INSTRUCTIONS ON HOW TO USE MNL.PRO
( Estimation of Multinomial/Conditional Logit Model with Shazam)

Before you execute the procedure

The attached procedure file (MNL.PRO) includes maximisation of a likelihood function that requires high-precision calculations. For the procedure to be successfully executed, the precision setting for Shazam has to be changed to “Quad Precision”.

To change the setting, i) start Shazam Professional version, ii) click on “Project”, iii) click on “Options...”, iv) choose “Startup” from the list panel of “Options” window (see below), then v) select “Use Quad Precision”. Close and restart Shazam.

Execution of the Procedure

Copy all the files to a working folder. Then, open the execution file (MNL.SHA) in Shazam. Provide the necessary parameters. Those lines are enclosed between two lines marked as “/////....\\\” and \\
\\....\\///. The choice that is coded with the lowest number (0 or 1) will become the base choice and hence the coefficients (for the variables that do not vary across choices but have choice-specific coefficients: “multinomial logit” part) or the variables (for the variables that vary across choices and have the same coefficient for all choices: “conditional logit” part) will be normalised to zero.

Choice-specific intercept terms will be automatically included.
The Execution File

****************************************
MULTINOMIAL/CONDITIONAL LOGIT MODEL
****************************************
*
* This file and the accompanying procedure file, MNL.PRO, have been created by
* Daehoon Nahm
* Department of Economics
* Macquarie University
* Australia
*
*--------
* Model
*--------
* U[ij] = aj0+aj1*X1[i]+aj2*X2[i]+...+bl*Z1[ij]+b2*Z2[ij]+... + u[ij]
* Y[i] = j if U[ij] > U[ik] for any k (not=j)
* X[i] = decision-maker-specific explanatory variables
* Z[ij] = choice-specific (or choice & decision-maker specific) explanatory variables
* * Provide necessary information by changing the lines between ////----\\ and \\
*****/././.

=PAR 10000
=SET NOECHO
=SET NODOECHO
=SET NOOUTPUT
=SET NOWARN
=SET WIDE

*/////---Working Directory---\\
WD:d:\\works\ (Provide the path to your working folder here.)
*\\
FILE PATH [WD]
FILE PROC [WD]MNL.PRO

*/////---Sample Range----\\
SAM:1 100 (The sample range)
*\\
SAMPLE [SAM]

*/////---Data File & Variables---\\
READ(mnl.dat) Y X1 X2 X3 Z11 Z21 Z31 Z12 Z22 Z32 /skiplines=1
(The data are read by this command.)
(If the data file includes text lines (like labels for the variables), include
"skiplines= no. of lines to skip at the top of the file" option.)

*\\
SET OUTPUT
STAT y x1-x3 z11 z21 z31 z12 z22 z32 (This will compute descriptive statistics.)
SET NOOUTPUT

*/////---Define the Variables
*--------------------

*/////---The Discrete Dependent Variable {1,2,...,M}---\\
GENR Y=y (Provide the name of the discrete choice variable.)
*\\

*/////---The lowest choice (usually 0 or 1)---\\
GEN1 JLOW=1 (Type "0" if Y in your data set is defined as 0,1,...,M-1,
while type "1" if it is defined as 1,2,...,M.)

****---The number of choices (minimum=2 [binary logit], maximum=6)---\\\\
GEN1 JNUM=3

****---The Number of X variables (excluding intercept, maximum=10)---\\\\
GEN1 KX=3
(The number of decision-maker's characteristic variables that do not vary across the choices. These variables will have choice specific coefficients.)

****---The Number of Z variables (excluding intercept, maximum=10)---\\\\
GEN1 KZ=2
(The number of choice-specific variables. These variables will have the same coefficient for all choices.)

SET ECHO

****---Decision-maker's characteristic explanatory variables (X[i])---\\\\
* Supply the variable names as defined in the READ command starting from X1.
* Leave zeros for the unused lines.
* The coefficient for each X variable is allowed to be different across choices.

GENR X1=x1
GENR X2=x2
GENR X3=x3
GENR X4=0
GENR X5=0
GENR X6=0
GENR X7=0
GENR X8=0
GENR X9=0
GENR X10=0

****---Choice-specific explanatory variables (Z[ij])---\\\\
* Supply the variable names as defined in the READ command starting from Z1.
* For each Z characteristic, there must be M (i.e. the number of choices) variables.
* Leave zeros for the unused lines.
* The variable names are defined as: Zjk, where j=choice and k=characteristic.

