

Solutions Homework Problems Chapter 23

Problem 23.1

(a) `_ols y x / predict=yhat`

```

REQUIRED MEMORY IS PAR=          2 CURRENT PAR=          781
OLS ESTIMATION
  21 OBSERVATIONS      DEPENDENT VARIABLE= Y
...NOTE..SAMPLE RANGE SET TO:      1,      21
...WARNING..DEPENDENT VARIABLE IS DUMMY VARIABLE ...TRY LOGIT or PROBIT

```

```

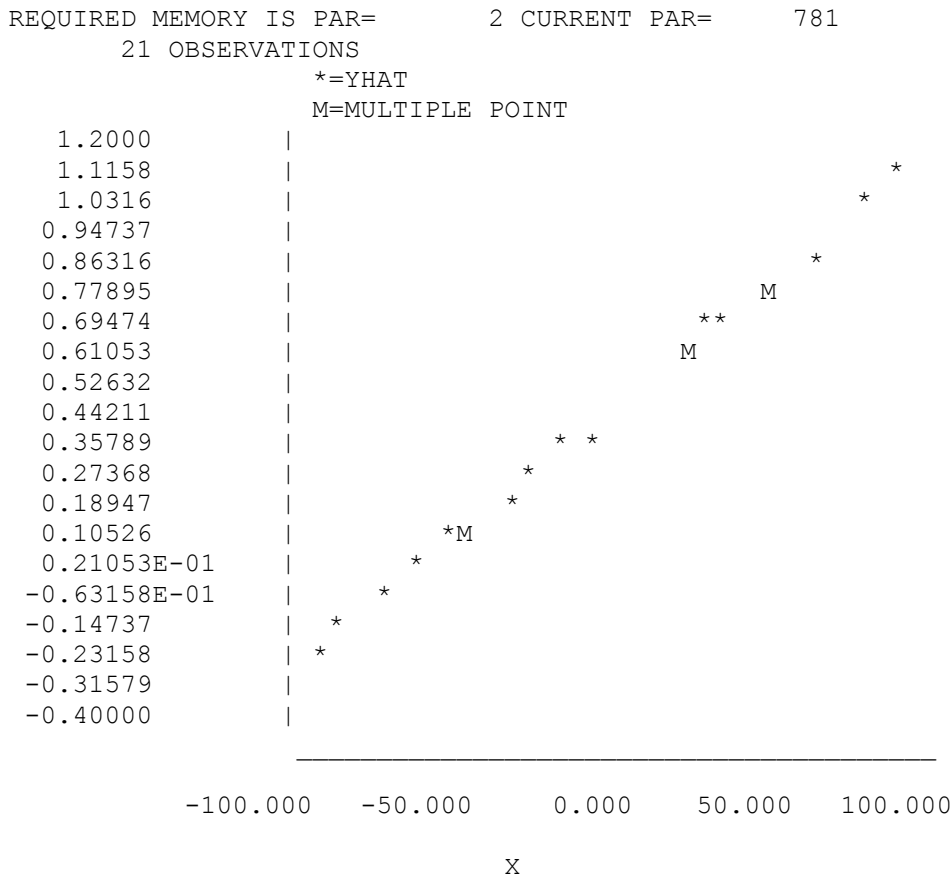
R-SQUARE =      0.6113      R-SQUARE ADJUSTED =      0.5909
VARIANCE OF THE ESTIMATE-SIGMA**2 =      0.10715
STANDARD ERROR OF THE ESTIMATE-SIGMA =      0.32734
SUM OF SQUARED ERRORS-SSE=      2.0359
MEAN OF DEPENDENT VARIABLE =      0.47619
LOG OF THE LIKELIHOOD FUNCTION = -5.29514

```

VARIABLE NAME	ESTIMATED COEFFICIENT	STANDARD ERROR	T-RATIO	P-VALUE	PARTIAL CORR.	STANDARDIZED COEFFICIENT	ELASTICITY AT MEANS
X	0.70310E-02	0.1286E-02	5.467	0.000	0.782	0.7819	-0.0181
CONSTANT	0.48480	0.7145E-01	6.785	0.000	0.841	0.0000	1.0181

