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Assignment 6
April 25, 2021

1. Logistic Regression, Linear Regression or Linear Discriminant Analysis?

All three of these techniques have many applications in analyzing the relationship between the independent and dependent variable. They are similar, but there are also some key differences between them. The main factors that differ are whether the variables are metric or nonmetric, how many categories the variable can have (if they are nonmetric), and how many of each variable is allowed.

First, linear regression involves all metric variables, a single dependent variable, and multiple independent variables. The resulting regression coefficients tell you how much power or influence each of the independent variables have on the dependent variable.

Next, linear discriminant analysis involves metric independent variables and nonmetric dependent variables. Again, there can be multiple independent variables and just a single dependent variable. Additionally, since the dependent variable is nonmetric, the variable can have multiple categories. There is no limit to the number of categories. Similar to linear regression, the discriminant function gives discriminant weights for each independent variable, telling you how much power or influence each independent variable has.

Lastly, logistic regression involves metric independent variables and a nonmetric dependent variable. Unlike linear discriminant analysis, the dependent variable for logistic regression is binary and can only have two categories. Like both linear discriminant analysis and linear regression, the resulting coefficients for the independent variables tell us the influence of each on the dependent variable.

Which technique to use depends on the application. If you have all metric data, linear regression probably makes the most sense. However, it is also possible to turn metric data into nonmetric data by assigning categories to the values. If you have multiple categories in your dependent variable, you'll have to use linear discriminant analysis. If there are only two categories in your dependent variable, you have the option of using both linear discriminant analysis and logistic regression, but logistic regression is often preferred. This is because it is a more robust technique; it is less affected when certain normality assumptions are not met compared to linear discriminant analysis.

2. Results attached below.

The results of both were similar but there were slightly higher R2 values (highest being 0.6121) for the backward compared to the forward (highest being 0.5920). There was also slightly more area under the ROC curves in each step for the backward.

Model Information		
Data Set	WORK.IMPORT	
Response Variable	x4	x4
Number of Response Levels	2	
Model	binary logit	
Optimization Technique	Fisher's scoring	

Number of Observations Read	100
Number of Observations Used	100

Response Profile		
Ordered Value	**x4**	**Total Frequency**
1	0	39
2	1	61

Probability modeled is x4='1'.

Forward Selection Procedure

Step 0. Intercept entered:

Model Convergence Status
Convergence criterion (GCONV=1E-8) satisfied.

-2 Log L	=	133.750

Analysis of Maximum Likelihood Estimates					
Parameter	**DF**	**Estimate**	**Standard Error**	**Wald Chi-Square**	**Pr > ChiSq**
Intercept	1	0.4473	0.2050	4.7601	0.0291

Residual Chi-Square Test		
Chi-Square	**DF**	**Pr > ChiSq**
62.3998	10	<.0001

Analysis of Effects Eligible for Entry			
Effect	**DF**	**Score Chi-Square**	**Pr > ChiSq**
x6	1	26.5415	<.0001
x7	1	3.4428	0.0635
x8	1	3.0470	0.0809
x9	1	0.0092	0.9237
x10	1	3.7494	0.0528

Analysis of Effects Eligible for Entry			
Effect	**DF**	**Score Chi-Square**	**Pr > ChiSq**
x11	1	30.0740	<.0001
x12	1	16.1246	<.0001
x13	1	29.8781	<.0001
x14	1	2.2167	0.1365
x15	1	1.2038	0.2726

Step 1. Effect x11 entered:

Model Convergence Status
Convergence criterion (GCONV=1E-8) satisfied.

Model Fit Statistics		
Criterion	**Intercept Only**	**Intercept and Covariates**
AIC	135.750	102.699
SC	138.355	107.910
-2 Log L	133.750	98.699

R-Square	0.2957	**Max-rescaled R-Square**	0.4009

Testing Global Null Hypothesis: BETA=0			
Test	**Chi-Square**	**DF**	**Pr > ChiSq**
Likelihood Ratio	35.0502	1	<.0001
Score	30.0740	1	<.0001
Wald	22.6577	1	<.0001

Analysis of Maximum Likelihood Estimates					
Parameter	**DF**	**Estimate**	**Standard Error**	**Wald Chi-Square**	**Pr > ChiSq**
Intercept	1	7.5318	1.5387	23.9587	<.0001
x11	1	-1.1831	0.2486	22.6577	<.0001

Odds Ratio Estimates			
Effect	**Point Estimate**	**95% Wald Confidence Limits**	
x11	0.306	0.188	0.499

Association of Predicted Probabilities and Observed Responses			
Percent Concordant	83.2	**Somers' D**	0.677
Percent Discordant	15.5	**Gamma**	0.686
Percent Tied	1.3	**Tau-a**	0.325
Pairs	2379	**c**	0.839

Residual Chi-Square Test		
Chi-Square	**DF**	**Pr > ChiSq**
38.7177	9	<.0001

Analysis of Effects Eligible for Entry			
Effect	**DF**	**Score Chi-Square**	**Pr > ChiSq**
x6	1	9.8161	0.0017
x7	1	2.8646	0.0905
x8	1	1.0181	0.3130
x9	1	16.0663	<.0001
x10	1	3.5431	0.0598
x12	1	17.9196	<.0001
x13	1	12.8206	0.0003
x14	1	0.0177	0.8943
x15	1	2.7846	0.0952

Step 2. Effect x12 entered:

Model Convergence Status
Convergence criterion (GCONV=1E-8) satisfied.

Model Fit Statistics		
Criterion	**Intercept Only**	**Intercept and Covariates**
AIC	135.750	83.119
SC	138.355	90.934
-2 Log L	133.750	77.119

R-Square	0.4324	**Max-rescaled R-Square**	0.5863

Testing Global Null Hypothesis: BETA=0			
Test	**Chi-Square**	**DF**	**Pr > ChiSq**
Likelihood Ratio	56.6308	2	<.0001
Score	43.6623	2	<.0001
Wald	23.1885	2	<.0001

Analysis of Maximum Likelihood Estimates					
Parameter	**DF**	**Estimate**	**Standard Error**	**Wald Chi-Square**	**Pr > ChiSq**
Intercept	1	2.4116	1.9628	1.5096	0.2192
x11	1	-1.5173	0.3360	20.3951	<.0001
x12	1	1.3900	0.3707	14.0577	0.0002

Odds Ratio Estimates			
Effect	**Point Estimate**	**95% Wald Confidence Limits**	
x11	0.219	0.114	0.424
x12	4.015	1.941	8.303

Association of Predicted Probabilities and Observed Responses			
Percent Concordant	90.2	**Somers' D**	0.806
Percent Discordant	9.5	**Gamma**	0.809
Percent Tied	0.3	**Tau-a**	0.387
Pairs	2379	**c**	0.903

Residual Chi-Square Test		
Chi-Square	**DF**	**Pr > ChiSq**
28.2567	8	0.0004

Analysis of Effects Eligible for Entry			
Effect	**DF**	**Score Chi-Square**	**Pr > ChiSq**
x6	1	6.9973	0.0082
x7	1	10.9080	0.0010
x8	1	0.4477	0.5034
x9	1	8.6547	0.0033
x10	1	1.1844	0.2765
x13	1	4.4374	0.0352
x14	1	0.0203	0.8868
x15	1	2.8288	0.0926

Step 3. Effect x7 entered:

Model Convergence Status
Convergence criterion (GCONV=1E-8) satisfied.

Model Fit Statistics		
Criterion	Intercept Only	Intercept and Covariates
AIC	135.750	73.494
SC	138.355	83.915
-2 Log L	133.750	65.494

R-Square	0.4947	Max-rescaled R-Square	0.6707

Testing Global Null Hypothesis: BETA=0			
Test	Chi-Square	DF	Pr > ChiSq
Likelihood Ratio	68.2552	3	<.0001
Score	48.5053	3	<.0001
Wald	20.2136	3	0.0002

Analysis of Maximum Likelihood Estimates					
Parameter	DF	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq
Intercept	1	4.3503	2.2011	3.9060	0.0481
x7	1	-2.4692	0.8374	8.6934	0.0032
x11	1	-1.9459	0.4437	19.2333	<.0001
x12	1	3.3023	0.8823	14.0075	0.0002

Odds Ratio Estimates			
Effect	Point Estimate	95% Wald Confidence Limits	
x7	0.085	0.016	0.437
x11	0.143	0.060	0.341
x12	27.174	4.821	153.181

Association of Predicted Probabilities and Observed Responses			
Percent Concordant	92.9	Somers' D	0.858
Percent Discordant	7.1	Gamma	0.858
Percent Tied	0.0	Tau-a	0.412
Pairs	2379	c	0.929

Residual Chi-Square Test		
Chi-Square	DF	Pr > ChiSq
19.5429	7	0.0066

Analysis of Effects Eligible for Entry			
Effect	DF	Score Chi-Square	Pr > ChiSq
x6	1	7.7382	0.0054
x8	1	0.3925	0.5310
x9	1	10.5702	0.0011
x10	1	2.9553	0.0856
x13	1	6.6448	0.0099
x14	1	0.0169	0.8967
x15	1	1.5048	0.2199

Step 4. Effect x9 entered:

Model Convergence Status
Convergence criterion (GCONV=1E-8) satisfied.

