

```

1      title1 'Generic multiple regression introduction';
2      dm'log;clear;output;clear';
3
4      ODS HTML style=minimal body='C:\EXST 7005\SAS\Example09.html' ;
NOTE: Writing HTML Body file: C:\EXST 7005\SAS\Example09.html
5      ODS RTF style=minimal body='C:\EXST 7005\SAS\Example09.rtf';
NOTE: Writing RTF Body file: C:\EXST 7005\SAS\Example09.rtf
6      ODS PDF style=minimal body='C:\EXST 7005\SAS\Example09.PDF';
NOTE: Writing ODS PDF output to DISK destination
      "C:\EXST 7005\SAS\Example09.PDF", printer "PDF".
7
8      *****;
9      *** Multiple Regression : Small Generic Example ***;
10     *****;
11     options ps=256 ls=99 nocenter nodate nonumber;
12
13     data one; infile cards missover;
14         input Y X1 X2 X3;
15     cards;
NOTE: The data set WORK.ONE has 12 observations and 4 variables.
NOTE: DATA statement used (Total process time):
      real time          0.01 seconds
      cpu time           0.01 seconds
15     !      run;
28     ;
29     proc print data=one; title2 'Raw data listing'; run;
NOTE: There were 12 observations read from the data set WORK.ONE.
NOTE: The PROCEDURE PRINT printed page 1.
NOTE: PROCEDURE PRINT used (Total process time):
      real time          0.18 seconds
      cpu time           0.01 seconds

```

Generic multiple regression introduction
Raw data listing

Obs	Y	X1	X2	X3
1	1	2	9	2
2	3	4	6	5
3	5	7	7	9
4	3	3	5	5
5	6	5	8	9
6	4	3	4	2
7	2	2	3	6
8	8	6	2	1
9	9	7	5	3
10	3	8	2	4
11	5	7	3	7
12	6	9	1	4

```

30
31      title2 'All possible models with PROC REG';
32      proc reg data=one; model y = x1/ ss1 ss2; run;
NOTE: The PROCEDURE REG printed page 2.
NOTE: PROCEDURE REG used (Total process time):
      real time          0.10 seconds
      cpu time           0.01 seconds

```

Generic multiple regression introduction
All possible models with PROC REG

The REG Procedure
Model: MODEL1
Dependent Variable: Y

```

Number of Observations Read      12
Number of Observations Used      12

```

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	23.97763	23.97763	6.16	0.0325
Error	10	38.93904	3.89390		
Corrected Total	11	62.91667			

Root MSE	1.97330	R-Square	0.3811
Dependent Mean	4.58333	Adj R-Sq	0.3192
Coeff Var	43.05377		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > t	Type I SS	Type II SS
Intercept	1	1.37613	1.41242	0.97	0.3529	252.08333	3.69640
x1	1	0.61089	0.24618	2.48	0.0325	23.97763	23.97763

```

33      proc reg data=one; model y = x2 / ss1 ss2; run;
NOTE: The PROCEDURE REG printed page 3.
NOTE: PROCEDURE REG used (Total process time):
      real time          0.12 seconds
      cpu time           0.01 seconds

```

```

NOTE: The PROCEDURE GLM printed pages 10-11.
NOTE: PROCEDURE GLM used (Total process time):
      real time          0.47 seconds
      cpu time           0.06 seconds

```

Generic multiple regression introduction
All possible models with PROC REG

The REG Procedure
Model: MODEL1
Dependent Variable: Y

```

Number of Observations Read      12
Number of Observations Used      12

```

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	4.11526	4.11526	0.70	0.4224
Error	10	58.80141	5.88014		
Corrected Total	11	62.91667			

Root MSE	2.42490	R-Square	0.0654
Dependent Mean	4.58333	Adj R-Sq	-0.0281
Coeff Var	52.90691		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > t	Type I SS	Type II SS
Intercept	1	5.68743	1.49393	3.81	0.0034	252.08333	85.22336
X2	1	-0.24089	0.28795	-0.84	0.4224	4.11526	4.11526

34 proc reg data=one; model y = x3 / ssl ss2; run;

NOTE: The PROCEDURE REG printed page 4.