(b)

`_plot yhat x`



```
(c) |_ genr var = yhat*(1-yhat)
|_ print var
VAR
  0.1231158      0.2255543      -0.7144498E-01  0.2145931      0.1936487
 -0.1401443      0.1267220      -0.1492002      0.2318473      0.1076440
 -0.1762991      0.5168562E-01  0.1446552      0.2458498      0.1291782
  0.2048016      0.4775173E-01  0.1998917      0.2172536      -0.2853507E-01
  0.1373447
```

Some of the estimated variances are negative and to do the feasible GLS estimates we must divide each observation by the standard error which is the square root of the variance. We can not take square roots of negative numbers. These negative values arise whenever the prediction is greater than one or less than zero.

In doing this estimate, we change each negative variance to 0.01 prior to taking the square root.

```
|_ if(var.lt.0) var=0.01
|_ print var
VAR
  0.1231158      0.2255543      0.1000000E-01  0.2145931      0.1936487
  0.1000000E-01  0.1267220      0.1000000E-01  0.2318473      0.1076440
  0.1000000E-01  0.5168562E-01  0.1446552      0.2458498      0.1291782
  0.2048016      0.4775173E-01  0.1998917      0.2172536      0.1000000E-01
  0.1373447
|_ genr sterr = sqrt(var)
|_ genr w = 1/sterr
```

```
|_ ols y x / weight=w predict=yhatstar
```

```
REQUIRED MEMORY IS PAR=          3 CURRENT PAR=          781
OLS ESTIMATION
      21 OBSERVATIONS      DEPENDENT VARIABLE= Y
...NOTE..SAMPLE RANGE SET TO:          1,          21
...WARNING..DEPENDENT VARIABLE IS DUMMY VARIABLE ...TRY LOGIT or PROBIT
SUM OF LOG(SQRT(ABS(WEIGHT))) = -2.2160
```

```
R-SQUARE = 0.7830      R-SQUARE ADJUSTED = 0.7716
VARIANCE OF THE ESTIMATE-SIGMA**2 = 0.59366E-01
STANDARD ERROR OF THE ESTIMATE-SIGMA = 0.24365
SUM OF SQUARED ERRORS-SSE= 1.1280
MEAN OF DEPENDENT VARIABLE = 0.45057
LOG OF THE LIKELIHOOD FUNCTION = -1.31046
```

VARIABLE NAME	ESTIMATED COEFFICIENT	STANDARD ERROR	T-RATIO	PARTIAL CORR. COEFFICIENT	STANDARDIZED	ELASTICITY AT MEANS
X	0.63374E-02	0.7653E-03	8.281	0.000 0.885	0.8849	-0.1015
CONSTANT	0.49632	0.5346E-01	9.285	0.000 0.905	0.0000	1.1015

ITERATION 2 LOG OF LIKELIHOOD FUNCTION = -6.2052

ITERATION 3 ESTIMATES
0.29764E-01-0.64981E-01

ITERATION 3 LOG OF LIKELIHOOD FUNCTION = -6.1654

ITERATION 4 ESTIMATES
0.29997E-01-0.64438E-01

ITERATION 4 LOG OF LIKELIHOOD FUNCTION = -6.1652

ITERATION 5 ESTIMATES
0.29999E-01-0.64430E-01

VARIABLE NAME	ESTIMATED COEFFICIENT	ASYMPTOTIC		ELASTICITY AT MEANS	WEIGHTED AGGREGATE ELASTICITY
		STANDARD ERROR	T-RATIO		
X	0.29999E-01	0.10286E-01	2.9164	-0.31697E-01	0.34059E-01
CONSTANT	-0.64430E-01	0.39923	-0.16139	-0.55627E-01	-0.21379E-01

SCALE FACTOR = 0.39691

VARIABLE NAME	MARGINAL EFFECT	VARIABLE MEANS
X	0.11907E-01	-1.2238

LOG-LIKELIHOOD FUNCTION = -6.1652

LOG-LIKELIHOOD(0) = -14.532

LIKELIHOOD RATIO TEST = 16.7342 WITH 1 D.F. P-VALUE= 0.00004

ESTRELLA R-SQUARE 0.69479
MADDALA R-SQUARE 0.54926
CRAGG-UHLER R-SQUARE 0.73290
MCFADDEN R-SQUARE 0.57576

ADJUSTED FOR DEGREES OF FREEDOM 0.55343
APPROXIMATELY F-DISTRIBUTED 2.7143 WITH 1 AND 2 D.F.