Model Fit Statistics		
Criterion	Intercept Only	Intercept and Covariates
AIC	135.750	64.172
SC	138.355	77.197
-2 Log L	133.750	54.172

R-Square	0.5488	**Max-rescaled R-Square**	0.7441

Testing Global Null Hypothesis: BETA=0			
Test	Chi-Square	DF	Pr > ChiSq
Likelihood Ratio	79.5781	4	<.0001
Score	54.2067	4	<.0001
Wald	19.8353	4	0.0005

Analysis of Maximum Likelihood Estimates					
Parameter	DF	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq
Intercept	1	3.8776	2.4277	2.5513	0.1102
x7	1	-2.9920	0.9493	9.9339	0.0016
x9	1	1.3088	0.4518	8.3933	0.0038
x11	1	-2.9747	0.6744	19.4542	<.0001
x12	1	3.5787	1.0111	12.5275	0.0004

Odds Ratio Estimates			
Effect	Point Estimate	95% Wald Confidence Limits	
x7	0.050	0.008	0.323
x9	3.702	1.527	8.974
x11	0.051	0.014	0.192
x12	35.827	4.938	259.936

Association of Predicted Probabilities and Observed Responses			
Percent Concordant	94.7	Somers' D	0.894
Percent Discordant	5.3	Gamma	0.894
Percent Tied	0.0	Tau-a	0.430
Pairs	2379	c	0.947

Residual Chi-Square Test		
Chi-Square	DF	Pr > ChiSq
11.9947	6	0.0621

Analysis of Effects Eligible for Entry			
Effect	DF	Score Chi-Square	Pr > ChiSq
x6	1	5.7531	0.0165
x8	1	0.2646	0.6070
x10	1	2.8011	0.0942
x13	1	5.3643	0.0206
x14	1	0.0079	0.9290
x15	1	0.5725	0.4493

Step 5. Effect x6 entered:

Model Convergence Status
Convergence criterion (GCONV=1E-8) satisfied.

Model Fit Statistics		
Criterion	**Intercept Only**	**Intercept and Covariates**
AIC	135.750	60.136
SC	138.355	75.767
-2 Log L	133.750	48.136

R-Square	0.5752	**Max-rescaled R-Square**	0.7799

Testing Global Null Hypothesis: BETA=0			
Test	**Chi-Square**	**DF**	**Pr > ChiSq**
Likelihood Ratio	85.6139	5	<.0001
Score	58.3411	5	<.0001
Wald	22.3075	5	0.0005

Analysis of Maximum Likelihood Estimates					
Parameter	**DF**	**Estimate**	**Standard Error**	**Wald Chi-Square**	**Pr > ChiSq**
Intercept	1	8.0103	3.2279	6.1582	0.0131
x6	1	-0.7391	0.3285	5.0612	0.0245
x7	1	-2.9647	0.9567	9.6036	0.0019
x9	1	1.2357	0.4622	7.1491	0.0075
x11	1	-2.4724	0.6573	14.1484	0.0002
x12	1	3.4179	0.9791	12.1858	0.0005

Odds Ratio Estimates			
Effect	**Point Estimate**	**95% Wald Confidence Limits**	
x6	0.478	0.251	0.909
x7	0.052	0.008	0.336
x9	3.441	1.391	8.512
x11	0.084	0.023	0.306
x12	30.506	4.477	207.875

Association of Predicted Probabilities and Observed Responses			
Percent Concordant	96.3	Somers' D	0.926
Percent Discordant	3.7	Gamma	0.926
Percent Tied	0.0	Tau-a	0.445
Pairs	2379	c	0.963

Residual Chi-Square Test		
Chi-Square	DF	Pr > ChiSq
7.8611	5	0.1641

Analysis of Effects Eligible for Entry			
Effect	DF	Score Chi-Square	Pr > ChiSq
x8	1	0.0434	0.8349
x10	1	3.5158	0.0608
x13	1	3.8538	0.0496
x14	1	0.0034	0.9532
x15	1	1.1257	0.2887

Step 6. Effect x13 entered:

Model Convergence Status
Convergence criterion (GCONV=1E-8) satisfied.

Model Fit Statistics		
Criterion	Intercept Only	Intercept and Covariates
AIC	135.750	58.094
SC	138.355	76.331
-2 Log L	133.750	44.094

R-Square	0.5920	Max-rescaled R-Square	0.8027

Testing Global Null Hypothesis: BETA=0			
Test	Chi-Square	DF	Pr > ChiSq
Likelihood Ratio	89.6552	6	<.0001
Score	61.2808	6	<.0001
Wald	19.7754	6	0.0030

Analysis of Maximum Likelihood Estimates					
Parameter	**DF**	**Estimate**	**Standard Error**	**Wald Chi-Square**	**Pr > ChiSq**
Intercept	1	2.4521	4.3499	0.3178	0.5730
x6	1	-0.6824	0.3721	3.3634	0.0667
x7	1	-3.7533	1.2248	9.3911	0.0022
x9	1	1.2454	0.5243	5.6419	0.0175
x11	1	-2.2770	0.7405	9.4554	0.0021
x12	1	3.8647	1.2210	10.0191	0.0015
x13	1	0.6657	0.3542	3.5327	0.0602

Odds Ratio Estimates			
Effect	**Point Estimate**	**95% Wald Confidence Limits**	
x6	0.505	0.244	1.048
x7	0.023	0.002	0.259
x9	3.474	1.243	9.709
x11	0.103	0.024	0.438
x12	47.690	4.356	522.050
x13	1.946	0.972	3.896

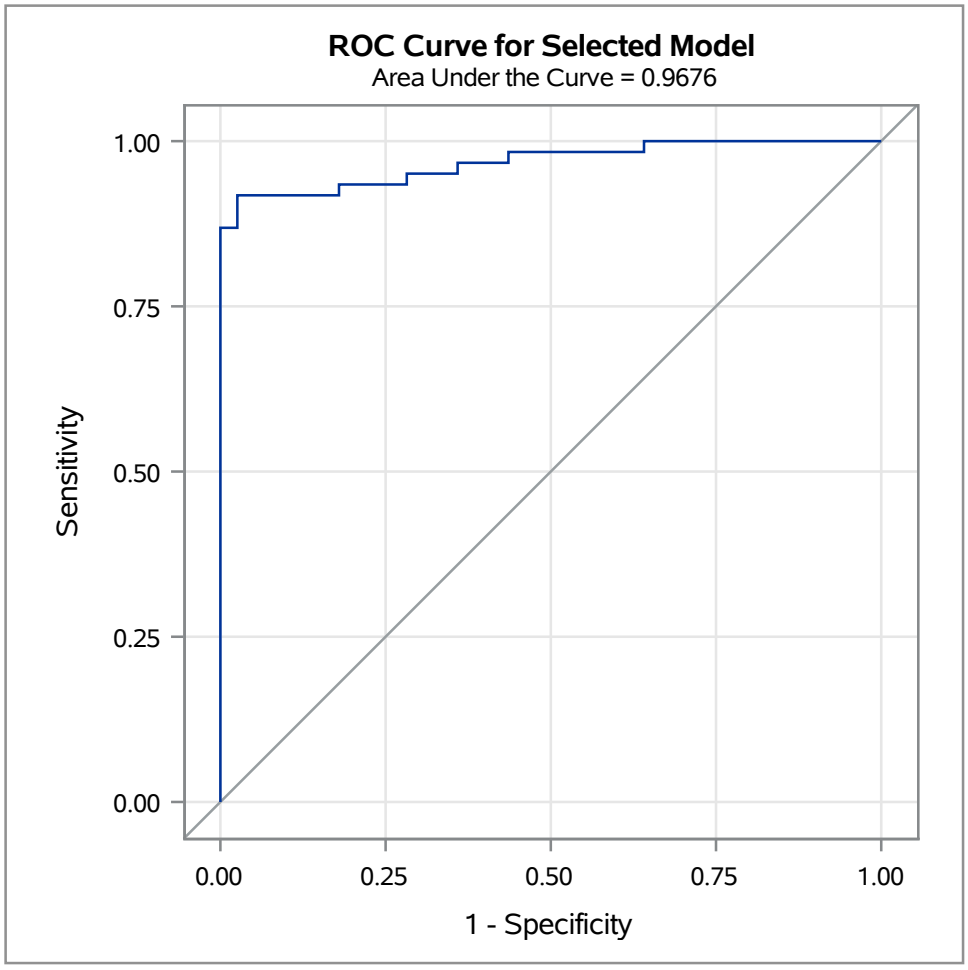
Association of Predicted Probabilities and Observed Responses			
Percent Concordant	96.8	**Somers' D**	0.935
Percent Discordant	3.2	**Gamma**	0.935
Percent Tied	0.0	**Tau-a**	0.449
Pairs	2379	**c**	0.968