GENR 211=z11
GENR 212=z12
GENR 213=0
GENR 214=0
GENR 215=0
GENR 216=0
GENR 217=0
GENR 218=0
GENR 219=0
GENR 2110=0

GENR 221=z21
GENR 222=z22
GENR 223=0
GENR 224=0
GENR 225=0
GENR 226=0
GENR 227=0
GENR 228=0
GENR 229=0
GENR 2210=0

GENR 231=z31
GENR 232=z32
GENR 233=0
GENR 234=0
GENR 235=0
GENR 236=0
GENR 237=0
GENR 238=0
GENR 239=0
GENR 2310=0
GENR Z41=0
GENR Z42=0
GENR Z43=0
GENR Z44=0
GENR Z45=0
GENR Z46=0
GENR Z47=0
GENR Z48=0
GENR Z49=0
GENR Z510=0
GENR Z51=0
GENR Z52=0
GENR Z53=0
GENR Z54=0
GENR Z55=0
GENR Z56=0
GENR Z57=0
GENR Z58=0
GENR Z59=0
GENR Z510=0
GENR Z61=0
GENR Z62=0
GENR Z63=0
GENR Z64=0
GENR Z65=0
GENR Z66=0
GENR Z67=0
GENR Z68=0
GENR Z69=0
GENR Z610=0

**\---------------------------------------------------------------/////
\=?SET NOECHO
**************************************************************************
* DO NOT CHANGE ANY PART BELOW THIS LINE.
*----------------------------------------------------
* If needed, predicted probabilities (P1HAT, P2HAT, etc.) and predicted Y (Y1HAT, Y2HAT, etc.)
* can be printed by adding the print command, for example,
* PRINT P1HAT P2HAT P3HAT P4HAT Y1HAT Y2HAT Y3HAT Y4HAT
* at the bottom of this file.
***************************************************************************
.
***********************************************************************
SAMPLE 1 100
PRINT P1HAT P2HAT P3HAT Y1HAT Y2HAT Y3HAT
(These command may be added to print out predictions.)
STOP

Output

Welcome to SHAZAM - Version 10.0 - SYSTEM=WIN-XP PAR=10000 -
CURRENT WORKING DIRECTORY IS: D:\works\
|**************************************************************************
| MULTINOMIAL/CONDITIONAL LOGIT MODEL
|**************************************************************************
| This file and the accompanying procedure file, MNL.PRO, have been created by
| Daehoon Nahm
| Department of Economics
| Macquarie University
| Australia
|---------------------
| Model
|---------------------
| U  = aj0+aj1*X1[i]+aj2*X2[i]+...+b1*Z1[ij]+b2*Z2[ij]+... + u[ij]
| Y  = j if U[ij] > U[ik] for any k (not=j)
| X  = decision-maker-specific explanatory variables
| Z  = choice-specific (or choice & decision-maker specific) explanatory variables
Provide necessary information by changing the lines between /////////////////////////////////////////////////////////////////// and ///////////////////////////////////////////////////////////////////.

..PAR IS 10000 MAXIMUM VARIABLES IS 1000

<table>
<thead>
<tr>
<th>NAME</th>
<th>N</th>
<th>MEAN</th>
<th>ST. DEV</th>
<th>VARIANCE</th>
<th>MINIMUM</th>
<th>MAXIMUM</th>
<th>COEF. OF VARIATION</th>
<th>CONSTANT -DIGITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y</td>
<td>100</td>
<td>2.0600</td>
<td>0.78907</td>
<td>0.62263</td>
<td>1.0000</td>
<td>3.0000</td>
<td>0.38304</td>
<td>0.0000</td>
</tr>
<tr>
<td>X1</td>
<td>100</td>
<td>-0.42635E-01</td>
<td>1.1136</td>
<td>1.2401</td>
<td>-4.5155</td>
<td>2.0203</td>
<td>-26.119</td>
<td>0.0000</td>
</tr>
<tr>
<td>X2</td>
<td>100</td>
<td>-0.19430</td>
<td>1.8724</td>
<td>3.5060</td>
<td>-3.2057</td>
<td>4.1928</td>
<td>-9.6366</td>
<td>0.0000</td>
</tr>
<tr>
<td>X3</td>
<td>100</td>
<td>0.13111</td>
<td>1.8008</td>
<td>3.2430</td>
<td>-3.8865</td>
<td>4.1550</td>
<td>15.921</td>
<td>0.0000</td>
</tr>
<tr>
<td>Z11</td>
<td>100</td>
<td>0.15008</td>
<td>3.0584</td>
<td>9.3540</td>
<td>-7.4300</td>
<td>6.0717</td>
<td>20.379</td>
<td>0.0000</td>
</tr>
<tr>
<td>Z12</td>
<td>100</td>
<td>5.0402</td>
<td>2.8024</td>
<td>7.8535</td>
<td>0.69300E-01</td>
<td>9.9341</td>
<td>0.55601</td>
<td>0.0000</td>
</tr>
<tr>
<td>Z21</td>
<td>100</td>
<td>0.11311</td>
<td>1.8008</td>
<td>3.2430</td>
<td>-3.8865</td>
<td>4.1550</td>
<td>15.921</td>
<td>0.0000</td>
</tr>
<tr>
<td>Z22</td>
<td>100</td>
<td>0.15008</td>
<td>3.0584</td>
<td>9.3540</td>
<td>-7.4300</td>
<td>6.0717</td>
<td>20.379</td>
<td>0.0000</td>
</tr>
<tr>
<td>Z31</td>
<td>100</td>
<td>0.15008</td>
<td>3.0584</td>
<td>9.3540</td>
<td>-7.4300</td>
<td>6.0717</td>
<td>20.379</td>
<td>0.0000</td>
</tr>
<tr>
<td>Z32</td>
<td>100</td>
<td>4.9197</td>
<td>3.0806</td>
<td>9.4900</td>
<td>0.17070E-01</td>
<td>9.8683</td>
<td>0.62617</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

