Categorical Data Analysis
Lab material #5-1

```
* ANTIBIOTIC DATA;
data antibiotic;
input treatment $ reaction $ count;
cards;
uremic yes 38
uremic no 62
normal yes 21
normal no 79
;
run;

proc genmod data=antibiotic order=data;
class treatment reaction;
model count=treatment reaction/dist=poisson link=log;
run;
proc genmod data=antibiotic order=data;
class treatment reaction;
model count=treatment|reaction/dist=poisson link=log;
run;
```

Output 1 Results

The GENMOD Procedure

Model Information

Data Set	WORK.ANTIBIOTIC
Distribution	Poisson
Link Function	Log
Dependent Variable	count

Number of Observations Read	4
Number of Observations Used	4

Class Level Information

Class	Levels	Values
treatment	2	uremic normal
reaction	2	yes no

Criteria For Assessing Goodness Of Fit

Criterion	DF	Value	Value/DF
Deviance	1	7.0231	7.0231
Scaled Deviance	1	7.0231	7.0231
Pearson Chi-Square	1	6.9479	6.9479
Scaled Pearson X2	1	6.9479	6.9479
Log Likelihood		599.7204	
Full Log Likelihood		-14.7852	
AIC (smaller is better)		35.5704	
AICC (smaller is better)		.	

BIC (smaller is better)	33.7293

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates

Parameter		DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept		1	4.2556	0.1100	4.0401	4.4711	1497.68	<.0001
treatment	uremic	1	-0.0000	0.1414	-0.2772	0.2772	0.00	1.0000
treatment	normal	0	0.0000	0.0000	0.0000	0.0000	.	.
reaction	yes	1	-0.8712	0.1551	-1.1751	-0.5673	31.57	<.0001
reaction	no	0	0.0000	0.0000	0.0000	0.0000	.	.
Scale		0	1.0000	0.0000	1.0000	1.0000		

NOTE: The scale parameter was held fixed.

The GENMOD Procedure

Model Information

Data Set	WORK.ANTIBIOTIC
Distribution	Poisson
Link Function	Log
Dependent Variable	count

Number of Observations Read	4
Number of Observations Used	4

Class Level Information

Class	Levels	Values
treatment	2	uremic normal
reaction	2	yes no

Criteria For Assessing Goodness Of Fit

Criterion	DF	Value	Value/DF
Deviance	0	0.0000	.
Scaled Deviance	0	0.0000	.
Pearson Chi-Square	.	0.0000	.
Scaled Pearson X2	.	0.0000	.
Log Likelihood		603.2320	
Full Log Likelihood		-11.2737	
AIC (smaller is better)		30.5473	
AICC (smaller is better)		.	
BIC (smaller is better)		28.0925	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates

Parameter			DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square
Intercept			1	4.3694	0.1125	4.1489	4.5900	1508.27
treatment	uremic		1	−0.2423	0.1697	−0.5749	0.0902	2.04
treatment	normal		0	0.0000	0.0000	0.0000	0.0000	.
reaction	yes		1	−1.3249	0.2455	−1.8061	−0.8437	29.12
reaction	no		0	0.0000	0.0000	0.0000	0.0000	.
treatment*reaction	uremic	yes	1	0.8354	0.3205	0.2072	1.4636	6.79
treatment*reaction	uremic	no	0	0.0000	0.0000	0.0000	0.0000	.
treatment*reaction	normal	yes	0	0.0000	0.0000	0.0000	0.0000	.
treatment*reaction	normal	no	0	0.0000	0.0000	0.0000	0.0000	.
Scale			0	1.0000	0.0000	1.0000	1.0000	

Analysis Of Maximum Likelihood Parameter Estimates

Parameter			Pr > ChiSq
Intercept			<.0001
treatment	uremic		0.1532
treatment	normal		.
reaction	yes		<.0001
reaction	no		.
treatment*reaction	uremic	yes	0.0091
treatment*reaction	uremic	no	.
treatment*reaction	normal	yes	.
treatment*reaction	normal	no	.
Scale			

NOTE: The scale parameter was held fixed.

```
* DRUG USE DATA;
data drug;
input parent $ student $ count;
cards;
neither never 141
neither occasion 44
neither regular 40
one never 68
one occasion 44
one regular 51
both never 17
both occasion 11
both regular 19
;
run;

proc freq data=drug order=data;
weight count;
tables parent*student / chisq;
run;

proc genmod data=drug order=data;
class parent student;
model count=parent student / dist=poisson link=log;
run;
proc genmod data=drug order=data;
class parent student;
model count=parent|student / dist=poisson link=log;
run;
```

Output 2 Results

The FREQ Procedure

Table of parent by student

parent	student			
Frequency | Percent | Row Pct | Col Pct	never	occasion	regular	Total
neither	141	44	40	225
	32.41	10.11	9.20	51.72
	62.67	19.56	17.78	
	62.39	44.44	36.36	
one	68	44	51	163
	15.63	10.11	11.72	37.47
	41.72	26.99	31.29	
	30.09	44.44	46.36	
both	17	11	19	47
	3.91	2.53	4.37	10.80
	36.17	23.40	40.43	
	7.52	11.11	17.27	
Total	226	99	110	435
	51.95	22.76	25.29	100.00