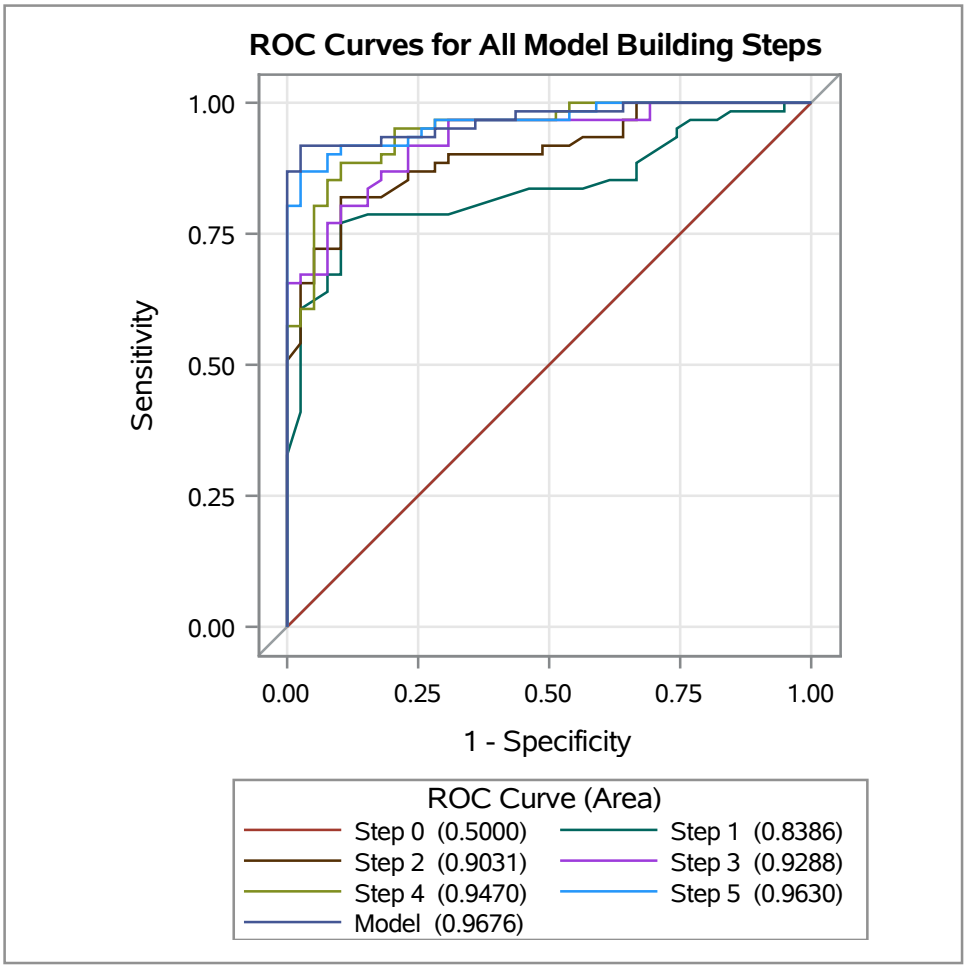
Residual Chi-Square Test		
Chi-Square	**DF**	**Pr > ChiSq**
4.6644	4	0.3235

Analysis of Effects Eligible for Entry			
Effect	**DF**	**Score Chi-Square**	**Pr > ChiSq**
x8	1	0.0090	0.9244
x10	1	2.7967	0.0945
x14	1	0.0512	0.8210
x15	1	1.3770	0.2406

Note: No (additional) effects met the 0.05 significance level for entry into the model.

Summary of Forward Selection						
Step	**Effect Entered**	**DF**	**Number In**	**Score Chi-Square**	**Pr > ChiSq**	**Variable Label**
1	**x11**	1	1	30.0740	<.0001	x11
2	**x12**	1	2	17.9196	<.0001	x12
3	**x7**	1	3	10.9080	0.0010	x7
4	**x9**	1	4	10.5702	0.0011	x9
5	**x6**	1	5	5.7531	0.0165	x6
6	**x13**	1	6	3.8538	0.0496	x13



