

Ordered Categorical Response Variable

```
/* ordinal.sas */
%include 'readmath.sas';
title2 'Logistic regression with multinomial outcome';
options pagesize=100;

if (0<=mark<=49) then result = '3=Fail';
  else if (50<=mark<=100) then result = '1=Pass';
  else result = '2=Gone';

proc logistic;
  title3 'Test ordinal resp';
  class sex / param=ref;
  model result = hsgpa hscal hsenl sex;
  Gender_and_English: test sexFemale = hsenl = 0;
```

Gender, Ethnicity and Math performance
Logistic regression with multinomial outcome
Test ordinal resp

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The LOGISTIC Procedure

Model Information

Data Set	WORK.MATH
Response Variable	result
Number of Response Levels	3
Model	cumulative logit
Optimization Technique	Fisher's scoring

Number of Observations Read	579
Number of Observations Used	428

Response Profile

Ordered Value	result	Total Frequency
1	1=Pass	255
2	2=Gone	107
3	3=Fail	66

Probabilities modeled are cumulated over the lower Ordered Values.

NOTE: 151 observations were deleted due to missing values for the response or explanatory variables.

Class Level Information

Class	Value	Design Variables
sex	Female	1
	Male	0

Model Convergence Status

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

Score Test for the Proportional Odds Assumption

Chi-Square	DF	Pr > ChiSq
20.3003	4	0.0004

Model Fit Statistics

Criterion	Intercept Only	Intercept and Covariates
AIC	811.545	711.199
SC	819.663	735.553
-2 Log L	807.545	699.199

Testing Global Null Hypothesis: BETA=0

Test	Chi-Square	DF	Pr > ChiSq
Likelihood Ratio	108.3466	4	<.0001
Score	95.9749	4	<.0001
Wald	77.7286	4	<.0001

Type 3 Analysis of Effects

Effect	DF	Wald Chi-Square	Pr > ChiSq
hsgpa	1	19.0821	<.0001
hscal	1	15.5982	<.0001
hsengl	1	0.0578	0.8100
sex	1	0.0011	0.9740

Analysis of Maximum Likelihood Estimates

Parameter	DF	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq
Intercept 1=Pass	1	-13.0894	1.7526	55.7793	<.0001
Intercept 2=Gone	1	-11.5066	1.7265	44.4200	<.0001
hsgpa	1	0.1270	0.0291	19.0821	<.0001
hscal	1	0.0438	0.0111	15.5982	<.0001
hsengl	1	0.00364	0.0151	0.0578	0.8100
sex Female	1	0.00699	0.2144	0.0011	0.9740

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The LOGISTIC Procedure

Odds Ratio Estimates

Effect	Point Estimate	95% Wald Confidence Limits	
hsgpa	1.135	1.073	1.202
hscal	1.045	1.022	1.068
hsengl	1.004	0.974	1.034
sex Female vs Male	1.007	0.661	1.533

Association of Predicted Probabilities and Observed Responses

Percent Concordant	75.5	Somers' D	0.512
Percent Discordant	24.3	Gamma	0.513
Percent Tied	0.2	Tau-a	0.287
Pairs	51177	c	0.756

Linear Hypotheses Testing Results

Label	Wald Chi-Square	DF	Pr > ChiSq
Gender_and_English	0.0668	2	0.9672