

The Computer Program A&ULR

This program carries out the calculations for the situation where one or more samples of used resource units are compared with a sample of available units. It is assumed that samples consist of only a small fraction of the possible units, and that because relatively few units are selected, the available distribution stays fairly constant.

Data Input

Line	
1	Title for the data.
2	NUNIT,NSAMP,NX, the number of sampled resource units, the number of samples (available and used), and the number of X variables for which data are input.
3	SPL(1),X(1,1),X(1,2),...,X(1,NX), the data for resource unit 1, consisting of the sample it is in (with the available sample as number 1), and the values for the X variables for this unit.
.	
.	
NUNIT+ 2	SP((NUNIT),X(NUNIT,1),X(NUNIT,2),...,X(NUNIT,NX), the data for the last unit, in the same format as for resource unit 1.

Example

In this example there are 1309 observations, with four samples (one of available locations for the owls, and three of used locations), and five variables (elevation, distance to the nest, ..., whether the area is cleared) describing the nature of the locations.

```
NSO Telemetry Data (Sample,Elevation,Dist to Nest,Old,Young,Cleared)
1309 4 5
 2 0.87 1.06 0 1 0
 2 0.69 0.56 0 1 0
 2 0.68 0.98 0 1 0
 2 0.88 0.32 0 1 0
 2 0.55 1.65 0 0 1
 2 0.72 1.57 0 1 0
 2 0.61 2.25 0 1 0
 2 1.24 2.17 0 1 0
 2 0.55 2.53 0 1 0
 2 0.67 0.74 0 1 0
.
.
.
 1 0.49 0.48 0 1 0
 1 1.47 1.78 0 1 0
 1 0.47 1.09 0 1 0
```

Computer Output

The output for the set of data shown above is as follows:

```
*****
*                                     A&ULR                                     *
*                                                                              *
* A program for polytomous logistic regression with                          *
* resource selection data, where there is one sample of                      *
* available units, and one or more samples of used units.                   *
* This program is based on the program MAXLIK written by                     *
* T.E. Reed for fitting a general multinomial model.                         *
*                                                                              *
* There can be up to 5000 resource units, with up to 9                      *
* samples of used units, and up to 100 estimated                            *
* parameters.                                                                  *
*                                                                              *
*                                     Written by                               *
*                                     Bryan F.J. Manly                       *
*                                                                              *
*                                     Version 1.0, Dated July 2000            *
*****
```

Date: 9/ 7/2000 Time: 10:51

Data Title: NSO Telemetry Data (Sample,Elevation,Dist to Nest,Old,Young,Cleared)
Number of Units = 1309 Number of Samples = 4

Unit	Spl	X-Values				
1	2	0.87	1.06	0.00	1.00	0.00
2	2	0.69	0.56	0.00	1.00	0.00
3	2	0.68	0.98	0.00	1.00	0.00
4	2	0.88	0.32	0.00	1.00	0.00
5	2	0.55	1.65	0.00	0.00	1.00
6	2	0.72	1.57	0.00	1.00	0.00
7	2	0.61	2.25	0.00	1.00	0.00
8	2	1.24	2.17	0.00	1.00	0.00
9	2	0.55	2.53	0.00	1.00	0.00
10	2	0.67	0.74	0.00	1.00	0.00
11	2	0.64	0.67	0.00	1.00	0.00
12	2	0.72	0.76	0.00	1.00	0.00
13	2	0.91	1.50	0.00	0.00	1.00
14	2	0.73	0.95	0.00	1.00	0.00
15	2	1.09	1.29	0.00	1.00	0.00
16	2	1.09	1.37	0.00	1.00	0.00
17	2	0.67	0.68	0.00	1.00	0.00
18	2	0.55	0.86	0.00	1.00	0.00
19	2	0.58	2.15	1.00	0.00	0.00
20	2	0.62	0.69	0.00	1.00	0.00
21	2	0.57	2.40	0.00	0.00	1.00
22	2	0.92	2.03	0.00	1.00	0.00
23	2	0.85	1.95	1.00	0.00	0.00
24	2	1.28	1.62	0.00	1.00	0.00
25	2	0.87	1.47	0.00	1.00	0.00
26	2	1.33	1.27	0.00	1.00	0.00
27	2	0.74	1.24	0.00	1.00	0.00
28	2	1.08	1.05	0.00	1.00	0.00
29	2	1.12	1.09	0.00	1.00	0.00
30	2	1.09	1.65	1.00	0.00	0.00
31	2	0.57	0.55	0.00	1.00	0.00
32	2	0.92	2.15	0.00	1.00	0.00
33	2	0.56	2.41	0.00	1.00	0.00
34	2	0.67	1.83	1.00	0.00	0.00
35	2	0.69	0.85	0.00	1.00	0.00
36	2	0.79	0.55	0.00	1.00	0.00
37	2	0.69	1.28	0.00	1.00	0.00
38	2	0.61	0.53	0.00	1.00	0.00
39	2	0.75	1.23	0.00	1.00	0.00
40	2	0.56	2.17	0.00	1.00	0.00
41	2	0.69	2.77	0.00	1.00	0.00
42	2	0.88	1.71	1.00	0.00	0.00
43	2	0.93	1.83	1.00	0.00	0.00
44	2	0.88	2.89	0.00	1.00	0.00
45	2	0.62	3.04	0.00	1.00	0.00
46	2	0.93	1.57	0.00	1.00	0.00
47	2	1.01	1.48	0.00	1.00	0.00
48	2	0.66	1.31	0.00	1.00	0.00

49	2	1.29	1.90	1.00	0.00	0.00
50	2	1.05	1.34	0.00	1.00	0.00
.
1309	1	0.47	1.09	0.00	1.00	0.00

Sample Sizes
1000 128 90 91

*** NULL MODEL FIT ***
The null model is fitted first. This just has the constant terms (Beta0) for samples 2 to 4 as parameters.