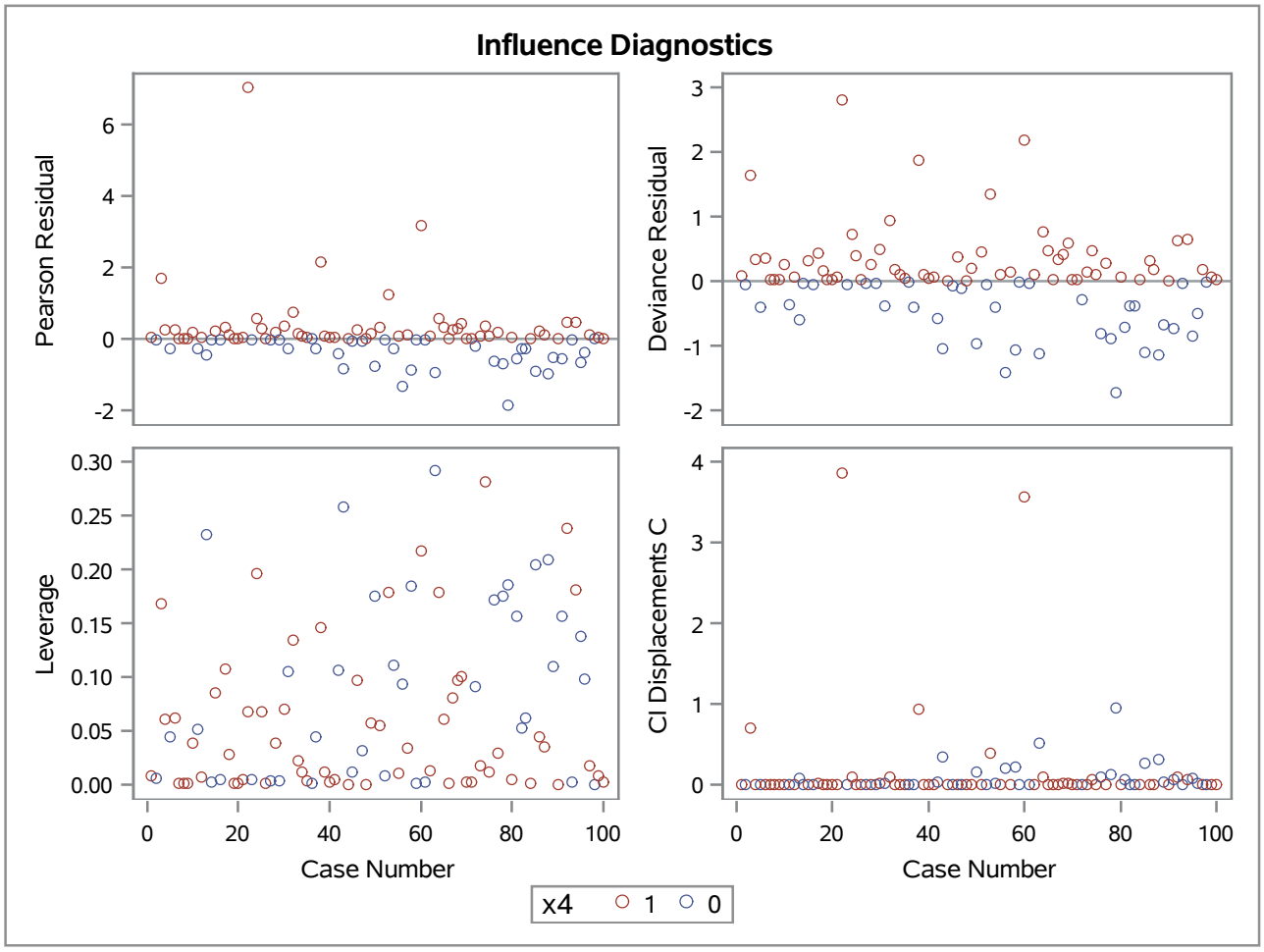


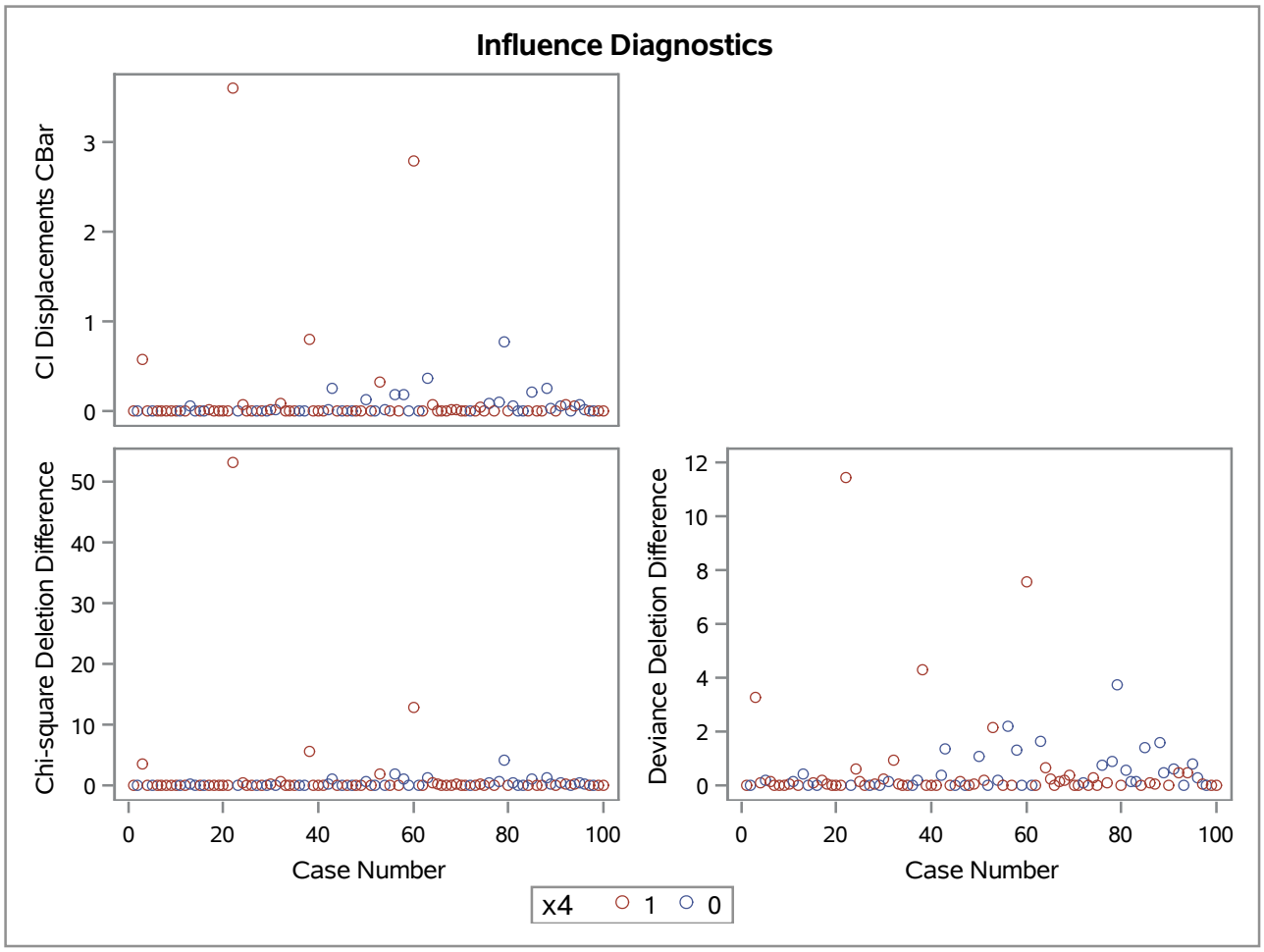
Classification Table

Prob Level	Correct		Incorrect		Percentages				
	Event	Non-Event	Event	Non-Event	Correct	Sensi-tivity	Speci-ficity	Pos Pred	Neg Pred
0.000	61	0	39	0	61.0	100.0	0.0	61.0	.
0.020	59	14	25	2	73.0	96.7	35.9	70.2	87.5
0.040	59	14	25	2	73.0	96.7	35.9	70.2	87.5
0.060	59	15	24	2	74.0	96.7	38.5	71.1	88.2
0.080	58	19	20	3	77.0	95.1	48.7	74.4	86.4
0.100	58	22	17	3	80.0	95.1	56.4	77.3	88.0
0.120	58	22	17	3	80.0	95.1	56.4	77.3	88.0
0.140	57	23	16	4	80.0	93.4	59.0	78.1	85.2
0.160	57	23	16	4	80.0	93.4	59.0	78.1	85.2
0.180	57	24	15	4	81.0	93.4	61.5	79.2	85.7
0.200	57	24	15	4	81.0	93.4	61.5	79.2	85.7
0.220	57	24	15	4	81.0	93.4	61.5	79.2	85.7
0.240	57	26	13	4	83.0	93.4	66.7	81.4	86.7
0.260	57	26	13	4	83.0	93.4	66.7	81.4	86.7
0.280	57	27	12	4	84.0	93.4	69.2	82.6	87.1

Classification Table									
	Correct		Incorrect		Percentages				
Prob Level	Event	Non-Event	Event	Non-Event	Correct	Sensi-tivity	Speci-ficity	Pos Pred	Neg Pred
0.300	56	28	11	5	84.0	91.8	71.8	83.6	84.8
0.320	56	28	11	5	84.0	91.8	71.8	83.6	84.8
0.340	56	29	10	5	85.0	91.8	74.4	84.8	85.3
0.360	56	30	9	5	86.0	91.8	76.9	86.2	85.7
0.380	56	30	9	5	86.0	91.8	76.9	86.2	85.7
0.400	56	30	9	5	86.0	91.8	76.9	86.2	85.7
0.420	56	31	8	5	87.0	91.8	79.5	87.5	86.1
0.440	56	31	8	5	87.0	91.8	79.5	87.5	86.1
0.460	56	32	7	5	88.0	91.8	82.1	88.9	86.5
0.480	56	32	7	5	88.0	91.8	82.1	88.9	86.5
0.500	56	32	7	5	88.0	91.8	82.1	88.9	86.5
0.520	56	32	7	5	88.0	91.8	82.1	88.9	86.5
0.540	56	33	6	5	89.0	91.8	84.6	90.3	86.8
0.560	56	33	6	5	89.0	91.8	84.6	90.3	86.8
0.580	56	35	4	5	91.0	91.8	89.7	93.3	87.5
0.600	55	35	4	6	90.0	90.2	89.7	93.2	85.4
0.620	55	36	3	6	91.0	90.2	92.3	94.8	85.7
0.640	55	36	3	6	91.0	90.2	92.3	94.8	85.7
0.660	55	37	2	6	92.0	90.2	94.9	96.5	86.0
0.680	55	37	2	6	92.0	90.2	94.9	96.5	86.0
0.700	54	38	1	7	92.0	88.5	97.4	98.2	84.4
0.720	53	38	1	8	91.0	86.9	97.4	98.1	82.6
0.740	53	38	1	8	91.0	86.9	97.4	98.1	82.6
0.760	53	38	1	8	91.0	86.9	97.4	98.1	82.6
0.780	51	38	1	10	89.0	83.6	97.4	98.1	79.2
0.800	51	38	1	10	89.0	83.6	97.4	98.1	79.2
0.820	51	38	1	10	89.0	83.6	97.4	98.1	79.2
0.840	50	38	1	11	88.0	82.0	97.4	98.0	77.6
0.860	49	38	1	12	87.0	80.3	97.4	98.0	76.0
0.880	48	38	1	13	86.0	78.7	97.4	98.0	74.5
0.900	46	38	1	15	84.0	75.4	97.4	97.9	71.7
0.920	44	39	0	17	83.0	72.1	100.0	100.0	69.6
0.940	40	39	0	21	79.0	65.6	100.0	100.0	65.0
0.960	37	39	0	24	76.0	60.7	100.0	100.0	61.9

Classification Table									
	Correct		Incorrect		Percentages				
Prob Level	Event	Non-Event	Event	Non-Event	Correct	Sensi-tivity	Speci-ficity	Pos Pred	Neg Pred
0.980	33	39	0	28	72.0	54.1	100.0	100.0	58.2
1.000	0	39	0	61	39.0	0.0	100.0	.	39.0




Influence Diagnostics
CI Displacements CBar
Chi-square Deletion Difference
Deviance Deletion Difference
Case Number
Case Number
x4 1 0

Model Information		
Data Set	WORK.IMPORT	
Response Variable	x4	x4
Number of Response Levels	2	
Model	binary logit	
Optimization Technique	Fisher's scoring	

Number of Observations Read	100
Number of Observations Used	100

Response Profile		
Ordered Value	**x4**	**Total Frequency**
1	0	39
2	1	61

Probability modeled is x4='1'.

