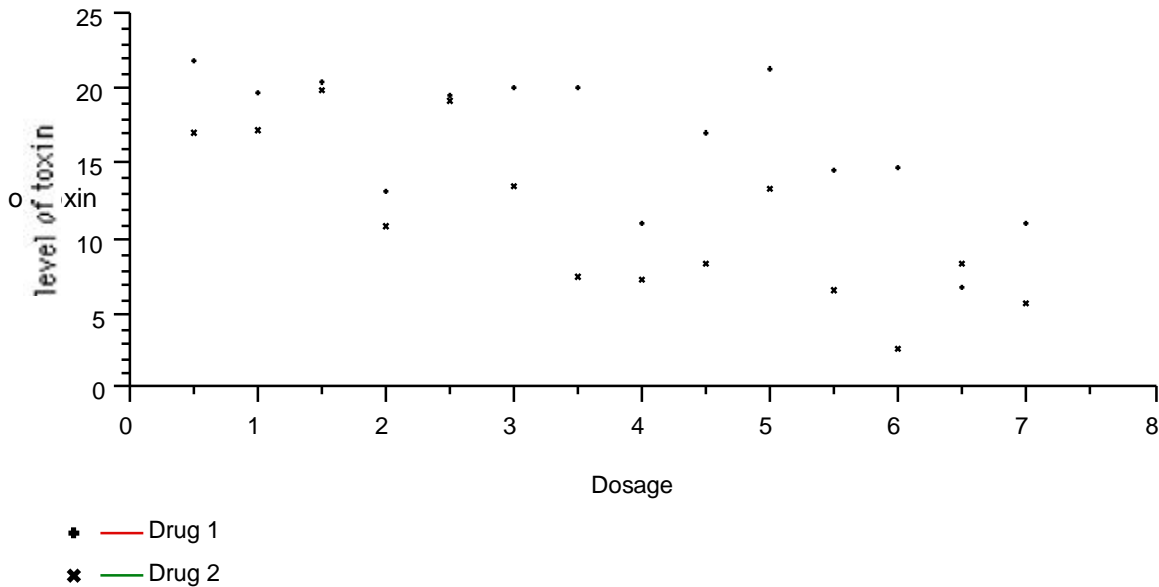


**FINAL EXAM
STAT 461
Fall 1995**

NAME _____

1. A pathologist is studying the effect of two drugs on the level of certain toxin. He runs an experiment using the two drugs at various dosages (in mg) on 28 homogeneous rats (14 rats per drug). The level of toxin (in mg per cubic cm) observed per rat after three hours is plotted in the following figure.



The following are results of two models fitted to these data.

Model 1:

Response: level of toxin

Summary of Fit

RSquare	0.415321
RSquare Adj	0.392833
Root Mean Square Error	4.448483
Mean of Response	13.86503
Observations (or Sum Wgts)	28

Lack of Fit

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob> t
Intercept	20.586852	1.775723	11.59	0.0000
Dosage	-1.792487	0.417096	-4.30	0.0002

Effect Test

Source	Nparm	DF	Sum of Squares	F Ratio	Prob>F
Dosage	1	1	365.47978	18.4688	0.0002

Model 2:

Response: level of toxin

Summary of Fit

RSquare	0.637192
RSquare Adj	0.608167
Root Mean Square Error	3.573619
Mean of Response	13.86503
Observations (or Sum Wgts)	28

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob> t
Intercept	20.586852	1.426499	14.43	0.0000
Dosage	-1.792487	0.335068	-5.35	0.0000
Drug[Drug 1-Drug 2]	2.6406521	0.675351	3.91	0.0006

Effect Test

Source	Nparm	DF	Sum of Squares	F Ratio	Prob>F
Dosage	1	1	365.47978	28.6185	0.0000
Drug	1	1	195.24521	15.2885	0.0006

a) Write out the estimated model for Model 1 and interpret the slope. (5 p)

b) Obtain the correlation between level of toxin and dosage and test its significance. (5 p)

c) The pure error sum of squares is 318.514. Conduct a test for lack of fit. (10 p)

d) Write out the estimated model for the second model fitted and interpret the coefficients (The variable Drug was coded 1 for Drug 1 and 0 for Drug 2). (10p)

e) Plot the last model in the figure above. (5 p)

f) Which of the two drugs seems to be more effective in reducing the level of toxin and by how much? (5 p)

g) The interaction term was added to the model and the coefficient of determination was $R^2 = 0.6498$. Is the interaction significant? (5 p)

2. An experiment was conducted to investigate the effect of pressure and temperature on the strength of certain material. At different settings of the two factors, a sample of material was subjected to a stress test and whether it failed ($y = 1$) or not ($y = 0$) was recorded. The results of the analysis in JMP follow (The probability being modeled is $P[Y = 0]$).

Response: Response

Iteration History

Converged by Objective

Whole-Model Test

Model	-LogLikelihood	DF	ChiSquare	Prob>ChiSq
Difference	12.133766	2	24.26753	0.000005
Full	14.886152			
Reduced	27.019918			
RSquare (U)		0.4491		
Observations (or Sum Wgts)		39		

Lack of Fit

Parameter Estimates

Term	Estimate	Std Error	ChiSquare	Prob>ChiSq
Intercept	9.52925907	3.2330834	8.69	0.0032
Pressure	-3.8820066	1.4285624	7.38	0.0066
Temperature	-2.6490359	0.9141912	8.40	0.0038

Effect Test

Source	Nparm	DF	Wald ChiSquare	Prob>ChiSq
Pressure	1	1	7.3843812	0.0066
Temperature	1	1	8.3965652	0.0038

a) Comment about the results of the whole-model test and the individual contributions of the two factors. (10 p)

b) Write the estimated model. (5 p)

c) Interpret the coefficients of the two factors. In particular, determine whether the pressure and temperature should be increased or decreased in order to increase the strength of the material. (5 p)

d) Estimate the probability of failure for levels of 2.25 and 1.05 for pressure and temperature, respectively. (5 p)