Summary of Iterations

Iter	Initial log-lik	Final log-lik	Halvings
1	-1050.453	-1050.453	1

Final Deviance = 2100.91 with 1306 df
AIC = 2106.91

Param	Final estimate	Standard error	Last change
1	-2.0557	0.0939	0.0000
2	-2.4079	0.1100	0.0000
3	-2.3969	0.1095	0.0000

Correlation matrix for parameters

1	1.000		
2	0.097	1.000	
3	0.097	0.083	1.000

Models allowing for selection related to the X-variables are now fitted. This process can be repeated as much as necessary. First, variables to be used are chosen. Then the constant selection model is fitted, followed by the model that allows selection to change from used sample to used sample.

Variables chosen for use are:
1 2 4 5

*** CONSTANT SELECTION MODEL FIT ***
Parameters of the fitted model are the constants (Beta0) for samples 2 to 4 followed by the coefficients of the 4 X-variables.

Summary of Iterations

Iter	Initial log-lik	Final log-lik	Halvings
1	-1050.453	-972.504	1
2	-972.504	-964.590	1
3	-964.590	-963.763	1
4	-963.763	-963.737	1
5	-963.737	-963.737	5
6	-963.737	-963.737	2
7	-963.737	-963.737	5

Final Deviance = 1927.47 with 1302 df
AIC = 1941.47

Param	Final estimate	Standard error	Last change
1	0.3082	0.3104	0.0001
2	-0.0440	0.3156	0.0001
3	-0.0330	0.3154	0.0001
4	-0.6238	0.2761	-0.0001
5	-0.8762	0.1200	-0.0001
6	-0.6349	0.1590	0.0000
7	-3.0321	0.4083	-0.0015

Correlation matrix for parameters

1	1.000					
2	0.904	1.000				
3	0.904	0.889	1.000			
4	-0.734	-0.722	-0.722	1.000		
5	-0.335	-0.330	-0.330	-0.178	1.000	
6	-0.440	-0.433	-0.433	0.070	0.027	1.000

7 -0.182 -0.179 -0.179 0.024 0.038 0.284 1.000

*** VARIABLE SELECTION MODEL FIT ***

Parameters of the fitted model are the constants (Beta0) for samples 2 to 4 followed by the coefficients of the X variables for sample 2, then sample 3, and so on.

Summary of Iterations

Iter	Initial log-lik	Final log-lik	Halvings
1	-963.737	-949.409	1
2	-949.409	-948.506	1
3	-948.506	-948.319	1
4	-948.319	-948.252	1
5	-948.252	-948.228	1
6	-948.228	-948.217	1
7	-948.217	-948.215	1
8	-948.215	-948.213	1
9	-948.213	-948.213	1
10	-948.213	-948.213	4
11	-948.213	-948.213	1
12	-948.213	-948.212	10
13	-948.212	-948.212	10

Final Deviance = 1896.42 with 1294 df
AIC = 1926.42

Param	Final estimate	Standard error	Last change
1	-0.2327	0.4262	0.0004
2	-0.0809	0.4665	0.0000
3	0.5865	0.4776	-0.0011
4	-0.7980	0.3833	-0.0004
5	-0.4643	0.1635	0.0000
6	-0.3382	0.2258	0.0000
7	-2.7782	0.6142	0.0000
8	0.1451	0.4610	0.0000
9	-1.4979	0.2097	0.0000
10	-0.6250	0.2525	0.0000
11	-13.1414	107.9348	-0.9993
12	-1.0311	0.4774	0.0014
13	-0.9186	0.1910	-0.0001
14	-1.0153	0.2429	0.0001
15	-2.5963	0.5419	0.0001

Correlation matrix for parameters

1	1.000													
2	0.174	1.000												
3	0.169	0.182	1.000											
4	-0.738	-0.098	-0.096	1.000										
5	-0.367	-0.091	-0.084	-0.165	1.000									
6	-0.469	-0.089	-0.090	0.076	0.022	1.000								
7	-0.184	-0.040	-0.038	0.031	0.025	0.278	1.000							
8	-0.095	-0.794	-0.098	0.116	-0.008	0.007	0.007	1.000						
9	-0.070	-0.183	-0.073	-0.018	0.142	0.020	0.013	-0.261	1.000					
10	-0.088	-0.391	-0.102	0.005	0.025	0.169	0.050	0.048	-0.069	1.000				
11	0.000	-0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000			
12	-0.089	-0.090	-0.801	0.107	-0.008	0.010	0.006	0.110	-0.022	0.005	0.000	1.000		
13	-0.082	-0.101	-0.272	-0.012	0.150	0.026	0.015	-0.012	0.151	0.051	0.000	0.000	1.000	
14	-0.088	-0.100	-0.408	0.007	0.022	0.170	0.050	0.008	0.028	0.184	0.000	0.000	0.000	1.000
15	-0.050	-0.055	-0.185	0.009	0.022	0.062	0.039	0.009	0.022	0.067	0.000	0.044	0.005	0.286
	0.000	0.044	0.005	0.286	1.000									