Backward Elimination Procedure

Step 0. The following effects were entered:

Intercept x6 x7 x8 x9 x10 x11 x12 x13 x14 x15

Model Convergence Status
Convergence criterion (GCONV=1E-8) satisfied.

Model Fit Statistics		
Criterion	**Intercept Only**	**Intercept and Covariates**
AIC	135.750	61.041
SC	138.355	89.698
-2 Log L	133.750	39.041

R-Square	0.6121	**Max-rescaled R-Square**	0.8300

Testing Global Null Hypothesis: BETA=0			
Test	**Chi-Square**	**DF**	**Pr > ChiSq**
Likelihood Ratio	94.7086	10	<.0001
Score	62.3998	10	<.0001
Wald	17.3346	10	0.0673

Analysis of Maximum Likelihood Estimates					
Parameter	**DF**	**Estimate**	**Standard Error**	**Wald Chi-Square**	**Pr > ChiSq**
Intercept	1	0.2723	6.3839	0.0018	0.9660
x6	1	-0.8788	0.4405	3.9809	0.0460
x7	1	-4.2963	1.5038	8.1623	0.0043
x8	1	0.0265	0.4305	0.0038	0.9510
x9	1	1.3931	0.6027	5.3421	0.0208
x10	1	-0.9639	0.5362	3.2318	0.0722
x11	1	-2.8285	0.9511	8.8432	0.0029
x12	1	5.7906	1.9720	8.6225	0.0033
x13	1	0.6467	0.3927	2.7117	0.0996
x14	1	0.0325	0.8954	0.0013	0.9710
x15	1	0.4262	0.2945	2.0937	0.1479

Odds Ratio Estimates			
Effect	**Point Estimate**	**95% Wald Confidence Limits**	
x6	0.415	0.175	0.985
x7	0.014	<0.001	0.260
x8	1.027	0.442	2.387
x9	4.027	1.236	13.123
x10	0.381	0.133	1.091
x11	0.059	0.009	0.381
x12	327.198	6.859	>999.999
x13	1.909	0.884	4.122
x14	1.033	0.179	5.975
x15	1.531	0.860	2.728

Association of Predicted Probabilities and Observed Responses			
Percent Concordant	97.3	**Somers' D**	0.946
Percent Discordant	2.7	**Gamma**	0.946
Percent Tied	0.0	**Tau-a**	0.455
Pairs	2379	**c**	0.973

Analysis of Effects Eligible for Removal			
Effect	**DF**	**Wald Chi-Square**	**Pr > ChiSq**
x6	1	3.9809	0.0460
x7	1	8.1623	0.0043
x8	1	0.0038	0.9510
x9	1	5.3421	0.0208
x10	1	3.2318	0.0722
x11	1	8.8432	0.0029
x12	1	8.6225	0.0033
x13	1	2.7117	0.0996
x14	1	0.0013	0.9710
x15	1	2.0937	0.1479

Step 1. Effect x14 is removed:

Model Convergence Status
Convergence criterion (GCONV=1E-8) satisfied.

Model Fit Statistics		
Criterion	**Intercept Only**	**Intercept and Covariates**
AIC	135.750	59.042
SC	138.355	85.094
-2 Log L	133.750	39.042

R-Square	0.6121	**Max-rescaled R-Square**	0.8300

Testing Global Null Hypothesis: BETA=0			
Test	**Chi-Square**	**DF**	**Pr > ChiSq**
Likelihood Ratio	94.7073	9	<.0001
Score	62.3993	9	<.0001
Wald	17.3050	9	0.0441

Analysis of Maximum Likelihood Estimates					
Parameter	**DF**	**Estimate**	**Standard Error**	**Wald Chi-Square**	**Pr > ChiSq**
Intercept	1	0.3859	5.5742	0.0048	0.9448
x6	1	-0.8803	0.4389	4.0236	0.0449
x7	1	-4.3077	1.4727	8.5561	0.0034
x8	1	0.0366	0.3271	0.0125	0.9109
x9	1	1.3919	0.6019	5.3478	0.0207
x10	1	-0.9619	0.5333	3.2535	0.0713
x11	1	-2.8233	0.9398	9.0240	0.0027
x12	1	5.7973	1.9648	8.7058	0.0032
x13	1	0.6490	0.3877	2.8027	0.0941
x15	1	0.4260	0.2946	2.0906	0.1482

Odds Ratio Estimates			
Effect	**Point Estimate**	**95% Wald Confidence Limits**	
x6	0.415	0.175	0.980
x7	0.013	<0.001	0.241
x8	1.037	0.546	1.969
x9	4.023	1.236	13.088
x10	0.382	0.134	1.087
x11	0.059	0.009	0.375
x12	329.413	7.003	>999.999
x13	1.914	0.895	4.091
x15	1.531	0.859	2.728

Association of Predicted Probabilities and Observed Responses			
Percent Concordant	97.3	**Somers' D**	0.946
Percent Discordant	2.7	**Gamma**	0.946
Percent Tied	0.0	**Tau-a**	0.455
Pairs	2379	**c**	0.973

Residual Chi-Square Test		
Chi-Square	**DF**	**Pr > ChiSq**
0.0013	1	0.9710

Analysis of Effects Eligible for Removal			
Effect	DF	Wald Chi-Square	Pr > ChiSq
x6	1	4.0236	0.0449
x7	1	8.5561	0.0034
x8	1	0.0125	0.9109
x9	1	5.3478	0.0207
x10	1	3.2535	0.0713
x11	1	9.0240	0.0027
x12	1	8.7058	0.0032
x13	1	2.8027	0.0941
x15	1	2.0906	0.1482

Step 2. Effect x8 is removed:

Model Convergence Status
Convergence criterion (GCONV=1E-8) satisfied.

Model Fit Statistics		
Criterion	Intercept Only	Intercept and Covariates
AIC	135.750	57.055
SC	138.355	80.501
-2 Log L	133.750	39.055

R-Square	0.6121	Max-rescaled R-Square	0.8299

Testing Global Null Hypothesis: BETA=0			
Test	Chi-Square	DF	Pr > ChiSq
Likelihood Ratio	94.6948	8	<.0001
Score	62.2586	8	<.0001
Wald	17.3080	8	0.0271

Analysis of Maximum Likelihood Estimates					
Parameter	DF	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq
Intercept	1	0.6195	5.1516	0.0145	0.9043
x6	1	-0.8803	0.4393	4.0153	0.0451
x7	1	-4.3143	1.4712	8.5996	0.0034
x9	1	1.3799	0.5909	5.4533	0.0195

Analysis of Maximum Likelihood Estimates					
Parameter	DF	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq
x10	1	-0.9571	0.5317	3.2408	0.0718
x11	1	-2.7997	0.9112	9.4403	0.0021
x12	1	5.7811	1.9550	8.7440	0.0031
x13	1	0.6477	0.3870	2.8018	0.0942
x15	1	0.4237	0.2949	2.0636	0.1509

Odds Ratio Estimates			
Effect	Point Estimate	95% Wald Confidence Limits	
x6	0.415	0.175	0.981
x7	0.013	<0.001	0.239
x9	3.975	1.248	12.655
x10	0.384	0.135	1.089
x11	0.061	0.010	0.363
x12	324.121	7.024	>999.999
x13	1.911	0.895	4.080
x15	1.528	0.857	2.723

Association of Predicted Probabilities and Observed Responses			
Percent Concordant	97.4	**Somers' D**	0.948
Percent Discordant	2.6	**Gamma**	0.948
Percent Tied	0.0	**Tau-a**	0.456
Pairs	2379	**c**	0.974

Residual Chi-Square Test		
Chi-Square	DF	Pr > ChiSq
0.0138	2	0.9931

Analysis of Effects Eligible for Removal			
Effect	DF	Wald Chi-Square	Pr > ChiSq
x6	1	4.0153	0.0451
x7	1	8.5996	0.0034
x9	1	5.4533	0.0195
x10	1	3.2408	0.0718
x11	1	9.4403	0.0021

Analysis of Effects Eligible for Removal			
Effect	DF	Wald Chi-Square	Pr > ChiSq
x12	1	8.7440	0.0031
x13	1	2.8018	0.0942
x15	1	2.0636	0.1509

Step 3. Effect x15 is removed:

Model Convergence Status
Convergence criterion (GCONV=1E-8) satisfied.

