USF UNIVERSITY OF SOUTH FLORIDA

Statistical and Econometric Methods

Assignment #3
(Discrete Data – Multinomial Logit Analysis)

You are given 151 observations of a travel survey collected in State College Pennsylvania (same data as in assignment #1). All of the households in the sample are making the morning commute to work. They are all departing from the same origin (a large residential complex in the suburbs) and going to work in the Central Business District. They have the choice of three alternate routes; 1) a four-lane arterial (speed limit = 35mph, 2 lanes each direction), 2) a two-lane rural road (speed limit = 35mph, 1 lane each direction) and 3) a limited access four-lane freeway (speed limit = 55mph, 2 lanes each direction).

Your task is to estimate a model of ***Route Choice*** (i.e., the likelihood of an individual traveler taking one of the three routes). Your solution to this problem should include:

1. The results of your best model specification.

2. A discussion of the logical process that led you to the selection of your final specification. (e.g. Discuss the theory behind the inclusion of your selected variables). Include t-statistics and justify the sign of your variables.

For reference, see Example 13.1 on page 319 of the text.

Variables available for your specification are (in file LOGIT-A1.txt):

Variable Number	Explanation
x1	Route chosen, rows: 1 - arterial, 2 - rural road, 3 - freeway
x2	Arterial row indicator; 1 for arterial row, 0 for others
x3	Rural row indicator; 1 for rural row, 0 for others
x4	Freeway row indicator; 1 for freeway row, 0 for others
x5	Traffic flow rate
x6	Number of traffic signals
x7	Distance in tenths of miles
x8	Seat belts: 1 - if wear, 0 - if not
x9	Number of passengers in car
x10	Driver age in years: 1 - 18 to 23, 2 - 24 to 29, 3 - 30 to 39, 4 - 40 to 49, 5 - 50 and above
x11	Gender: 1 - male, 0 - female
x12	Marital status: 1 - single, 0 - married
x13	Number of children
x14	Annual income: 1 - less than 20000, 2 - 20000 to 29999, 3 - 30000 to 39999, 4 - 40000 to 49999, 5 - more than 50000
x15	Model year of car (e.g. 86 = 1986)
x16	Origin of car: 1 - domestic, 0 - foreign
x17	Fuel efficiency in miles per gallon

```
-------Initializing NLOGIT Version 5  (May 1, 2012)--------
-----------------------------------------------------------

|-> read;nvar=17;nobs=453;file=U:\00Work-Purdue\new_laptop\CE697N-disk\LOGIT-A1.txt$
|-> create;cage=86-x15$
|-> nlogit;lhs=x1;choices=arterial,rural,freeway;model:
    u(arterial)=dist*x7/
    u(rural)=rural*one+dist*x7+cager*cage/
    u(freeway)=freeway*one+dist*x7+malef*x11+cagef*cage$
Iterative procedure has converged
Normal exit:   6 iterations. Status=0, F=    .9757331D+02

------------------------------------------------------------------------------
Discrete choice (multinomial logit) model
Dependent variable                Choice
Log likelihood function       -97.57331
Estimation based on N =    151, K =   6
Inf.Cr.AIC  =    207.1 AIC/N =    1.372
--------------------------------------
           Log likelihood R-sqrd R2Adj
Constants only   -124.2267  .2146 .1986
Note: R-sqrd = 1 - logL/Logl(constants)
--------------------------------------
Chi-squared[ 4]          =     53.30671
Prob [ chi squared > value ] =   .00000
Response data are given as ind. choices
Number of obs.=   151, skipped    0 obs

--------+---------------------------------------------------------------------
        |                   Standard            Prob.      95% Confidence
      X1|  Coefficient       Error       z    |z|>Z*         Interval
--------+---------------------------------------------------------------------
    DIST|    -.16731***      .02998    -5.58  .0000     -.22607   -.10856
   RURAL|     .15641         .33257      .47  .6381     -.49542    .80825
   CAGER|     .12846*        .06796     1.89  .0587     -.00473    .26166
 FREEWAY|    -.06375         .72233     -.09  .9297    -1.47948   1.35198
   MALEF|     .55314         .63151      .88  .3811     -.68460   1.79088
   CAGEF|     .23492***      .08451     2.78  .0054      .06928    .40055
--------+---------------------------------------------------------------------
***, **, * ==>  Significance at 1%, 5%, 10% level.
Model was estimated on Sep 20, 2016 at 00:39:24 PM
------------------------------------------------------------------------------


|-> nlogit;lhs=x1;choices=arterial,rural,freeway;model:
    u(arterial)=dista*x7/
    u(rural)=rural*one+distr*x7+cager*cage/
    u(freeway)=freeway*one+distf*x7+malef*x11+cagef*cage
    ;prob=proute
    ;effects:x7(arterial)/x7(rural)/x7(freeway)/x11(freeway)$
Iterative procedure has converged
Normal exit:   6 iterations. Status=0, F=    .9444041D+02

------------------------------------------------------------------------------
Discrete choice (multinomial logit) model
Dependent variable                Choice
Log likelihood function       -94.44041
Estimation based on N =    151, K =   8
Inf.Cr.AIC  =    204.9 AIC/N =    1.357
--------------------------------------
           Log likelihood R-sqrd R2Adj
Constants only   -124.2267  .2398 .2191
Note: R-sqrd = 1 - logL/Logl(constants)
--------------------------------------
```

Chi-squared[6]   =   59.57252
Prob [chi squared > value] =   .00000
Response data are given as ind. choices
Number of obs.=   151, skipped   0 obs

X1	Coefficient	Standard Error	z	Prob. |z|>Z*	95% Confidence Interval	
DISTA	-.12291***	.03012	-4.08	.0000	-.18194	-.06388
RURAL	2.81353**	1.39935	2.01	.0444	.07085	5.55621
DISTR	-.17737***	.03066	-5.79	.0000	-.23746	-.11728
CAGER	.12369*	.06864	1.80	.0716	-.01085	.25822
FREEWAY	-2.68647	2.72779	-.98	.3247	-8.03285	2.65990
DISTF	-.09565**	.04736	-2.02	.0434	-.18847	-.00283
MALEF	.59917	.66098	.91	.3647	-.69633	1.89468
CAGEF	.22688***	.08456	2.68	.0073	.06114	.39262

***, **, * ==> Significance at 1%, 5%, 10% level.
Model was estimated on Sep 20, 2016 at 00:39:24 PM

Elasticity wrt change of X in row choice on Prob[column choice]

X7	ARTERIAL	RURAL	FREEWAY
ARTERIAL	-5.2380	1.3528	1.3528

Elasticity wrt change of X in row choice on Prob[column choice]

X7	ARTERIAL	RURAL	FREEWAY
RURAL	5.3869	-3.0165	5.3869

Elasticity wrt change of X in row choice on Prob[column choice]

X7	ARTERIAL	RURAL	FREEWAY
FREEWAY	.6664	.6664	-5.6301