

Block Number 2. Method: Enter GRE_V GRE_Q

Variable(s) Entered on Step Number

3.. GRE_Q GRE-Quant
4.. GRE_V GRE-Verbal

2
Y_{K1} → Multiple R .94062
R Square .88476 R Square Change .10447
Adjusted R Square .85403 F Change 6.79918
Standard Error .16901 Signif F Change .0079

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	4 → k1	3.28953	.82238
Residual	15	.42847	.02856

F = 28.79035 Signif F = .0000

----- Variables in the Equation -----

Variable	B	SE B	Beta	T	Sig T
GPA_U	.540282	.224071	.362042	2.411	.0292
GRE_V	.003191	9.5846E-04	.469534	3.329	.0046
GRE_Q	-5.81444E-04	7.4879E-04	-.098479	-.777	.4495
MOTIV	.015213	.005803	.341521	2.622	.0192
(Constant)	-1.126417	.450169		-2.502	.0244

End Block Number 2 All requested variables entered.

Test for Added Variables : $H_0: \beta_3 = \beta_4 = 0$ (refer to notes)

$$F = \frac{\left(\frac{.88476 - 0.78029}{2} \right)}{\left(\frac{1 - 0.88476}{20 - 4 - 1} \right)} = \frac{0.0522}{0.00768} = 6.795$$