Model Fit Statistics		
Criterion	Intercept Only	Intercept and Covariates
AIC	135.750	57.364
SC	138.355	78.205
-2 Log L	133.750	41.364

R-Square	0.6030	Max-rescaled R-Square	0.8177

Testing Global Null Hypothesis: BETA=0			
Test	Chi-Square	DF	Pr > ChiSq
Likelihood Ratio	92.3857	7	<.0001
Score	61.3542	7	<.0001
Wald	19.4924	7	0.0068

Analysis of Maximum Likelihood Estimates					
Parameter	DF	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq
Intercept	1	3.0194	4.7614	0.4021	0.5260
x6	1	-0.6940	0.3902	3.1636	0.0753
x7	1	-4.2214	1.3783	9.3813	0.0022
x9	1	1.3077	0.5651	5.3541	0.0207
x10	1	-0.7538	0.4697	2.5759	0.1085
x11	1	-2.6512	0.8413	9.9298	0.0016
x12	1	5.1429	1.6731	9.4485	0.0021
x13	1	0.6225	0.3694	2.8394	0.0920

Odds Ratio Estimates			
Effect	**Point Estimate**	**95% Wald Confidence Limits**	
x6	0.500	0.233	1.073
x7	0.015	<0.001	0.219
x9	3.698	1.221	11.194
x10	0.471	0.187	1.181
x11	0.071	0.014	0.367
x12	171.210	6.447	>999.999
x13	1.864	0.903	3.844

Association of Predicted Probabilities and Observed Responses			
Percent Concordant	97.2	**Somers' D**	0.944
Percent Discordant	2.8	**Gamma**	0.944
Percent Tied	0.0	**Tau-a**	0.454
Pairs	2379	**c**	0.972

Residual Chi-Square Test		
Chi-Square	**DF**	**Pr > ChiSq**
2.2464	3	0.5229

Analysis of Effects Eligible for Removal			
Effect	**DF**	**Wald Chi-Square**	**Pr > ChiSq**
x6	1	3.1636	0.0753
x7	1	9.3813	0.0022
x9	1	5.3541	0.0207
x10	1	2.5759	0.1085
x11	1	9.9298	0.0016
x12	1	9.4485	0.0021
x13	1	2.8394	0.0920

Step 4. Effect x10 is removed:

Model Convergence Status
Convergence criterion (GCONV=1E-8) satisfied.

Model Fit Statistics		
Criterion	Intercept Only	Intercept and Covariates
AIC	135.750	58.094
SC	138.355	76.331
-2 Log L	133.750	44.094

R-Square	0.5920	Max-rescaled R-Square	0.8027

Testing Global Null Hypothesis: BETA=0			
Test	Chi-Square	DF	Pr > ChiSq
Likelihood Ratio	89.6552	6	<.0001
Score	61.2808	6	<.0001
Wald	19.7754	6	0.0030

Analysis of Maximum Likelihood Estimates					
Parameter	DF	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq
Intercept	1	2.4521	4.3499	0.3178	0.5730
x6	1	-0.6824	0.3721	3.3634	0.0667
x7	1	-3.7533	1.2248	9.3911	0.0022
x9	1	1.2454	0.5243	5.6419	0.0175
x11	1	-2.2770	0.7405	9.4554	0.0021
x12	1	3.8647	1.2210	10.0191	0.0015
x13	1	0.6657	0.3542	3.5327	0.0602

Odds Ratio Estimates			
Effect	Point Estimate	95% Wald Confidence Limits	
x6	0.505	0.244	1.048
x7	0.023	0.002	0.259
x9	3.474	1.243	9.709
x11	0.103	0.024	0.438
x12	47.690	4.356	522.050
x13	1.946	0.972	3.896

Association of Predicted Probabilities and Observed Responses			
Percent Concordant	96.8	**Somers' D**	0.935
Percent Discordant	3.2	**Gamma**	0.935
Percent Tied	0.0	**Tau-a**	0.449
Pairs	2379	**c**	0.968

Residual Chi-Square Test		
Chi-Square	**DF**	**Pr > ChiSq**
4.6644	4	0.3235

Analysis of Effects Eligible for Removal			
Effect	**DF**	**Wald Chi-Square**	**Pr > ChiSq**
x6	1	3.3634	0.0667
x7	1	9.3911	0.0022
x9	1	5.6419	0.0175
x11	1	9.4554	0.0021
x12	1	10.0191	0.0015
x13	1	3.5327	0.0602

Step 5. Effect x6 is removed:

Model Convergence Status
Convergence criterion (GCONV=1E-8) satisfied.

Model Fit Statistics		
Criterion	**Intercept Only**	**Intercept and Covariates**
AIC	135.750	60.097
SC	138.355	75.728
-2 Log L	133.750	48.097

R-Square	0.5754	**Max-rescaled R-Square**	0.7802

Testing Global Null Hypothesis: BETA=0			
Test	**Chi-Square**	**DF**	**Pr > ChiSq**
Likelihood Ratio	85.6523	5	<.0001
Score	58.3094	5	<.0001
Wald	17.6636	5	0.0034

Analysis of Maximum Likelihood Estimates					
Parameter	**DF**	**Estimate**	**Standard Error**	**Wald Chi-Square**	**Pr > ChiSq**
Intercept	1	-1.5238	3.6192	0.1773	0.6737
x7	1	-3.9401	1.2726	9.5863	0.0020
x9	1	1.4405	0.5292	7.4104	0.0065
x11	1	-2.8713	0.7428	14.9434	0.0001
x12	1	4.0801	1.2728	10.2752	0.0013
x13	1	0.7308	0.3336	4.7979	0.0285

Odds Ratio Estimates			
Effect	**Point Estimate**	**95% Wald Confidence Limits**	
x7	0.019	0.002	0.236
x9	4.223	1.497	11.914
x11	0.057	0.013	0.243
x12	59.151	4.881	716.815
x13	2.077	1.080	3.994

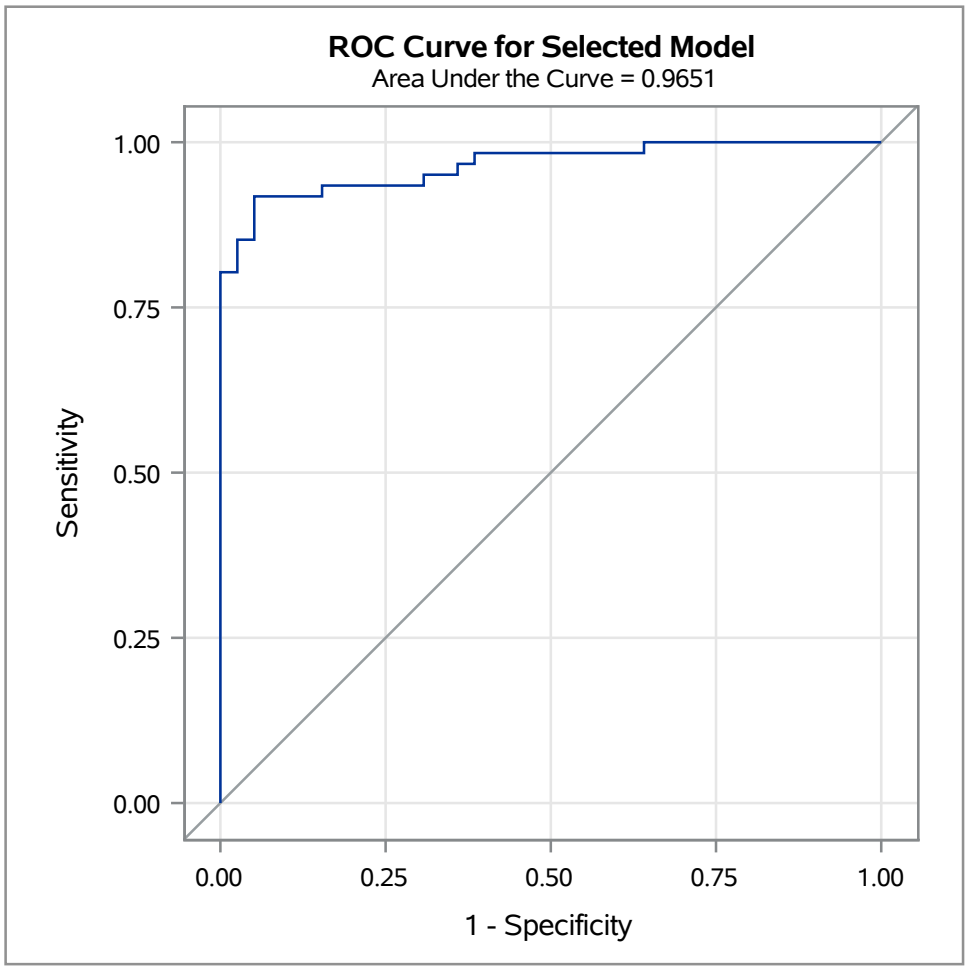
Association of Predicted Probabilities and Observed Responses			
Percent Concordant	96.5	**Somers' D**	0.930
Percent Discordant	3.5	**Gamma**	0.930
Percent Tied	0.0	**Tau-a**	0.447
Pairs	2379	**c**	0.965

