

b. Predictors: (Constant), Spelling test score, spelling2