CHOW R-SQUARE 0.64941

PREDICTION SUCCESS TABLE

PREDICTED	ACTUAL	
	0	1
0	10.	1.
1	1.	9.

NUMBER OF RIGHT PREDICTIONS = 19.0

PERCENTAGE OF RIGHT PREDICTIONS = 0.90476

NAIVE MODEL PERCENTAGE OF RIGHT PREDICTIONS = 0.52381

EXPECTED OBSERVATIONS AT 0 = 10.8 OBSERVED = 11.0

EXPECTED OBSERVATIONS AT 1 = 10.2 OBSERVED = 10.0

SUM OF SQUARED "RESIDUALS" = 1.8364

WEIGHTED SUM OF SQUARED "RESIDUALS" = 16.637

HENSHER-JOHNSON PREDICTION SUCCESS TABLE

ACTUAL	PREDICTED CHOICE		OBSERVED COUNT	OBSERVED SHARE
	0	1		
0	9.047	1.953	11.000	0.524
1	1.741	8.259	10.000	0.476

PREDICTED COUNT	10.787	10.213	21.000	1.000
PREDICTED SHARE	0.514	0.486	1.000	
PROP. SUCCESSFUL	0.839	0.809	0.824	
SUCCESS INDEX	0.325	0.322	0.324	
PROPORTIONAL ERROR	-0.010	0.010		
NORMALIZED SUCCESS INDEX			0.648	

|_ logit y x

REQUIRED MEMORY IS PAR= 3 CURRENT PAR= 781
 LOGIT ANALYSIS DEPENDENT VARIABLE =Y CHOICES = 2
 21. TOTAL OBSERVATIONS
 10. OBSERVATIONS AT ONE
 11. OBSERVATIONS AT ZERO
 25 MAXIMUM ITERATIONS
 CONVERGENCE TOLERANCE =0.00100

LOG OF LIKELIHOOD WITH CONSTANT TERM ONLY = -14.532
 BINOMIAL ESTIMATE = 0.4762
 ITERATION 0 LOG OF LIKELIHOOD FUNCTION = -14.532

ITERATION 1 ESTIMATES
 0.28188E-01-0.60814E-01
 ITERATION 1 LOG OF LIKELIHOOD FUNCTION = -7.2631

ITERATION 2 ESTIMATES
 0.43031E-01-0.14542
 ITERATION 2 LOG OF LIKELIHOOD FUNCTION = -6.3063

ITERATION 3 ESTIMATES
 0.51126E-01-0.21521
 ITERATION 3 LOG OF LIKELIHOOD FUNCTION = -6.1709

ITERATION 4 ESTIMATES
 0.53025E-01-0.23643
 ITERATION 4 LOG OF LIKELIHOOD FUNCTION = -6.1661

ITERATION 5 ESTIMATES
 0.53110E-01-0.23757

VARIABLE	ESTIMATED	ASYMPTOTIC	T-RATIO	ELASTICITY	WEIGHTED
NAME	COEFFICIENT	STANDARD		AT MEANS	AGGREGATE
		ERROR			ELASTICITY
X	0.53110E-01	0.20605E-01	2.5776	-0.37377E-01	0.57999E-01
CONSTANT	-0.23757	0.74966	-0.31691	-0.13662	-0.43356E-01

SCALE FACTOR = 0.24436

VARIABLE	MARGINAL	VARIABLE
NAME	EFFECT	MEANS
X	0.12978E-01	-1.2238

LOG-LIKELIHOOD FUNCTION = -6.1661
 LOG-LIKELIHOOD(0) = -14.532
 LIKELIHOOD RATIO TEST = 16.7324 WITH 1 D.F. P-VALUE= 0.00004

ESTRELLA R-SQUARE 0.69473
 MADDALA R-SQUARE 0.54922
 CRAGG-UHLER R-SQUARE 0.73285

MCFADDEN R-SQUARE 0.57570
 ADJUSTED FOR DEGREES OF FREEDOM 0.55337
 APPROXIMATELY F-DISTRIBUTED 2.7136 WITH 1 AND 2 D.F.
 CHOW R-SQUARE 0.65921

PREDICTION SUCCESS TABLE
 ACTUAL

	0	1
0	10.	1.
PREDICTED 1	1.	9.

