APPENDED MPLUS OUTPUT

```
INPUT INSTRUCTIONS

TITLE: Class 4 model with covariate (female)

DATA:FILE = "/Users/github/dber-logistic/cov_c4/lca_lsay.dat";

VARIABLE:

NAMES = Enjoy Useful Logical Job Adult Female;

MISSING=.;

categorical = Enjoy-Adult;
     usevar = Enjoy-Adult;

classes = c(4);
auxiliary = Female (r3step);

ANALYSIS:
estimator = mlr;
type = mixture;
starts = 500 200;
processors = 10;

OUTPUT:
sampstat residual tech11 tech14;

PLOT: type = plot3;
series = Enjoy-Adult(*);

SUMMARY OF ANALYSIS

Number of groups                                                 1
Number of observations                                        3061

Number of dependent variables                                    5
Number of independent variables                                  0
Number of continuous latent variables                            0
Number of categorical latent variables                           1

Observed dependent variables

  Binary and ordered categorical (ordinal)
   ENJOY       USEFUL      LOGICAL     JOB         ADULT

Observed auxiliary variables
   FEMALE

Categorical latent variables
   C
```

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MODEL RESULTS

	Estimate	S.E.	Est./S.E.	Two-Tailed P-Value
Latent Class 1				
Thresholds				
ENJOY$1	-2.049	0.142	-14.462	0.000
USEFUL$1	-2.849	0.657	-4.339	0.000
LOGICAL$1	-2.614	0.314	-8.329	0.000
JOB$1	-2.070	0.210	-9.845	0.000
ADULT$1	-2.626	0.266	-9.855	0.000
Latent Class 2				
Thresholds				
ENJOY$1	-0.391	0.120	-3.258	0.001
USEFUL$1	0.599	0.209	2.872	0.004
LOGICAL$1	-0.260	0.137	-1.895	0.058
JOB$1	1.248	0.167	7.458	0.000
ADULT$1	15.000	0.000	999.000	999.000
Latent Class 3				
Thresholds				
ENJOY$1	-0.754	0.163	-4.637	0.000
USEFUL$1	0.926	0.242	3.825	0.000
LOGICAL$1	0.161	0.214	0.755	0.450
JOB$1	0.241	0.194	1.244	0.214
ADULT$1	-15.000	0.000	999.000	999.000
Latent Class 4				
Thresholds				
ENJOY$1	0.815	0.118	6.914	0.000
USEFUL$1	15.000	0.000	999.000	999.000
LOGICAL$1	4.408	3.926	1.123	0.262
JOB$1	2.662	0.225	11.846	0.000
ADULT$1	3.667	1.113	3.296	0.001
Categorical Latent Variables				
Means				
C#1	-0.003	0.165	-0.021	0.983
C#2	-0.062	0.209	-0.297	0.766
C#3	-0.296	0.137	-2.158	0.031

APPENDED MPLUS OUTPUT

TESTS OF CATEGORICAL LATENT VARIABLE MULTINOMIAL LOGISTIC REGRESSIONS USING
THE 3-STEP PROCEDURE

	Estimate	S.E.	Est./S.E.	Two-Tailed P-Value
C#1 ON				
FEMALE	-0.851	0.119	-7.130	0.000
C#2 ON				
FEMALE	-0.554	0.143	-3.883	0.000
C#3 ON				
FEMALE	-0.597	0.133	-4.500	0.000
Intercepts				
C#1	0.420	0.086	4.908	0.000
C#2	0.234	0.106	2.202	0.028
C#3	0.021	0.097	0.211	0.833

Parameterization using Reference Class 1

C#2 ON				
FEMALE	0.297	0.126	2.354	0.019
C#3 ON				
FEMALE	0.253	0.143	1.770	0.077
C#4 ON				
FEMALE	0.851	0.119	7.130	0.000
Intercepts				
C#2	-0.186	0.082	-2.264	0.024
C#3	-0.400	0.093	-4.294	0.000
C#4	-0.420	0.086	-4.908	0.000

Parameterization using Reference Class 2

C#1 ON				
FEMALE	-0.297	0.126	-2.354	0.019
C#3 ON				
FEMALE	-0.044	0.130	-0.335	0.737
C#4 ON				
FEMALE	0.554	0.143	3.883	0.000
Intercepts				
C#1	0.186	0.082	2.264	0.024
C#3	-0.213	0.088	-2.416	0.016
C#4	-0.234	0.106	-2.202	0.028

APPENDED MPLUS OUTPUT

Parameterization using Reference Class 3

C#1 ON				
FEMALE	-0.253	0.143	-1.770	0.077
C#2 ON				
FEMALE	0.044	0.130	0.335	0.737
C#4 ON				
FEMALE	0.597	0.133	4.500	0.000
Intercepts				
C#1	0.400	0.093	4.294	0.000
C#2	0.213	0.088	2.416	0.016
C#4	-0.021	0.097	-0.211	0.833

ODDS RATIOS FOR TESTS OF CATEGORICAL LATENT VARIABLE MULTINOMIAL LOGISTIC REGRESSIONS
USING THE 3-STEP PROCEDURE

			95% C.I.	
	Estimate	S.E.	Lower 2.5%	Upper 2.5%
C#1 ON				
FEMALE	0.427	0.051	0.338	0.540
C#2 ON				
FEMALE	0.575	0.082	0.435	0.760
C#3 ON				
FEMALE	0.550	0.073	0.424	0.714

Parameterization using Reference Class 1

C#2 ON				
FEMALE	1.346	0.170	1.051	1.723
C#3 ON				
FEMALE	1.288	0.184	0.973	1.705
C#4 ON				
FEMALE	2.341	0.279	1.853	2.958

Parameterization using Reference Class 2

C#1 ON				
FEMALE	0.743	0.094	0.580	0.952
C#3 ON				

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```
    FEMALE             0.957      0.125      0.741      1.236

 C#4      ON
    FEMALE             1.740      0.248      1.315      2.301

Parameterization using Reference Class 3

 C#1      ON
    FEMALE             0.776      0.111      0.586      1.028

 C#2      ON
    FEMALE             1.045      0.136      0.809      1.349

 C#4      ON
    FEMALE             1.817      0.241      1.401      2.358
```

EQUATIONS:

Threshold → Probability $= 1/(1 + \exp(x))$

$$logit\ ratio = ln\left(\frac{p(c = k|x)}{p(c = K|x)}\right) = a + b(x)$$

$$p(c = k|x) = \frac{e^{a_k + b_k\,(x)}}{(e^{a_k + b_k\,(x)} + e^{a_2 + b_2\,(x)} + e^{a_3 + b_3\,(x)})}$$