------Decision-maker's characteristic explanatory variables (X )------

**Supply the variable names as defined in the READ command starting from X1.**

**The coefficient for each X variable is allowed to be different across choices.**

**GENR X1=x1**

**GENR X2=x2**

**GENR X3=x3**

------Choice-specific explanatory variables (Z )------

**Supply the variable names as defined in the READ command starting from Z1.**

**For each Z characteristic, there must be M (i.e. the number of choices) variables.**

**Leave zeros for the unused lines.**

**The variable names are defined as: Zjk, where j=choice and k=characteristic.**

**GENR Z11=z11**

**GENR Z12=z12**

**GENR Z21=z21**

**GENR Z22=z22**

**GENR Z31=z31**

**GENR Z32=z32**

---end of statement---

**NOTE..SAMPLE RANGE SET TO: 1, 100**

35 VARIABLES IN 1 EQUATIONS WITH 10 COEFFICIENTS

100 OBSERVATIONS

REQUIRED MEMORY IS PAR= 692 CURRENT PAR= 10000

COEFFICIENT STARTING VALUES

| A20 | 1.0000 | A21 | 1.0000 | A22 | 1.0000 |
| A23 | 1.0000 | B1  | 1.0000 | B2  | 1.0000 |
| A30 | 1.0000 | A31 | 1.0000 | A32 | 1.0000 |
| A33 | 1.0000 |     |        |     |        |

300 MAXIMUM ITERATIONS, CONVERGENCE = 0.100000E-05

(This is the estimated variance-covariance matrix of the coefficient estimates.)

ASYMPTOTIC COVARIANCE MATRIX

| (This is the estimated variance-covariance matrix of the coefficient estimates.)
| A20 | 0.23085 |
| A21 | 0.56974E-03 | 0.53954E-01 |
| A22 | 0.16843E-01 | 0.26589E-02 | 0.26572E-01 |
| A23 | -0.35129E-01 | 0.40922E-04 | -0.22375E-02 | 0.76429E-02 |
| B1  | 0.78420E-03 | -0.48961E-03 | 0.55568E-03 | -0.32434E-03 | 0.28002E-02 |
| B2  | -0.20912E-03 | -0.11184E-02 | 0.12615E-03 | 0.17876E-03 | 0.27719E-04 | 0.19091E-02 |
| A30 | 0.12031 | 0.16718E-02 | 0.12549E-01 | -0.18480E-01 | 0.55615E-03 | -0.92002E-03 | 0.20245 |
| A31 | -0.18183E-02 | 0.30359E-01 | 0.19080E-02 | 0.52346E-03 | -0.76182E-03 | -0.11270E-02 | 0.35472E-02 | 0.57205E-01 |
| A32 | -0.18038E-01 | 0.52851E-03 | 0.14048E-01 | -0.10611E-02 | 0.82997E-04 | 0.49563E-03 | 0.14950E-01 | 0.58226E-03 |
| A33 | -0.18498E-01 | -0.64971E-04 | -0.12146E-02 | 0.42975E-02 | -0.31833E-03 | 0.21010E-03 | -0.31299E-01 | 0.13159E-03 | -0.31689E-02 | 0.74021E-02 | 0.62152E-02 | A20 | A21 | A22 | A23 | B1  | B2  | A30 |
| A31 | A32 | A33 | GTRANSPOSE*INVERSE(H)*G STATISTIC = 0.11735E-10 |
(The coefficient estimates, their standard errors, and t-ratios)

