

Math Data: Trying to predict calculus mark

```
/****** mathreg2.sas *****/
*          Serious try at predicting final grade          *
*****/

%include 'mathread.sas';
/* Quantitative Vars: precalc calc totscore hsgpa hscalcalc hsengl grade
   Categorical Vars: course sex ethnic (6 cats) tongue passed
                       course = c1 c2 c3 (leave out c2 for standard)
                       gender is indicator for Female
                       lang1 is indicator for English
                       ethnic = e1-e6: Leave out e3 to make European
                               non-eastern the reference category. */

options pagesize=100; /* Fewer page breaks */

   ecalc = hscalcalc*hsengl;

proc reg;
  title2 'Predict grade from everything, no interactions';
  model grade = gender e1 e2 e4 e5 e6 lang1
             hsgpa hscalcalc hsengl
             c1 c3 precalc calc ;
  ethnic:   test e1=e2=e4=e5=e6=0;
  course:   test c1=c3=0;
  Calculus: test hscalcalc=calc=0;

proc reg;
  title2 'With one interaction';
  model grade = gender e1 e2 e4 e5 e6 lang1
             hsgpa hscalcalc hsengl ecalc
             c1 c3 precalc calc ;
  ethnic:   test e1=e2=e4=e5=e6=0;
  course:   test c1=c3=0;
  Calculus: test hscalcalc=calc=0;

/* I tried a bunch more interactions, one or two at a time. Nothing. */

proc freq;
  tables ethnic * (sex lang1) / nocol nopercents chisq;

proc glm;
  title2 'Sex by tongue by ethnic';
  class sex tongue ethnic;
  model grade = sex|tongue|ethnic;

proc glm;
  title2 'Sex by tongue by ethnic ancova';
  class sex tongue ethnic;
  model grade = hsgpa hscalcalc hsengl precalc calc sex|tongue|ethnic;

proc reg;
  title2 'My favorite prediction model: 46% of the variation';
  model grade = lang1 hsgpa hscalcalc hsengl precalc;
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proc reg;
  title2 'Politically safer model: 45% of the variation';
  model grade = hsgpa hscalcalc hsengl precalc;

proc iml;
  print
  "Proportion of remaining variation explained by precalc in safe model";
  T = 3.63; F = T**2;
  n = 289 ; p = 5 ; s = 1 ;
  a = s*f / (n - p + s*F); print a;

proc stepwise;
  title2 'Try forward stepwise selection: Explain 47%';
  /* Note: Redundant variables are okay */
  model grade = gender e1-e6 lang1
              hsgpa hscalcalc hsengl
              c1-c3 precalc calc totscode
  / forward slentry=0.05;
  /* Default signif level for entry is 0.5 */

proc reg;
  title2 'Add e5 (East Indian) to my favorite prediction model: 47%';
  model grade = lang1 e5 hsgpa hscalcalc hsengl precalc;

proc glm;
  title2 'Language by e5 Interaction?';
  class lang1 e5;
  model grade = hsgpa hscalcalc hsengl precalc lang1|e5;

proc reg;
  title2 'Conclude no meaningful effect for sex?';
  model grade = gender lang1 e5 hsgpa hscalcalc hsengl precalc;

/* 95% Confidence interval for a regression coefficient is b plus or minus
the standard error times the t critical value (with 97.5% below) for
n-p degrees of freedom. These critical values are seldom in the tables,
so we use proc iml. */

proc iml;
  b = 1.69082; se = 1.69302; tcrit = tinv(0.975,279);
  print b se tcrit;
  lower95 = b - se*tcrit; upper95 = b + se*tcrit;
  print lower95 upper95;

```

Gender, Ethnicity and Math performance 1
 Predict grade from everything, no interactions

The REG Procedure
 Model: MODEL1
 Dependent Variable: grade Final mark (if any)

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	14	46767	3340.47977	18.15	<.0001
Error	272	50062	184.05293		
Corrected Total	286	96829			

Root MSE	13.56661	R-Square	0.4830
Dependent Mean	60.59582	Adj R-Sq	0.4564
Coeff Var	22.38869		

Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value
Intercept	Intercept	1	-66.04800	11.73653	-5.63
gender	Indicator for Female	1	1.81127	1.74763	1.04
e1		1	-1.21904	2.31897	-0.53
e2		1	-1.55530	2.73198	-0.57
e4		1	-2.28555	2.88218	-0.79
e5		1	3.68304	2.55945	1.44
e6		1	2.33070	5.36615	0.43
lang1	Indicator for English	1	-4.73479	2.19787	-2.15
hsgpa	High School GPA	1	1.56363	0.22272	7.02
hscal	HS Calculus	1	0.24454	0.10413	2.35
hsengl	HS English	1	-0.35793	0.12877	-2.78
c1		1	5.11126	4.38522	1.17
c3		1	-2.26101	2.93938	-0.77
precalc	Number precalculus correct	1	1.78737	0.56837	3.14
calc	Number calculus correct	1	0.70710	0.38573	1.83

Parameter Estimates

Variable	Label	DF	Pr > t
Intercept	Intercept	1	<.0001
gender	Indicator for Female	1	0.3009
e1		1	0.5995
e2		1	0.5696
e4		1	0.4285
e5		1	0.1513
e6		1	0.6644
lang1	Indicator for English	1	0.0321
hsgpa	High School GPA	1	<.0001
hscal	HS Calculus	1	0.0196
hsengl	HS English	1	0.0058

c1		1	0.2448
c3		1	0.4424
precalc	Number precalculus correct	1	0.0018
calc	Number calculus correct	1	0.0679

Gender, Ethnicity and Math performance 2
 Predict grade from everything, no interactions

The REG Procedure
 Model: MODEL1

Test ethnic Results for Dependent Variable grade

Source	DF	Mean Square	F Value	Pr > F
Numerator	5	180.53608	0.98	0.4298
Denominator	272	184.05293		

Gender, Ethnicity and Math performance 3
 Predict grade from everything, no interactions

The REG Procedure
 Model: MODEL1

Test course Results for Dependent Variable grade

Source	DF	Mean Square	F Value	Pr > F
Numerator	2	185.59162	1.01	0.3662
Denominator	272	184.05293		

Gender, Ethnicity and Math performance 4
 Predict grade from everything, no interactions

The REG Procedure
 Model: MODEL1

Test Calculus Results for Dependent Variable grade

Source	DF	Mean Square	F Value	Pr > F
Numerator	2	986.13713	5.36	0.0052
Denominator	272	184.05293		

Gender, Ethnicity and Math performance
With one interaction

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The REG Procedure
Model: MODEL1
Dependent Variable: grade Final mark (if any)

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	15	46784	3118.91386	16.89	<.0001
Error	271	50045	184.66940		
Corrected Total	286	96829			

Root MSE	13.58931	R-Square	0.4832
Dependent Mean	60.59582	Adj R-Sq	0.4545
Coeff Var	22.42615		

Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value
Intercept	Intercept	1	-82.90564	56.80526	-1.46
gender	Indicator for Female	1	1.76352	1.75762	1.00
e1		1	-1.27603	2.33043	-0.55
e2		1	-1.61601	2.74386	-0.59
e4		1	-2.24114	2.89071	-0.78
e5		1	3.69926	2.56429	1.44
e6		1	2.19789	5.39293	0.41
lang1	Indicator for English	1	-4.64557	2.22111	-2.09
hsgpa	High School GPA	1	1.56982	0.22403	7.01
hscal	HS Calculus	1	0.44614	0.67276	0.66
hsengl	HS English	1	-0.14473	0.71460	-0.20
ecal		1	-0.00265	0.00872	-0.30
c1		1	5.41410	4.50458	1.20
c3		1	-2.22436	2.94677	-0.75
precalc	Number precalculus correct	1	1.80286	0.57161	3.15
calc	Number calculus correct	1	0.71112	0.38660	1.84

