EPFL
ENAC INTER TRANSP-OR
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Mathematical Modeling of Behaviour
Fall 2012/2013

EXERCISES SESSION 4

For this lab we strongly encourage you to work in groups and discuss possible solutions to the questions given below. For some questions you probably need to consult the BIOGEME tutorial, the lecture notes or other documentation that is available on the BIOGEME web site (follow the link on the course web site).

Question 1
Which optimization algorithms are available in BIOGEME? How can you choose which algorithm to use? Give an example of a situation when it is interesting to try different optimization algortihms for the estimation of a same model.

Question 2
In your data file, the unit for the cost attributes (named costProduct1kCHF and costProduct2kCHF) is kCHF. You would like to define two new attributes (named costProduct1CHF and costProduct2CHF) where the unit is CHF. How can you specify this in the model file?

Question 3
The results of a model that you have estimated on the Netherlands mode choice data are shown below. Give an interpretation of the results.

Model:	Multinomial Logit
Number of estimated parameters:	4
Sample size:	228
Null log-likelihood:	-158.038
Init log-likelihood:	-158.038
Final log-likelihood:	-122.133
Likelihood ratio test:	71.8091
Rho-square:	0.22719
Adjusted rho-square:	0.20188
Final gradient norm:	3.01265
Variance-covariance:	from finite difference hessian

Name	Value	Std err	t-test		Robust Std err	Robust t-test	
ASC_CAR	-1.7037232e-02	+5.7689426e-01	-2.9532677e-02	*	+6.2538746e-01	-2.7242682e-02	*
B_COST_CAR	-5.7712704e-07	+1.2242850e-07	-4.7139925e+00		+1.4402280e-07	-4.0071923e+00	
B_COST_RAIL	-2.9714400e-07	+1.6658135e-07	-1.7837771e+00	*	+1.7432333e-07	-1.7045567e+00	*
B_TIME	-1.4198127e+00	+3.5398797e-01	-4.0109067e+00		+3.5573530e-01	-3.9912055e+00	

Question 4
What is the motivation for including alternative specific constants in the utilities? Why do we

have to set the constant for one of the alternatives to zero? Does it matter which alternative is selected?

Question 5

You have estimated two models where the first model has a generic attribute specification for cost and the second one a specific attribute specification for cost. Based only on the model fit results, is the second model significantly better than the first one? Give a motivation for your answer.

First model results:

Model:	Multinomial Logit
Number of estimated parameters:	3
Sample size:	2695
Null log-likelihood:	-1868.03
Init log-likelihood:	-1868.03
Final log-likelihood:	-218.682
Likelihood ratio test:	3298.7
Rho-square:	0.882935
Adjusted rho-square:	0.881329
Final gradient norm:	0.000215735
Variance-covariance:	from finite difference hessian

Second model results:

Model:	Multinomial Logit
Number of estimated parameters:	4
Sample size:	2695
Null log-likelihood:	-1868.03
Init log-likelihood:	-1868.03
Final log-likelihood:	-211.349
Likelihood ratio test:	3313.37
Rho-square:	0.88686
Adjusted rho-square:	0.884719
Final gradient norm:	0.000211087
Variance-covariance:	from finite difference hessian

Question 6

In the context of the Netherlands mode choice case, you hypothesize that women and men do not perceive car travel time in the same way. Namely, you believe that women like driving more than men and you therefore expect them to be less sensible to differences in car travel time than men. How would you model this and how can you implement it in BIOGEME?

Suppose that you have estimated the model, how can you know if your hypothesis is justified?

Question 7

You have estimated a Binary Logit model based on the Netherlands mode choice data. The deterministic parts of the utilities are

$$V_{\text{car}} = -0.798 - 1.326 \cdot \text{cartime} - 0.050 \cdot \text{carcost}$$

$$V_{\text{rail}} = -1.326 \cdot \text{railtime} - 0.050 \cdot \text{railcost},$$

where time is measured in hours and cost in Guilders. Compute the probabilities for the choice between a car trip that costs 16,- and takes 2 hours and a rail trip that costs 25,- and takes 1 hour.

You have also estimated a model with specific attribute specification for the time attribute. This yielded the following expressions for the deterministic parts of the utilities:

$$V_{\mathrm{car}} = 2.43 - 2.262 \cdot \mathrm{cartime} - 0.054 \cdot \mathrm{carcost}$$

$$V_{\mathrm{rail}} = -0.543 \cdot \mathrm{railtime} - 0.054 \cdot \mathrm{railcost}.$$

How have this effected the probabilities for the alternatives given above?

Make a sensitivity analysis of the probabilities with regard to travel time (consider the interval 0 to 6 hours).

Note that the travel time for car is assumed to be the sum of in-vehicle-time and access time, and the rail time is the sum of in-vehicle-time, access and egress time.

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