at $\alpha = 0.05$, $F_{.05}(2, 15) = 3.68$, $6.795 > 3.68$ Reject H_0 at 0.05

8.24

8

```

-> regression variables=gpa_u gre_v gre_q motiv gpa_g/
->   descriptive=corr/
->   statistics=default,cha/
->   dependent=gpa_g/method=stepwise.

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Stepwise

* * * * M U L T I P L E R E G R E S S I O N * * * *

Listwise Deletion of Missing Data

N of Cases = 20

Correlation:

	GPA_U	GRE_V	GRE_Q	MOTIV	GPA_G
GPA_U	1.000	.617	.452	.725	.855
GRE_V	.617	1.000	.708	.403	.761
GRE_Q	.452	.708	1.000	.199	.466
MOTIV	.725	.403	.199	1.000	.773
GPA_G	.855	.761	.466	.773	1.000

* * * * M U L T I P L E R E G R E S S I O N * * * *

Equation Number 1 Dependent Variable.. GPA_G Graduate GPA

Descriptive Statistics are printed on Page 7

Block Number 1. Method: Stepwise Criteria PIN .0500 POUT ..

Variable(s) Entered on Step Number

1.. GPA_U Undergrad GPA

Multiple R	.85453		
R Square	.73022	R Square Change	.73022
Adjusted R Square	.71524	F Change	48.72178
Standard Error	.23606	Signif F Change	.0000

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	1	2.71497	2.71497
Residual	18	1.00303	.05572

F = 48.72178 Signif F = .0000

----- Variables in the Equation -----

9
8.3

Variable	B	SE B	Beta	T	Sig T
GPA_U	1.275232	.182695	.854531	6.980	.0000
(Constant)	-1.004642	.606111		-1.658	.1147

----- Variables not in the Equation -----

Variable	Beta In	Partial	Min Toler	T	Sig T
GRE_V	.377034	.571467	.619764	2.871	.0106
GRE_Q	.100119	.171963	.795870	.720	.4815
MOTIV	.324641	.430778	.475014	1.968	.0656

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Variable(s) Entered on Step Number
2.. GRE_V GRE-Verbal

Multiple R	.90461			
R Square	.81833	R Square Change	.08810	
Adjusted R Square	.79695	F Change	8.24406	
Standard Error	.19933	Signif F Change	.0106	

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	2	3.04253	1.52127
Residual	17	.67547	.03973

F = 38.28691 Signif F = .0000

----- Variables in the Equation -----

Variable	B	SE B	Beta	T	Sig T
GPA_U	.928281	.195962	.622039	4.737	.0002
GRE_V	.002562	8.9244E-04	.377034	2.871	.0106
(Constant)	-1.317267	.523264		-2.517	.0221

----- Variables not in the Equation -----

Variable	Beta In	Partial	Min Toler	T	Sig T
GRE_Q	-.165425	-.273843	.387686	-1.139	.2715
MOTIV	.361886	.583243	.349125	2.872	.0111

8.26 (40)

Variable(s) Entered on Step Number
 3.. MOTIV Movitation

Multiple R	.93815		
R Square	.88013	R Square Change	.06180
Adjusted R Square	.85765	F Change	8.24876
Standard Error	.16690	Signif F Change	.0111

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	3	3.27231	1.09077
Residual	16	.44569	.02786

F = 39.15783 Signif F = .0000

----- Variables in the Equation -----

Variable	B	SE B	Beta	T	Sig T
GPA_U	.513375	.218612	.344012	2.348	.0320
GRE_V	.002737	7.4970E-04	.402688	3.650	.0022
MOTIV	.016120	.005613	.361886	2.872	.0111
(Constant)	-1.169684	.441130		-2.652	.0174

----- Variables not in the Equation -----

Variable	Beta In	Partial	Min Toler	T	Sig T
GRE_Q	-.098479	-.196582	.340776	-.777	.4495

End Block Number 1 PIN = .050 Limits reached.

8.27

Logistic Regression :

Predicting whether an event will or will not occur, as well as identifying the variables useful in making the prediction, is important in most academic disciplines as well as "real" world. Why do some people develop coronary heart disease and others not? Why do some businesses succeed, while others fail?

When the ^{dependent variable} Y can have only two values, the assumptions necessary for hypothesis testing in regression analysis are necessarily violated. Another difficulty with multiple regression is that predicted values cannot be interpreted as probabilities. They are not constrained to fall in the interval between 0 and 1.

In logistic regression we directly estimate the probability of an event occurring. For the case of a single independent variable, the logistic regression model can be written as:

$$\log \frac{P}{1-P} = b_0 + b_1 x_1$$

where b_0, b_1 can be estimated from the data

$$\Rightarrow \frac{P}{1-P} = e^{b_0 + b_1 x_1}$$

$$\Rightarrow P = \frac{e^{b_0 + b_1 x_1}}{1 + e^{b_0 + b_1 x_1}}$$

$$\Rightarrow p + e^{b_0 + b_1 x_1} = e^{b_0 + b_1 x_1}$$

$$\Rightarrow p(1 + e^{b_0 + b_1 x_1}) = e^{b_0 + b_1 x_1}$$

$$\Rightarrow p = \frac{e^{b_0 + b_1 x_1}}{1 + e^{b_0 + b_1 x_1}}$$

For a set of multiple predictors, we have

$$p = \frac{e^{b_0 + b_1 x_1 + b_2 x_2 + \dots + b_n x_n}}{1 + e^{b_0 + b_1 x_1 + b_2 x_2 + \dots + b_n x_n}}$$

(1) Hierarchical logistic regressions —

(2) Stepwise logistic regressions —

(3) Simultaneous logistic regressions —

See computer printout for discussion.

Logistic Regression

8.29 (11)

Total number of cases: 20 (Unweighted)
 Number of selected cases: 20
 Number of unselected cases: 0

Number of selected cases: 20
 Number rejected because of missing data: 0
 Number of cases included in the analysis: 20

Dependent Variable Encoding:

Original Value	Internal Value
.00	0
1.00	1

Dependent Variable.. FINISH Finish Grad School

Beginning Block Number 0. Initial Log Likelihood Function

-2 Log Likelihood 26.920467

* Constant is included in the model.

Beginning Block Number 1. Method: Enter

Variable(s) Entered on Step Number

1..	GPA_U	Undergrad GPA
	GRE_V	GRE-Verbal
	GRE_Q	GRE-Quant
	MOTIV	Movitation

Simultaneous Logistic Regression