Parameter Estimates

Variable	Label	DF	Pr > t
Intercept	Intercept	1	0.1456
gender	Indicator for Female	1	0.3166
e1		1	0.5845
e2		1	0.5564
e4		1	0.4388
e5		1	0.1503
e6		1	0.6839
lang1	Indicator for English	1	0.0374
hsgpa	High School GPA	1	<.0001

hscal	HS Calculus	1	0.5078
hsengl	HS English	1	0.8397
ecal		1	0.7619
c1		1	0.2304
c3		1	0.4510
precalc	Number precalculus correct	1	0.0018
calc	Number calculus correct	1	0.0669

Gender, Ethnicity and Math performance 6
With one interaction

The REG Procedure
Model: MODEL1

Test ethnic Results for Dependent Variable grade

Source	DF	Mean Square	F Value	Pr > F
Numerator	5	181.81409	0.98	0.4275
Denominator	271	184.66940		

Gender, Ethnicity and Math performance 7
With one interaction

The REG Procedure
Model: MODEL1

Test course Results for Dependent Variable grade

Source	DF	Mean Square	F Value	Pr > F
Numerator	2	193.71039	1.05	0.3517
Denominator	271	184.66940		

Gender, Ethnicity and Math performance 8
With one interaction

The REG Procedure
Model: MODEL1

Test Calculus Results for Dependent Variable grade

Source	DF	Mean Square	F Value	Pr > F
Numerator	2	351.53022	1.90	0.1510
Denominator	271	184.66940		

Gender, Ethnicity and Math performance
With one interaction

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The FREQ Procedure

Table of ethnic by sex

Frequency Row Pct	sex		Total
	Female	Male	
Asian	48 36.64	83 63.36	131
Eastern European	37 58.73	26 41.27	63
European not Eastern	107 55.15	87 44.85	194
Middle-Eastern and Pakistani	30 41.67	42 58.33	72
East Indian	35 45.45	42 54.55	77
Other and DK	9 64.29	5 35.71	14
Total	266	285	551

Frequency Missing = 28

Statistics for Table of ethnic by sex

Statistic	DF	Value	Prob
Chi-Square	5	16.4773	0.0056
Likelihood Ratio Chi-Square	5	16.6120	0.0053
Mantel-Haenszel Chi-Square	1	1.7025	0.1920
Phi Coefficient		0.1729	
Contingency Coefficient		0.1704	
Cramer's V		0.1729	

Effective Sample Size = 551

Frequency Missing = 28

Table of ethnic by lang1

ethnic(Judged Nationality of name)	lang1(Indicator for English)		Total
	0	1	
Frequency			
Row Pct			
Asian	69 52.67	62 47.33	131
Eastern European	23 36.51	40 63.49	63
European not Eastern	15 7.73	179 92.27	194
Middle-Eastern and Pakistani	22 30.56	50 69.44	72
East Indian	18 23.38	59 76.62	77
Other and DK	2 14.29	12 85.71	14
Total	149	402	551

Frequency Missing = 28

Statistics for Table of ethnic by lang1

Statistic	DF	Value	Prob
Chi-Square	5	85.2730	<.0001
Likelihood Ratio Chi-Square	5	89.8245	<.0001
Mantel-Haenszel Chi-Square	1	30.9788	<.0001
Phi Coefficient		0.3934	
Contingency Coefficient		0.3661	
Cramer's V		0.3934	

Effective Sample Size = 551

Frequency Missing = 28

Gender, Ethnicity and Math performance 10
 Sex by tongue by ethnic

The GLM Procedure

Class Level Information

Class	Levels	Values
sex	2	Female Male
tongue	2	English Other
ethnic	6	Asian East Indian Eastern European European not Eas Middle-Eastern Other and DK

Number of observations 579

NOTE: Due to missing values, only 383 observations can be used in this analysis.