<table>
<thead>
<tr>
<th>COEFFICIENT</th>
<th>ST. ERROR</th>
<th>T-RATIO</th>
</tr>
</thead>
<tbody>
<tr>
<td>A20</td>
<td>-0.63457E-01</td>
<td>0.48047</td>
</tr>
<tr>
<td>A21</td>
<td>-0.98061E-02</td>
<td>0.23228</td>
</tr>
<tr>
<td>A22</td>
<td>0.21636</td>
<td>0.16301</td>
</tr>
<tr>
<td>A23</td>
<td>0.88660E-01</td>
<td>0.87423E-01</td>
</tr>
<tr>
<td>B1</td>
<td>0.16578E-02</td>
<td>0.52917E-01</td>
</tr>
<tr>
<td>B2</td>
<td>-0.15173E-01</td>
<td>0.43693E-01</td>
</tr>
<tr>
<td>A30</td>
<td>0.22537</td>
<td>0.44994</td>
</tr>
<tr>
<td>A31</td>
<td>-0.77475E-01</td>
<td>0.23918</td>
</tr>
<tr>
<td>A32</td>
<td>0.14598</td>
<td>0.16869</td>
</tr>
<tr>
<td>A33</td>
<td>0.23289E-02</td>
<td>0.86035E-01</td>
</tr>
</tbody>
</table>

Log-likelihood function of the full model
-106.8999

Log-likelihood function of the model with choice-specific intercepts only
-109.0908

McFadden's R-square
0.2008297E-01

**PREDICTION SUCCESS TABLE**

<table>
<thead>
<tr>
<th>Actual</th>
<th>Y=1</th>
<th>Y=2</th>
<th>Y=3</th>
<th>Y=4</th>
<th>Y=5</th>
<th>Y=6</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>3&gt;Y=1</td>
<td>6.</td>
<td>5.</td>
<td>7.</td>
<td>0.</td>
<td>0.</td>
<td>0.</td>
<td>18.</td>
</tr>
<tr>
<td>4&gt;Y=2</td>
<td>13.</td>
<td>25.</td>
<td>17.</td>
<td>0.</td>
<td>0.</td>
<td>0.</td>
<td>55.</td>
</tr>
<tr>
<td>5&gt;Y=3</td>
<td>9.</td>
<td>8.</td>
<td>10.</td>
<td>0.</td>
<td>0.</td>
<td>0.</td>
<td>27.</td>
</tr>
<tr>
<td>6&gt;Y=4</td>
<td>0.</td>
<td>0.</td>
<td>0.</td>
<td>0.</td>
<td>0.</td>
<td>0.</td>
<td>0.</td>
</tr>
<tr>
<td>7&gt;Y=5</td>
<td>0.</td>
<td>0.</td>
<td>0.</td>
<td>0.</td>
<td>0.</td>
<td>0.</td>
<td>0.</td>
</tr>
<tr>
<td>8&gt;Y=6</td>
<td>0.</td>
<td>0.</td>
<td>0.</td>
<td>0.</td>
<td>0.</td>
<td>0.</td>
<td>0.</td>
</tr>
<tr>
<td>9&gt;Total</td>
<td>28.</td>
<td>38.</td>
<td>34.</td>
<td>0.</td>
<td>0.</td>
<td>0.</td>
<td>100.</td>
</tr>
</tbody>
</table>

**NUMBER OF RIGHT PREDICTIONS =**
41.00000

**PERCENTAGE OF RIGHT PREDICTIONS =**
0.4100000

(Predictions)

<table>
<thead>
<tr>
<th>P1HAT</th>
<th>P2HAT</th>
<th>P3HAT</th>
<th>Y1HAT</th>
<th>Y2HAT</th>
<th>Y3HAT</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.3214614</td>
<td>0.2987350</td>
<td>0.3798036</td>
<td>0.000000</td>
<td>0.000000</td>
<td>1.000000</td>
</tr>
<tr>
<td>0.2614700</td>
<td>0.4037182</td>
<td>0.3348118</td>
<td>0.000000</td>
<td>1.000000</td>
<td>0.000000</td>
</tr>
<tr>
<td>0.2969633</td>
<td>0.3414852</td>
<td>0.3615515</td>
<td>0.000000</td>
<td>0.000000</td>
<td>1.000000</td>
</tr>
<tr>
<td>0.3018958</td>
<td>0.2958673</td>
<td>0.4022369</td>
<td>0.000000</td>
<td>0.000000</td>
<td>1.000000</td>
</tr>
</tbody>
</table>