NOTE: PROCEDURE REG used (Total process time):

real time 0.20 seconds
cpu time 0.01 seconds

Generic multiple regression introduction
All possible models with PROC REG

The REG Procedure

Model: MODEL1

Dependent Variable: Y

Number of Observations Read 12
Number of Observations Used 12

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	0.23689	0.23689	0.04	0.8498
Error	10	62.67978	6.26798		
Corrected Total	11	62.91667			

Root MSE	2.50359	R-Square	0.0038
Dependent Mean	4.58333	Adj R-Sq	-0.0959
Coeff Var	54.62385		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > t	Type I SS	Type II SS
Intercept	1	4.84809	1.54176	3.14	0.0104	252.08333	61.97728
X3	1	-0.05574	0.28671	-0.19	0.8498	0.23689	0.23689

35 proc reg data=one; model y = x1 x2 / ssl ss2; run;

NOTE: The PROCEDURE REG printed page 5.

NOTE: PROCEDURE REG used (Total process time):

real time 0.17 seconds
cpu time 0.01 seconds

Generic multiple regression introduction
All possible models with PROC REG

The REG Procedure

Model: MODEL1

Dependent Variable: Y

Number of Observations Read 12
Number of Observations Used 12

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	24.07446	12.03723	2.79	0.1141
Error	9	38.84220	4.31580		
Corrected Total	11	62.91667			

Root MSE	2.07745	R-Square	0.3826
Dependent Mean	4.58333	Adj R-Sq	0.2454
Coeff Var	45.32619		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > t	Type I SS	Type II SS
Intercept	1	1.07558	2.49743	0.43	0.6768	252.08333	0.80049
X1	1	0.63159	0.29369	2.15	0.0600	23.97763	19.95921
X2	1	0.04187	0.27955	0.15	0.8842	0.09684	0.09684

36 proc reg data=one; model y = x1 x3 / ssl ss2; run;

NOTE: The PROCEDURE REG printed page 6.

NOTE: PROCEDURE REG used (Total process time):

real time	0.26 seconds
cpu time	0.03 seconds

Generic multiple regression introduction
All possible models with PROC REG

The REG Procedure

Model: MODEL1

Dependent Variable: Y

Number of Observations Read 12
Number of Observations Used 12

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	25.37078	12.68539	3.04	0.0980
Error	9	37.54588	4.17176		
Corrected Total	11	62.91667			

Root MSE	2.04249	R-Square	0.4032
Dependent Mean	4.58333	Adj R-Sq	0.2706
Coeff Var	44.56341		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > t	Type I SS	Type II SS
Intercept	1	1.91576	1.73473	1.10	0.2981	252.08333	5.08794
X1	1	0.63161	0.25732	2.45	0.0365	23.97763	25.13390
X3	1	-0.13650	0.23621	-0.58	0.5775	1.39316	1.39316

37 proc reg data=one; model y = x2 x3 / ssl ss2; run;

NOTE: The PROCEDURE REG printed page 7.

NOTE: PROCEDURE REG used (Total process time):

 real time 0.29 seconds
 cpu time 0.07 seconds

Generic multiple regression introduction
All possible models with PROC REG

The REG Procedure

Model: MODEL1

Dependent Variable: Y

Number of Observations Read 12
Number of Observations Used 12

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	4.13721	2.06860	0.32	0.7363
Error	9	58.77946	6.53105		
Corrected Total	11	62.91667			

Root MSE 2.55559 R-Square 0.0658
Dependent Mean 4.58333 Adj R-Sq -0.1419
Coeff Var 55.75837

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > t	Type I SS	Type II SS
Intercept	1	5.62891	1.87021	3.01	0.0147	252.08333	59.16272
X2	1	-0.24662	0.31913	-0.77	0.4595	4.11526	3.90032
X3	1	0.01784	0.30776	0.06	0.9550	0.02195	0.02195

38 proc reg data=one; model y = x1 x2 x3 / ssl ss2; run;

39

NOTE: The PROCEDURE REG printed page 8.

NOTE: PROCEDURE REG used (Total process time):

 real time 0.20 seconds
 cpu time 0.06 seconds

Generic multiple regression introduction
All possible models with PROC REG

The REG Procedure

Model: MODEL1

Dependent Variable: Y

Number of Observations Read 12
Number of Observations Used 12

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	3	26.18995	8.72998	1.90	0.2078
Error	8	36.72672	4.59084		
Corrected Total	11	62.91667			

Root MSE 2.14262 R-Square 0.4163
Dependent Mean 4.58333 Adj R-Sq 0.1974
Coeff Var 46.74817

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > t	Type I SS	Type II SS
Intercept	1	1.14454	2.57778	0.44	0.6688	252.08333	0.90503
X1	1	0.70578	0.32202	2.19	0.0598	23.97763	22.05274
X2	1	0.13483	0.31918	0.42	0.6838	0.09684	0.81916
X3	1	-0.18621	0.27431	-0.68	0.5164	2.11548	2.11548

```

40      proc mixed data=one; model y = x1 x2 x3 / solution HType=1 2 3;
41          title2 'Multiple Regression with PROC MIXED';
42      run;

```

NOTE: The PROCEDURE MIXED printed page 9.