Gender, Ethnicity and Math performance 11
 Sex by tongue by ethnic

The GLM Procedure

Dependent Variable: grade Final mark (if any)

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	21	9832.7490	468.2261	1.27	0.1915
Error	361	133084.8019	368.6560		
Corrected Total	382	142917.5509			

R-Square Coeff Var Root MSE grade Mean
 0.068800 32.72992 19.20042 58.66319

Source	DF	Type I SS	Mean Square	F Value	Pr > F
sex	1	110.794519	110.794519	0.30	0.5839
tongue	1	2060.201939	2060.201939	5.59	0.0186
sex*tongue	1	36.077235	36.077235	0.10	0.7546
ethnic	5	3186.572876	637.314575	1.73	0.1272
sex*ethnic	5	2582.039359	516.407872	1.40	0.2232
tongue*ethnic	4	293.094101	73.273525	0.20	0.9389
sex*tongue*ethnic	4	1563.968947	390.992237	1.06	0.3759

Source	DF	Type III SS	Mean Square	F Value	Pr > F
sex	1	16.126835	16.126835	0.04	0.8344
tongue	1	2048.505624	2048.505624	5.56	0.0189
sex*tongue	1	51.653832	51.653832	0.14	0.7084
ethnic	5	2543.674561	508.734912	1.38	0.2310
sex*ethnic	5	2106.573655	421.314731	1.14	0.3373
tongue*ethnic	4	148.448922	37.112231	0.10	0.9822
sex*tongue*ethnic	4	1563.968947	390.992237	1.06	0.3759

Gender, Ethnicity and Math performance 12
Sex by tongue by ethnic ancova

The GLM Procedure

Class Level Information

Class	Levels	Values
sex	2	Female Male
tongue	2	English Other
ethnic	6	Asian East Indian Eastern European European not Eas Middle-Eastern Other and DK

Number of observations 579

NOTE: Due to missing values, only 287 observations can be used in this analysis.

Gender, Ethnicity and Math performance 13
Sex by tongue by ethnic ancova

The GLM Procedure

Dependent Variable: grade Final mark (if any)

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	25	49522.64579	1980.90583	10.93	<.0001
Error	261	47306.46919	181.25084		
Corrected Total	286	96829.11498			

R-Square	Coeff Var	Root MSE	grade Mean
0.511444	22.21761	13.46294	60.59582

Source	DF	Type I SS	Mean Square	F Value	Pr > F
hsgpa	1	34656.39945	34656.39945	191.21	<.0001
hscal	1	4583.78372	4583.78372	25.29	<.0001
hsengl	1	1868.10929	1868.10929	10.31	0.0015
precalc	1	2596.17989	2596.17989	14.32	0.0002
calc	1	553.19037	553.19037	3.05	0.0818
sex	1	274.50311	274.50311	1.51	0.2196
tongue	1	833.13262	833.13262	4.60	0.0330
sex*tongue	1	593.00349	593.00349	3.27	0.0716
ethnic	5	1080.83198	216.16640	1.19	0.3131
sex*ethnic	5	1797.95591	359.59118	1.98	0.0814
tongue*ethnic	4	174.62445	43.65611	0.24	0.9150
sex*tongue*ethnic	3	510.93151	170.31050	0.94	0.4220

Source	DF	Type III SS	Mean Square	F Value	Pr > F
hsgpa	1	8821.986381	8821.986381	48.67	<.0001
hscal	1	607.880392	607.880392	3.35	0.0682
hsengl	1	1271.096272	1271.096272	7.01	0.0086
precalc	1	1889.434724	1889.434724	10.42	0.0014
calc	1	699.018544	699.018544	3.86	0.0506
sex	1	184.354542	184.354542	1.02	0.3141
tongue	1	680.462716	680.462716	3.75	0.0538
sex*tongue	1	170.199921	170.199921	0.94	0.3334
ethnic	5	405.373390	81.074678	0.45	0.8151
sex*ethnic	5	785.558563	157.111713	0.87	0.5039
tongue*ethnic	4	132.261103	33.065276	0.18	0.9474
sex*tongue*ethnic	3	510.931513	170.310504	0.94	0.4220

Gender, Ethnicity and Math performance 14
My favorite prediction model: 46% of the variation

The REG Procedure
Model: MODEL1
Dependent Variable: grade Final mark (if any)

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	5	44675	8935.02380	48.14	<.0001
Error	281	52154	185.60141		
Corrected Total	286	96829			

Root MSE	13.62356	R-Square	0.4614
Dependent Mean	60.59582	Adj R-Sq	0.4518
Coeff Var	22.48267		

Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value
Intercept	Intercept	1	-70.13523	11.21533	-6.25
lang1	Indicator for English	1	-4.86990	2.12951	-2.29
hsgpa	High School GPA	1	1.58158	0.22162	7.14
hscal	HS Calculus	1	0.26190	0.09995	2.62
hsengl	HS English	1	-0.30256	0.12292	-2.46
precalc	Number precalculus correct	1	1.93902	0.52332	3.71

Parameter Estimates

Variable	Label	DF	Pr > t
Intercept	Intercept	1	<.0001
lang1	Indicator for English	1	0.0229
hsgpa	High School GPA	1	<.0001
hscal	HS Calculus	1	0.0093
hsengl	HS English	1	0.0144
precalc	Number precalculus correct	1	0.0003

Gender, Ethnicity and Math performance
 Politically safer model: 45% of the variation

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The REG Procedure

Model: MODEL1

Dependent Variable: grade Final mark (if any)

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	43563	10891	57.91	<.0001
Error	284	53408	188.05524		
Corrected Total	288	96970			

Root MSE	13.71332	R-Square	0.4492
Dependent Mean	60.57785	Adj R-Sq	0.4415
Coeff Var	22.63752		

Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value
Intercept	Intercept	1	-74.11274	11.08720	-6.68
hsgpa	High School GPA	1	1.60015	0.22205	7.21
hscal	HS Calculus	1	0.29640	0.09937	2.98
hsengl	HS English	1	-0.35439	0.12101	-2.93
precalc	Number precalculus correct	1	1.90277	0.52470	3.63

Parameter Estimates

Variable	Label	DF	Pr > t
Intercept	Intercept	1	<.0001
hsgpa	High School GPA	1	<.0001
hscal	HS Calculus	1	0.0031
hsengl	HS English	1	0.0037
precalc	Number precalculus correct	1	0.0003

Gender, Ethnicity and Math performance 16
 Politically safer model: 45% of the variation

Proportion of remaining variation explained by precalc in safe model

A

0.0443403

Gender, Ethnicity and Math performance 17
 Try forward stepwise selection: Explain 47%

The STEPWISE Procedure
 Model: MODEL1
 Dependent Variable: grade Final mark (if any)

Forward Selection: Step 1

Variable hsgpa Entered: R-Square = 0.3579 and C(p) = 54.7980

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	34656	34656	158.87	<.0001
Error	285	62173	218.14988		
Corrected Total	286	96829			

Variable	Parameter Estimate	Standard Error	Type III SS	F Value	Pr > F
Intercept	-87.53291	11.78465	12035	55.17	<.0001
hsgpa	1.82997	0.14519	34656	158.87	<.0001

Bounds on condition number: 1, 1

Forward Selection: Step 2

Variable totscore Entered: R-Square = 0.4144 and C(p) = 27.0597

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	40130	20065	100.50	<.0001
Error	284	56699	199.64543		
Corrected Total	286	96829			

Variable	Parameter Estimate	Standard Error	Type II SS	F Value	Pr > F
Intercept	-77.92562	11.42210	9292.39457	46.54	<.0001
hsgpa	1.56942	0.14754	22591	113.15	<.0001
totscore	1.30211	0.24868	5473.41474	27.42	<.0001

Bounds on condition number: 1.1284, 4.5134

Forward Selection: Step 3

Variable hsengl Entered: R-Square = 0.4435 and C(p) = 13.7788

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	3	42942	14314	75.17	<.0001
Error	283	53887	190.41272		
Corrected Total	286	96829			

Variable	Parameter Estimate	Standard Error	Type II SS	F Value	Pr > F
Intercept	-72.85566	11.23260	8010.54144	42.07	<.0001
hsgpa	1.94618	0.17427	23747	124.71	<.0001
hsengl	-0.44468	0.11570	2812.50227	14.77	0.0001
totscore	1.15290	0.24595	4183.98406	21.97	<.0001

Bounds on condition number: 1.6507, 12.829

Forward Selection: Step 4

Variable lang1 Entered: R-Square = 0.4548 and C(p) = 9.8067

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	44041	11010	58.82	<.0001
Error	282	52788	187.19014		
Corrected Total	286	96829			