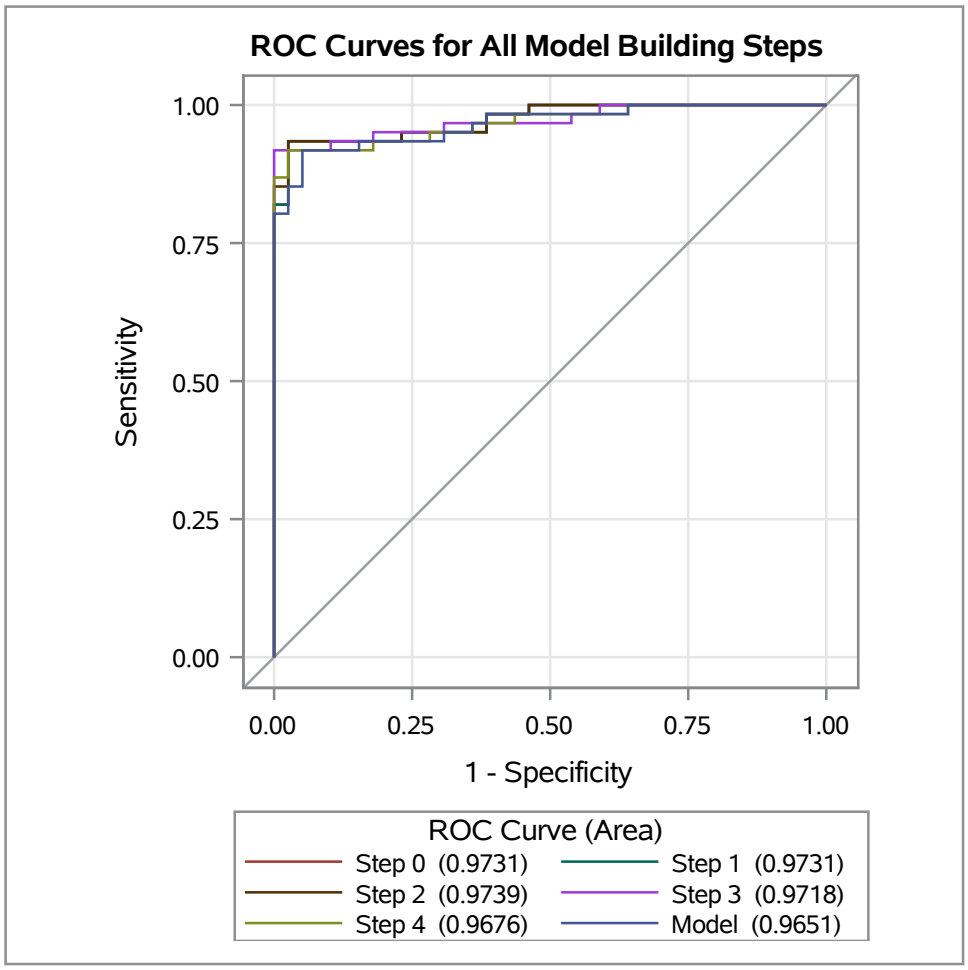
Residual Chi-Square Test		
Chi-Square	**DF**	**Pr > ChiSq**
7.4241	5	0.1910

Analysis of Effects Eligible for Removal			
Effect	**DF**	**Wald Chi-Square**	**Pr > ChiSq**
x7	1	9.5863	0.0020
x9	1	7.4104	0.0065
x11	1	14.9434	0.0001
x12	1	10.2752	0.0013
x13	1	4.7979	0.0285

Note: No (additional) effects met the 0.05 significance level for removal from the model.

Summary of Backward Elimination						
Step	**Effect Removed**	**DF**	**Number In**	**Wald Chi-Square**	**Pr > ChiSq**	**Variable Label**
1	**x14**	1	9	0.0013	0.9710	x14
2	**x8**	1	8	0.0125	0.9109	x8
3	**x15**	1	7	2.0636	0.1509	x15
4	**x10**	1	6	2.5759	0.1085	x10
5	**x6**	1	5	3.3634	0.0667	x6