Estimation terminated at iteration number 6 because Log Likelihood decreased by less than .01 percent.

-2 Log Likelihood	9.033
Goodness of Fit	10.461
Cox & Snell - R ²	.591
Nagelkerke - R ²	.799

	Chi-Square	df	Significance
Model	17.888	4	.0013
Block	17.888	4	.0013
Step	17.888	4	.0013

Classification Table for FINISH

The Cut Value is .50

Observed		Predicted			Percent Correct		
		no		yes			
		n	I	y			
no	n	I	7	I	1	I	87.50%
yes	y	I	0	I	12	I	100.00%
Overall							95.00%

----- Variables in the Equation -----

Variable	B	S.E.	Wald	df	Sig	R	Exp(B)
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8.30 (12)

GPA_U	3.7613	5.0064	.5644	1	.4525	.0000	43.0041
GRE_V	.0395	.0289	1.8664	1	.1719	.0000	1.0402
GRE_Q	-.0311	.0271	1.3172	1	.2511	.0000	.9694
MOTIV	.3339	.1790	3.4774	1	.0622	.2343	1.3964
Constant	-39.5097	22.0664	3.2059	1	.0734		

Logistic Regression

Total number of cases: 20 (Unweighted)
 Number of selected cases: 20
 Number of unselected cases: 0

Number of selected cases: 20
 Number rejected because of missing data: 0
 Number of cases included in the analysis: 20

Dependent Variable Encoding:

Original Value	Internal Value
.00	0
1.00	1

Dependent Variable.. FINISH Finish Grad School

Beginning Block Number 0. Initial Log Likelihood Function

-2 Log Likelihood 26.920467

* Constant is included in the model.

Beginning Block Number 1. Method: Enter

Variable(s) Entered on Step Number
 1.. MOTIV Movitation

Estimation terminated at iteration number 5 because Log Likelihood decreased by less than .01 percent.

-2 Log Likelihood	13.059
Goodness of Fit	18.730
Cox & Snell - R ²	.500
Nagelkerke - R ²	.676

	Chi-Square	df	Significance
Model	13.862	1	.0002
Block	13.862	1	.0002
Step	13.862	1	.0002

Hierarchical logistic reg.

Classification Table for FINISH
 The Cut Value is .50

Observed		Predicted		Percent Correct
		no	yes	
		n	I y	
no	n	I 7 I 1 I	87.50%	
yes	y	I 2 I 10 I	83.33%	
Overall				85.00%

----- Variables in the Equation -----

Variable	B	S.E.	Wald	df	Sig	R	Exp(B)
MOTIV	.2948	.1227	5.7768	1	.0162	.3746	1.3429
Constant	-19.5085	8.1600	5.7156	1	.0168		

Beginning Block Number 2. Method: Enter

Variable(s) Entered on Step Number
 1.. GPA_U Undergrad GPA
 GRE_V GRE-Verbal
 GRE_Q GRE-Quant

Estimation terminated at iteration number 6 because Log Likelihood decreased by less than .01 percent.

-2 Log Likelihood	9.033
Goodness of Fit	10.461
Cox & Snell - R ²	.591
Nagelkerke - R ²	.799

	Chi-Square	df	Significance
Model	17.888	4	.0013
Block	4.026	3	.2587
Step	4.026	3	.2587

Classification Table for FINISH
 The Cut Value is .50

Observed		Predicted		Percent Correct
		no	yes	
		n	I y	
no	n	I 7 I	1 I	87.50%
yes	y	I 0 I	12 I	100.00%
Overall				95.00%

----- Variables in the Equation -----

Variable	B	S.E.	Wald	df	Sig	R	Exp(B)
MOTIV	.3339	.1790	3.4774	1	.0622	.3364	1.3964
GPA_U	3.7613	5.0064	.5644	1	.4525	.0000	43.0041
GRE_V	.0395	.0289	1.8664	1	.1719	.0000	1.0402
GRE_Q	-.0311	.0271	1.3172	1	.2511	.0000	.9694
Constant	-39.5097	22.0664	3.2059	1	.0734		

Logistic Regression

Total number of cases: 20 (Unweighted)
 Number of selected cases: 20
 Number of unselected cases: 0

 Number of selected cases: 20
 Number rejected because of missing data: 0
 Number of cases included in the analysis: 20

Dependent Variable Encoding:

8.32

14

Original Value	Internal Value
.00	0
1.00	1

Dependent Variable.. FINISH Finish Grad School

Beginning Block Number 0. Initial Log Likelihood Function

-2 Log Likelihood 26.920467

* Constant is included in the model.

Estimation terminated at iteration number 2 because Log Likelihood decreased by less than .01 percent.

Classification Table for FINISH
The Cut Value is .50

		Predicted				Percent Correct
		no		yes		
Observed		n	I	y		
no	n	I	0	I	8	.00%
yes	y	I	0	I	12	100.00%
Overall						60.00%

----- Variables in the Equation -----

Variable	B	S.E.	Wald	df	Sig	R	Exp(B)
Constant	.4055	.4564	.7891	1	.3744		

Beginning Block Number 1. Method: Forward Stepwise (COND)

----- Variables not in the Equation -----
Residual Chi Square 11.423 with 4 df Sig = .0222

Variable	Score	df	Sig	R
GPA_U	7.5566	1	.0060	.4543
GRE_V	3.6628	1	.0556	.2485
GRE_Q	.3753	1	.5402	.0000
MOTIV	10.2827	1	.0013	.5547

Variable(s) Entered on Step Number
1.. MOTIV Movitation

Estimation terminated at iteration number 5 because Log Likelihood decreased by less than .01 percent.

-2 Log Likelihood	13.059
Goodness of Fit	18.730
Cox & Snell - R^2	.500
Nagelkerke - R^2	.676

	Chi-Square	df	Significance
Model	13.862	1	.0002
Block	13.862	1	.0002
Step	13.862	1	.0002

Stepwise logit reg.

8.33 (15)

Classification Table for FINISH
The Cut Value is .50

Observed		Predicted				Percent Correct	
		no		yes			
		n	I	y	I		
no	n	I	7	I	1	I	87.50%
yes	y	I	2	I	10	I	83.33%
Overall							85.00%

----- Variables in the Equation -----

Variable	B	S.E.	Wald	df	Sig	R	Exp(B)
MOTIV	.2948	.1227	5.7768	1	.0162	.3746	1.3429
Constant	-19.5085	8.1600	5.7156	1	.0168		

----- Model if Term Removed -----

Based on Conditional Parameter Estimates

Term Removed	Log Likelihood	-2 Log LR	df	Significance of Log LR
MOTIV	-13.804	14.549	1	.0001

----- Variables not in the Equation -----

Residual Chi Square 3.339 with 3 df Sig = .3423

Variable	Score	df	Sig	R
GPA_U	.8338	1	.3612	.0000
GRE_V	1.9148	1	.1664	.0000
JRE_Q	.0906	1	.7634	.0000

No more variables can be deleted or added.