Gender, Ethnicity and Math performance 18
 Try forward stepwise selection: Explain 47%

The STEPWISE Procedure

Model: MODEL1

Dependent Variable: grade Final mark (if any)

Forward Selection: Step 4

Variable	Parameter Estimate	Standard Error	Type II SS	F Value	Pr > F
Intercept	-68.22951	11.29959	6824.99653	36.46	<.0001
lang1	-5.15807	2.12860	1099.17931	5.87	0.0160
hsgpa	1.87948	0.17497	21599	115.38	<.0001
hsengl	-0.37609	0.11816	1896.30271	10.13	0.0016
totscore	1.11430	0.24438	3891.84700	20.79	<.0001

Bounds on condition number: 1.6926, 21.954

Forward Selection: Step 5

Variable hscalC Entered: R-Square = 0.4635 and C(p) = 7.2429

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	5	44881	8976.29511	48.56	<.0001
Error	281	51948	184.86704		
Corrected Total	286	96829			

Variable	Parameter Estimate	Standard Error	Type II SS	F Value	Pr > F
Intercept	-66.75516	11.25053	6508.53209	35.21	<.0001
lang1	-4.69657	2.12640	901.84272	4.88	0.0280
hsgpa	1.58918	0.22087	9570.77619	51.77	<.0001
hscalc	0.21759	0.10208	839.97980	4.54	0.0339
hsengl	-0.30024	0.12270	1106.96199	5.99	0.0150
totscore	0.97213	0.25185	2754.41724	14.90	0.0001

Bounds on condition number: 2.7308, 44.252

Forward Selection: Step 6

Variable e5 Entered: R-Square = 0.4710 and C(p) = 5.2948

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	6	45608	7601.35727	41.55	<.0001
Error	280	51221	182.93204		
Corrected Total	286	96829			

Variable	Parameter Estimate	Standard Error	Type II SS	F Value	Pr > F
Intercept	-64.60808	11.24323	6040.62097	33.02	<.0001
e5	4.57904	2.29748	726.66807	3.97	0.0472
lang1	-4.48110	2.11801	818.85180	4.48	0.0353
hsgpa	1.58717	0.21971	9546.34142	52.19	<.0001
hscalc	0.20766	0.10166	763.23017	4.17	0.0420
hsengl	-0.32445	0.12266	1279.97837	7.00	0.0086
totscore	0.95113	0.25075	2632.00623	14.39	0.0002

Bounds on condition number: 2.7309, 59.472

No other variable met the 0.0500 significance level for entry into the model.

Summary of Forward Selection

Step	Variable Entered	Label	Number Vars In	Partial R-Square	Model R-Square
1	hsgpa	High School GPA	1	0.3579	0.3579
2	totscore	Total # right on diagnostic test	2	0.0565	0.4144
3	hsengl	HS English	3	0.0290	0.4435
4	lang1	Indicator for English	4	0.0114	0.4548
5	hscalc	HS Calculus	5	0.0087	0.4635
6	e5		6	0.0075	0.4710

Gender, Ethnicity and Math performance
 Try forward stepwise selection: Explain 47%

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The STEPWISE Procedure
 Model: MODEL1
 Dependent Variable: grade Final mark (if any)

Summary of Forward Selection

Step	C(p)	F Value	Pr > F
1	54.7980	158.87	<.0001
2	27.0597	27.42	<.0001
3	13.7788	14.77	0.0001
4	9.8067	5.87	0.0160
5	7.2429	4.54	0.0339
6	5.2948	3.97	0.0472

Gender, Ethnicity and Math performance
 Add e5 (East Indian) to my favorite prediction model: 47%

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The REG Procedure
 Model: MODEL1
 Dependent Variable: grade Final mark (if any)

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	6	45489	7581.49168	41.35	<.0001
Error	280	51340	183.35773		
Corrected Total	286	96829			

Root MSE	13.54096	R-Square	0.4698
Dependent Mean	60.59582	Adj R-Sq	0.4584
Coeff Var	22.34637		

Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value
Intercept	Intercept	1	-67.76900	11.20377	-6.05
lang1	Indicator for English	1	-4.63620	2.11951	-2.19
e5		1	4.84196	2.29829	2.11
hsgpa	High School GPA	1	1.57813	0.22028	7.16
hscal	HS Calculus	1	0.24943	0.09952	2.51
hsengl	HS English	1	-0.32776	0.12276	-2.67
precalc	Number precalculus correct	1	1.92570	0.52019	3.70

Parameter Estimates

Variable	Label	DF	Pr > t
Intercept	Intercept	1	<.0001
lang1	Indicator for English	1	0.0295
e5		1	0.0360
hsgpa	High School GPA	1	<.0001
hscal	HS Calculus	1	0.0128
hsengl	HS English	1	0.0080
precalc	Number precalculus correct	1	0.0003

Gender, Ethnicity and Math performance
Language by e5 Interaction? 21

The GLM Procedure

Class Level Information

Class	Levels	Values
lang1	2	0 1
e5	2	0 1

Number of observations 579

NOTE: Due to missing values, only 287 observations can be used in this analysis.

Gender, Ethnicity and Math performance
Language by e5 Interaction? 22

The GLM Procedure

Dependent Variable: grade Final mark (if any)

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	7	45592.27332	6513.18190	35.47	<.0001
Error	279	51236.84166	183.64459		
Corrected Total	286	96829.11498			

R-Square	Coeff Var	Root MSE	grade Mean
0.470853	22.36384	13.55155	60.59582

Source	DF	Type I SS	Mean Square	F Value	Pr > F
hsgpa	1	34656.39945	34656.39945	188.71	<.0001
hscal	1	4583.78372	4583.78372	24.96	<.0001
hsengl	1	1868.10929	1868.10929	10.17	0.0016
precalc	1	2596.17989	2596.17989	14.14	0.0002
lang1	1	970.64664	970.64664	5.29	0.0222
e5	1	813.83107	813.83107	4.43	0.0362
lang1*e5	1	103.32327	103.32327	0.56	0.4538

Source	DF	Type III SS	Mean Square	F Value	Pr > F
hsgpa	1	9315.334403	9315.334403	50.72	<.0001
hscal	1	1088.703572	1088.703572	5.93	0.0155
hsengl	1	1185.079313	1185.079313	6.45	0.0116
precalc	1	2612.392623	2612.392623	14.23	0.0002
lang1	1	273.978283	273.978283	1.49	0.2230
e5	1	328.090797	328.090797	1.79	0.1824
lang1*e5	1	103.323269	103.323269	0.56	0.4538

Gender, Ethnicity and Math performance
 Conclude no meaningful effect for sex?

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The REG Procedure
 Model: MODEL1
 Dependent Variable: grade Final mark (if any)

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	7	45672	6524.54743	35.58	<.0001
Error	279	51157	183.35944		
Corrected Total	286	96829			

Root MSE	13.54103	R-Square	0.4717
Dependent Mean	60.59582	Adj R-Sq	0.4584
Coeff Var	22.34647		

Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value
Intercept	Intercept	1	-67.99805	11.20617	-6.07
gender	Indicator for Female	1	1.69082	1.69302	1.00
lang1	Indicator for English	1	-4.43282	2.12928	-2.08
e5		1	5.01075	2.30450	2.17
hsgpa	High School GPA	1	1.58862	0.22054	7.20
hscal	HS Calculus	1	0.25137	0.09954	2.53
hsengl	HS English	1	-0.35758	0.12634	-2.83
precalc	Number precalculus correct	1	2.02236	0.52912	3.82

Parameter Estimates

Variable	Label	DF	Pr > t
Intercept	Intercept	1	<.0001
gender	Indicator for Female	1	0.3188
lang1	Indicator for English	1	0.0383
e5		1	0.0305
hsgpa	High School GPA	1	<.0001
hscal	HS Calculus	1	0.0121
hsengl	HS English	1	0.0050
precalc	Number precalculus correct	1	0.0002

Gender, Ethnicity and Math performance
 Conclude no meaningful effect for sex?

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B	SE	TCRIT
1.69082	1.69302	1.9685031

LOWER95	UPPER95
-1.641895	5.0235352