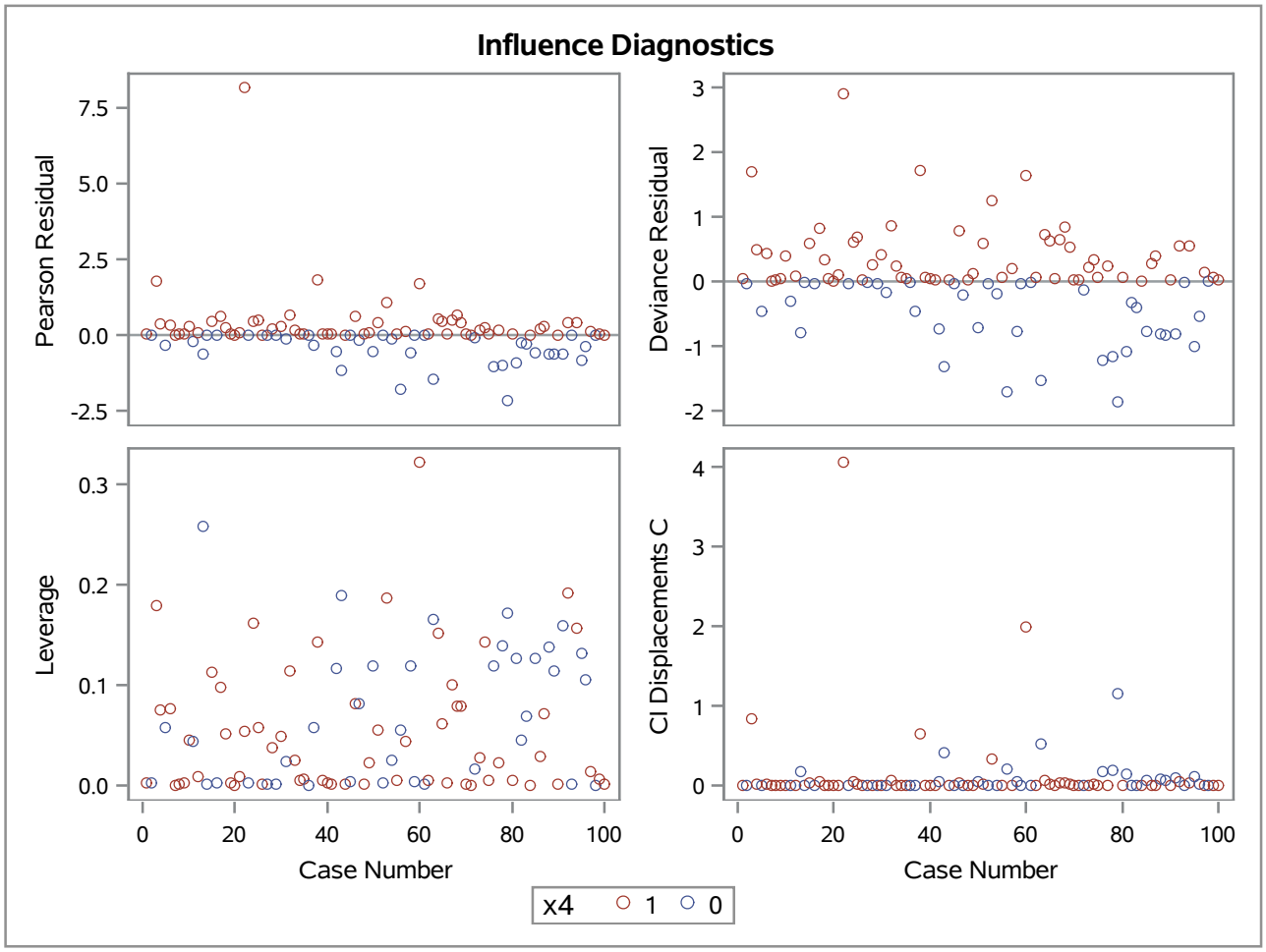


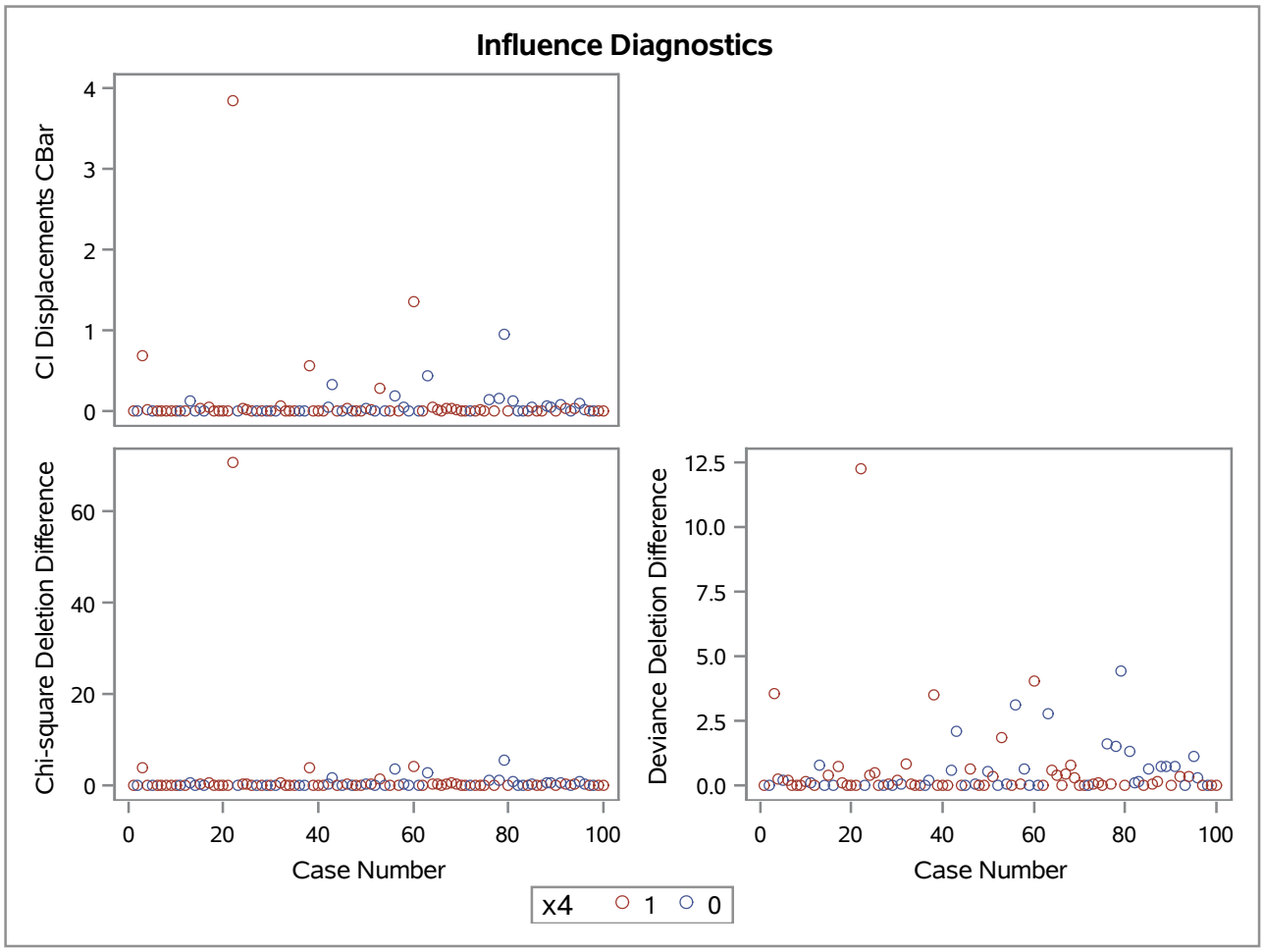


Classification Table									
	Correct		Incorrect		Percentages				
Prob Level	Event	Non-Event	Event	Non-Event	Correct	Sensi-tivity	Speci-ficity	Pos Pred	Neg Pred
0.000	61	0	39	0	61.0	100.0	0.0	61.0	.
0.020	60	16	23	1	76.0	98.4	41.0	72.3	94.1
0.040	60	17	22	1	77.0	98.4	43.6	73.2	94.4
0.060	59	19	20	2	78.0	96.7	48.7	74.7	90.5
0.080	59	19	20	2	78.0	96.7	48.7	74.7	90.5
0.100	59	20	19	2	79.0	96.7	51.3	75.6	90.9
0.120	58	22	17	3	80.0	95.1	56.4	77.3	88.0
0.140	57	22	17	4	79.0	93.4	56.4	77.0	84.6
0.160	57	23	16	4	80.0	93.4	59.0	78.1	85.2
0.180	57	23	16	4	80.0	93.4	59.0	78.1	85.2
0.200	57	23	16	4	80.0	93.4	59.0	78.1	85.2
0.220	57	23	16	4	80.0	93.4	59.0	78.1	85.2
0.240	57	23	16	4	80.0	93.4	59.0	78.1	85.2
0.260	57	24	15	4	81.0	93.4	61.5	79.2	85.7
0.280	57	25	14	4	82.0	93.4	64.1	80.3	86.2

Classification Table									
	Correct		Incorrect		Percentages				
Prob Level	Event	Non-Event	Event	Non-Event	Correct	Sensi-tivity	Speci-ficity	Pos Pred	Neg Pred
0.300	57	27	12	4	84.0	93.4	69.2	82.6	87.1
0.320	57	27	12	4	84.0	93.4	69.2	82.6	87.1
0.340	56	29	10	5	85.0	91.8	74.4	84.8	85.3
0.360	56	30	9	5	86.0	91.8	76.9	86.2	85.7
0.380	56	31	8	5	87.0	91.8	79.5	87.5	86.1
0.400	56	31	8	5	87.0	91.8	79.5	87.5	86.1
0.420	56	31	8	5	87.0	91.8	79.5	87.5	86.1
0.440	56	31	8	5	87.0	91.8	79.5	87.5	86.1
0.460	56	31	8	5	87.0	91.8	79.5	87.5	86.1
0.480	56	32	7	5	88.0	91.8	82.1	88.9	86.5
0.500	56	32	7	5	88.0	91.8	82.1	88.9	86.5
0.520	56	33	6	5	89.0	91.8	84.6	90.3	86.8
0.540	56	33	6	5	89.0	91.8	84.6	90.3	86.8
0.560	56	33	6	5	89.0	91.8	84.6	90.3	86.8
0.580	56	34	5	5	90.0	91.8	87.2	91.8	87.2
0.600	56	35	4	5	91.0	91.8	89.7	93.3	87.5
0.620	56	35	4	5	91.0	91.8	89.7	93.3	87.5
0.640	56	35	4	5	91.0	91.8	89.7	93.3	87.5
0.660	55	35	4	6	90.0	90.2	89.7	93.2	85.4
0.680	54	35	4	7	89.0	88.5	89.7	93.1	83.3
0.700	53	35	4	8	88.0	86.9	89.7	93.0	81.4
0.720	52	36	3	9	88.0	85.2	92.3	94.5	80.0
0.740	51	36	3	10	87.0	83.6	92.3	94.4	78.3
0.760	51	36	3	10	87.0	83.6	92.3	94.4	78.3
0.780	51	36	3	10	87.0	83.6	92.3	94.4	78.3
0.800	48	36	3	13	84.0	78.7	92.3	94.1	73.5
0.820	46	38	1	15	84.0	75.4	97.4	97.9	71.7
0.840	43	38	1	18	81.0	70.5	97.4	97.7	67.9
0.860	42	38	1	19	80.0	68.9	97.4	97.7	66.7
0.880	42	38	1	19	80.0	68.9	97.4	97.7	66.7
0.900	41	38	1	20	79.0	67.2	97.4	97.6	65.5
0.920	39	38	1	22	77.0	63.9	97.4	97.5	63.3
0.940	36	39	0	25	75.0	59.0	100.0	100.0	60.9
0.960	35	39	0	26	74.0	57.4	100.0	100.0	60.0

Classification Table									
	Correct		Incorrect		Percentages				
Prob Level	Event	Non-Event	Event	Non-Event	Correct	Sensi-tivity	Speci-ficity	Pos Pred	Neg Pred
0.980	30	39	0	31	69.0	49.2	100.0	100.0	55.7
1.000	0	39	0	61	39.0	0.0	100.0	.	39.0

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CI Displacements CBar
Chi-square Deletion Difference
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Case Number
Case Number
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