NOTE: PROCEDURE MIXED used (Total process time):

```

      real time          0.10 seconds
      cpu time           0.03 seconds

```

Generic multiple regression introduction

Multiple Regression with PROC MIXED

The Mixed Procedure

Model Information

```

Data Set                WORK.ONE
Dependent Variable      Y
Covariance Structure    Diagonal
Estimation Method       REML
Residual Variance Method Profile
Fixed Effects SE Method Model-Based
Degrees of Freedom Method Residual

```

Dimensions

```

Covariance Parameters    1
Columns in X             4
Columns in Z             0
Subjects                 1
Max Obs Per Subject     12

```

Number of Observations

```

Number of Observations Read      12
Number of Observations Used      12
Number of Observations Not Used  0

```

Covariance Parameter

Estimates

```

Cov Parm    Estimate
Residual    4.5908

```

Fit Statistics

```

-2 Res Log Likelihood    49.7
AIC (smaller is better)  51.7
AICC (smaller is better) 52.3
BIC (smaller is better)  51.7

```

Solution for Fixed Effects

Effect	Estimate	Standard Error	DF	t Value	Pr > t
Intercept	1.1445	2.5778	8	0.44	0.6688
X1	0.7058	0.3220	8	2.19	0.0598
X2	0.1348	0.3192	8	0.42	0.6838
X3	-0.1862	0.2743	8	-0.68	0.5164

Type 1 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
X1	1	8	5.22	0.0516
X2	1	8	0.02	0.8881
X3	1	8	0.46	0.5164

Type 2 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
X1	1	8	4.80	0.0598
X2	1	8	0.18	0.6838
X3	1	8	0.46	0.5164

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
X1	1	8	4.80	0.0598
X2	1	8	0.18	0.6838
X3	1	8	0.46	0.5164

```

43      proc glm data=one; model y = x1 x2 x3 / solution ssl ss2 ss3 ss4;
44          title2 'Multiple Regression with PROC GLM';
45      run;
46
47      ods html close;
48      ods rtf close;
49      ods PDF close;
NOTE: ODS PDF printed 12 pages to C:\EXST 7005\SAS\Example09.PDF.
50
51      run;
52      quit;

```

Generic multiple regression introduction
Multiple Regression with PROC GLM

The GLM Procedure

```

Number of Observations Read      12
Number of Observations Used      12

```

Generic multiple regression introduction
Multiple Regression with PROC GLM

The GLM Procedure

Dependent Variable: Y

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	3	26.18994658	8.72998219	1.90	0.2078
Error	8	36.72672008	4.59084001		
Corrected Total	11	62.91666667			

R-Square	Coeff Var	Root MSE	Y Mean
0.416264	46.74817	2.142625	4.583333

Source	DF	Type I SS	Mean Square	F Value	Pr > F
X1	1	23.97762646	23.97762646	5.22	0.0516
X2	1	0.09683730	0.09683730	0.02	0.8881
X3	1	2.11548283	2.11548283	0.46	0.5164

Source	DF	Type II SS	Mean Square	F Value	Pr > F
X1	1	22.05273729	22.05273729	4.80	0.0598
X2	1	0.81916182	0.81916182	0.18	0.6838
X3	1	2.11548283	2.11548283	0.46	0.5164

Source	DF	Type III SS	Mean Square	F Value	Pr > F
X1	1	22.05273729	22.05273729	4.80	0.0598
X2	1	0.81916182	0.81916182	0.18	0.6838
X3	1	2.11548283	2.11548283	0.46	0.5164

Source	DF	Type IV SS	Mean Square	F Value	Pr > F
X1	1	22.05273729	22.05273729	4.80	0.0598
X2	1	0.81916182	0.81916182	0.18	0.6838
X3	1	2.11548283	2.11548283	0.46	0.5164

Parameter	Estimate	Standard Error	t Value	Pr > t
Intercept	1.144541173	2.57777758	0.44	0.6688
X1	0.705779391	0.32202071	2.19	0.0598
X2	0.134827053	0.31918191	0.42	0.6838
X3	-0.186211994	0.27431463	-0.68	0.5164