NUMBER OF RIGHT PREDICTIONS = 19.0
 PERCENTAGE OF RIGHT PREDICTIONS = 0.90476
 NAIVE MODEL PERCENTAGE OF RIGHT PREDICTIONS = 0.52381

EXPECTED OBSERVATIONS AT 0 = 11.0 OBSERVED = 11.0
 EXPECTED OBSERVATIONS AT 1 = 10.0 OBSERVED = 10.0
 SUM OF SQUARED "RESIDUALS" = 1.7851
 WEIGHTED SUM OF SQUARED "RESIDUALS" = 18.440

HENSHER-JOHNSON PREDICTION SUCCESS TABLE

	PREDICTED	CHOICE	OBSERVED	OBSERVED
ACTUAL	0	1	COUNT	SHARE
0	9.195	1.805	11.000	0.524
1	1.805	8.195	10.000	0.476
PREDICTED COUNT	11.000	10.000	21.000	1.000
PREDICTED SHARE	0.524	0.476	1.000	
PROP. SUCCESSFUL	0.836	0.819	0.828	
SUCCESS INDEX	0.312	0.343	0.327	
PROPORTIONAL ERROR	0.000	0.000		
NORMALIZED SUCCESS INDEX			0.655	

Problem 23.4

Transit Choice Model: Probability Predictions and Estimated Marginal Effects						
Model:	Linear		Probit		Logit	
X	Probability	Marginal	Probability	Marginal	Probability	Marginal
0	0.4963	0.006337	0.4743	0.0119	0.4409	0.0131
-15	0.4013	0.006337	0.3035	0.0105	0.2623	0.0103
-60	0.1161	0.006337	0.0311	0.0021	0.0315	0.0016

Problem 23.6

(a) |_ probit vote income school urban midwest west

REQUIRED MEMORY IS PAR= 8 CURRENT PAR= 781
 PROBIT ANALYSIS DEPENDENT VARIABLE =VOTE CHOICES = 2
 51. TOTAL OBSERVATIONS
 24. OBSERVATIONS AT ONE
 27. OBSERVATIONS AT ZERO
 25 MAXIMUM ITERATIONS
 CONVERGENCE TOLERANCE =0.00100

LOG OF LIKELIHOOD WITH CONSTANT TERM ONLY = -35.262
 BINOMIAL ESTIMATE = 0.4706
 ITERATION 0 LOG OF LIKELIHOOD FUNCTION = -35.262