Statistics for Table of parent by student

Statistic	DF	Value	Prob
Chi-Square	4	24.4171	<.0001
Likelihood Ratio Chi-Square	4	24.3571	<.0001
Mantel-Haenszel Chi-Square	1	22.0289	<.0001
Phi Coefficient		0.2369	
Contingency Coefficient		0.2305	
Cramer's V		0.1675	

Sample Size = 435

The GENMOD Procedure

Model Information

Data Set	WORK.DRUG
Distribution	Poisson
Link Function	Log
Dependent Variable	count

Number of Observations Read	9
Number of Observations Used	9

Class Level Information

Class	Levels	Values
parent	3	neither one both
student	3	never occasion regular

Criteria For Assessing Goodness Of Fit

Criterion	DF	Value	Value/DF
Deviance	4	24.3571	6.0893
Scaled Deviance	4	24.3571	6.0893
Pearson Chi-Square	4	24.4171	6.1043
Scaled Pearson X2	4	24.4171	6.1043
Log Likelihood		1349.0959	
Full Log Likelihood		-36.7416	
AIC (smaller is better)		83.4833	
AICC (smaller is better)		103.4833	
BIC (smaller is better)		84.4694	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates

Parameter		DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept		1	2.4753	0.1675	2.1469	2.8037	218.29	<.0001
parent	neither	1	1.5660	0.1604	1.2516	1.8803	95.34	<.0001
parent	one	1	1.2436	0.1656	0.9191	1.5681	56.42	<.0001

parent	both	0	0.0000	0.0000	0.0000	0.0000	.	.
student	never	1	0.7201	0.1163	0.4922	0.9479	38.36	<.0001
student	occasion	1	-0.1054	0.1385	-0.3769	0.1662	0.58	0.4469
student	regular	0	0.0000	0.0000	0.0000	0.0000	.	.
Scale		0	1.0000	0.0000	1.0000	1.0000		

NOTE: The scale parameter was held fixed.

The GENMOD Procedure

Model Information

Data Set	WORK.DRUG
Distribution	Poisson
Link Function	Log
Dependent Variable	count

Number of Observations Read	9
Number of Observations Used	9

Class Level Information

Class	Levels	Values
parent	3	neither one both
student	3	never occasion regular

Criteria For Assessing Goodness Of Fit

Criterion	DF	Value	Value/DF
Deviance	0	0.0000	.
Scaled Deviance	0	0.0000	.
Pearson Chi-Square	.	0.0000	.
Scaled Pearson X2	.	0.0000	.
Log Likelihood		1361.2745	
Full Log Likelihood		-24.5631	
AIC (smaller is better)		67.1262	
AICC (smaller is better)		.	
BIC (smaller is better)		68.9012	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates

Parameter		DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square
Intercept		1	2.9444	0.2294	2.4948	3.3941	164.72
parent	neither	1	0.7444	0.2786	0.1983	1.2905	7.14
parent	one	1	0.9874	0.2688	0.4606	1.5142	13.50
parent	both	0	0.0000	0.0000	0.0000	0.0000	.
student	never	1	-0.1112	0.3338	-0.7656	0.5431	0.11
student	occasion	1	-0.5465	0.3789	-1.2891	0.1960	2.08
student	regular	0	0.0000	0.0000	0.0000	0.0000	.

parent*student	neither	never	1	1.3711	0.3789	0.6285	2.1137	13.10
parent*student	neither	occasion	1	0.6419	0.4373	-0.2153	1.4990	2.15
parent*student	neither	regular	0	0.0000	0.0000	0.0000	0.0000	.
parent*student	one	never	1	0.3989	0.3818	-0.3494	1.1472	1.09
parent*student	one	occasion	1	0.3989	0.4311	-0.4461	1.2439	0.86
parent*student	one	regular	0	0.0000	0.0000	0.0000	0.0000	.
parent*student	both	never	0	0.0000	0.0000	0.0000	0.0000	.
parent*student	both	occasion	0	0.0000	0.0000	0.0000	0.0000	.
parent*student	both	regular	0	0.0000	0.0000	0.0000	0.0000	.
Scale			0	1.0000	0.0000	1.0000	1.0000	

Analysis Of Maximum Likelihood
Parameter Estimates

Parameter			Pr > ChiSq
Intercept			<.0001
parent	neither		0.0075
parent	one		0.0002
parent	both		.
student	never		0.7390
student	occasion		0.1491
student	regular		.
parent*student	neither	never	0.0003
parent*student	neither	occasion	0.1422
parent*student	neither	regular	.
parent*student	one	never	0.2961
parent*student	one	occasion	0.3548
parent*student	one	regular	.
parent*student	both	never	.
parent*student	both	occasion	.
parent*student	both	regular	.
Scale			

NOTE: The scale parameter was held fixed.