ITERATION 1 ESTIMATES
 0.26240E-04 -4.6751 0.19591E-01-0.33513 -0.51234 56.946

ITERATION 1 LOG OF LIKELIHOOD FUNCTION = -19.932

ITERATION 2 ESTIMATES
 -0.13309E-04 -5.7124 0.27671E-01-0.36244 -0.66581 69.931

ITERATION 2 LOG OF LIKELIHOOD FUNCTION = -19.065

ITERATION 3 ESTIMATES
 -0.48090E-04 -5.7341 0.31328E-01-0.35310 -0.73268 70.452

ITERATION 3 LOG OF LIKELIHOOD FUNCTION = -19.011

ITERATION 4 ESTIMATES
 -0.53273E-04 -5.7158 0.31791E-01-0.35175 -0.74104 70.266

ITERATION 4 LOG OF LIKELIHOOD FUNCTION = -19.010

ITERATION 5 ESTIMATES
 -0.53327E-04 -5.7156 0.31796E-01-0.35174 -0.74113 70.264

VARIABLE NAME	ESTIMATED COEFFICIENT	ASYMPTOTIC		ELASTICITY AT MEANS	WEIGHTED AGGREGATE ELASTICITY
		STANDARD ERROR	T-RATIO		
INCOME	-0.53327E-04	0.23045E-03	-0.23140	-0.70595	-0.33229
SCHOOL	-5.7156	2.6161	-2.1847	-67.598	-31.336
URBAN	0.31796E-01	0.15656E-01	2.0309	1.7905	0.94332
MIDWEST	-0.35174	0.53976	-0.65166	-0.85006E-01	-0.52617E-01
WEST	-0.74113	0.70895	-1.0454	-0.23422	-0.73491E-01
CONSTANT	70.264	30.472	2.3058	66.617	30.890

SCALE FACTOR = 0.38875

VARIABLE NAME	MARGINAL EFFECT	----- PROBABILITIES FOR A TYPICAL CASE -----			MARGINAL EFFECT
		CASE VALUES	X=0	X=1	
INCOME	-0.20731E-04	13963.			
SCHOOL	-2.2219	12.475			
URBAN	0.12361E-01	59.394			
MIDWEST	-0.13674	0.0000	0.54350	0.40420	-0.13930
WEST	-0.28812	0.0000	0.54350	0.26373	-0.27976

LOG-LIKELIHOOD FUNCTION = -19.010
 LOG-LIKELIHOOD(0) = -35.262
 LIKELIHOOD RATIO TEST = 32.5037 WITH 5 D.F. P-VALUE= 0.00000

ESTRELLA R-SQUARE 0.57444
 MADDALA R-SQUARE 0.47130
 CRAGG-UHLER R-SQUARE 0.62912
 MCFADDEN R-SQUARE 0.46088
 ADJUSTED FOR DEGREES OF FREEDOM 0.40098
 APPROXIMATELY F-DISTRIBUTED 1.0259 WITH 5 AND 6 D.F.

CHOW R-SQUARE 0.52628

PREDICTION SUCCESS TABLE

	ACTUAL	
	0	1
0	21.	3.
PREDICTED 1	6.	21.

NUMBER OF RIGHT PREDICTIONS = 42.0
 PERCENTAGE OF RIGHT PREDICTIONS = 0.82353
 NAIVE MODEL PERCENTAGE OF RIGHT PREDICTIONS = 0.52941

EXPECTED OBSERVATIONS AT 0 = 27.0 OBSERVED = 27.0
 EXPECTED OBSERVATIONS AT 1 = 24.0 OBSERVED = 24.0
 SUM OF SQUARED "RESIDUALS" = 6.0191
 WEIGHTED SUM OF SQUARED "RESIDUALS" = 45.778

HENSHER-JOHNSON PREDICTION SUCCESS TABLE

	PREDICTED	CHOICE	OBSERVED	OBSERVED
ACTUAL	0	1	COUNT	SHARE
0	21.021	5.979	27.000	0.529
1	6.010	17.990	24.000	0.471
PREDICTED COUNT	27.031	23.969	51.000	1.000
PREDICTED SHARE	0.530	0.470	1.000	
PROP. SUCCESSFUL	0.778	0.751	0.765	
SUCCESS INDEX	0.248	0.281	0.263	
PROPORTIONAL ERROR	0.001	-0.001		
NORMALIZED SUCCESS INDEX			0.528	

(b)

State	Probability Prediction		Change	Marginal Effect	
	Original	+1000 income	Probability	Original	Times 1000
Louisiana	0.9034	0.8939	-0.0094	-0.0000091	-0.0091
Oklahoma	0.5875	0.5667	-0.0209	-0.0000208	-0.0208
California	0.3198	0.3010	-0.0188	-0.0000191	-0.0191

(c)

	Coefficients Oregon	
Constant	70.26	
Income	-5.33E-005	12172
School	-5.72	12.4
Urban	3.18E-002	55.6
Midwest	-0.14	0
West	-0.29	1
Prob		0.59

(d,e)

Problem	Log Likelihood		Likelihood Ratio Test	P-value	Decision
	Unrestricted	Restricted			
23.6(d)	-19.01	-19.6	1.18	0.5543	Fail Reject
23.6(e)	-19.01	-27.69	17.37	0.0006	Reject