AAEC6311 – Applied Econometrics II

Spring 2009

Instructor: Eric Belasco

Exam 1

Name: ____________________________________

You have one hour and 20 minutes to complete the exam. There are three questions. Point values will sum to 60, with points associated with each question indicated accordingly. **USE YOUR TIME WISELY**. Also, I will address clarifying questions, but not substantive questions. You are allowed to use one 3x5 note sheet (front and back), a calculator, and a pencil/pen. Good luck!

Question 1 (14 points). You are asked by the USDA to conduct a survey of the grizzly bear encroaching on livestock rangeland in Wyoming. You are asked to scout out one particular rangeland area and count the number of grizzly bear sightings per day. You assume the number of grizzly bears sighted (y_i) on day i can be distributed as a Poisson distribution such that:

$$f(y_i|\theta) = \frac{e^{-\theta}\theta^{y_i}}{y_i!}$$

After 10 days, you submit a report to your boss with observations from each day, which are y = (5,0,1,1,0,3,2,3,4,1).

(a) (4 points) Derive the log-likelihood function necessary for computing the Maximum Likelihood Estimate of θ.

(b) (6 points) Using the observations over the first 10 days, derive the optimal solution for θ (Show your work). (*Hint: The optimal solution for θ is where* $\frac{dLL}{d\theta} = 0$)

(c) (4 points) A colleague suggests some variables, x, that might help determine the number of bear sightings. Upon the suggestion, you augment your model such that

$$\theta_i = \exp(x_i \beta)$$

After estimating this function using MLE, discuss specifically how you assess which model is more appropriate.

Question 2 (34 points). You are asked to consult the Texas State Legislature on a bill to increase the amount of worker programs for inmates in state prisons. The proponents of this bill make the point that these worker programs can lead to less inmates being arrested after being released from prison. You collect data from a Texas prison and specify the following model:

$$\log(durat)_i = x_i \beta + \varepsilon_i$$

where *durat* is the time (in months) until an inmate is arrested after being released from prison. After 70 months (almost 6 years) you stop collecting data and notice that 901 out of 1,445 of the observations did not return to prison at the time you stopped collecting data (In other words, you will have 901 observations with *durat* = 70). x contains variables such as:

workprg (equal to 1 if inmate participated in worker program, 0 otherwise),
drugs (equal to 1 if inmate has a history of drug use, 0 otherwise),
alcohol (equal to 1 if inmate has a history of alcohol abuse, 0 otherwise),
age (in months),
among others.

(a) (4 points) Why might OLS estimation be inappropriate in this case?

(b) (4 points) Briefly describe one model that could be used to model these effects more appropriately.

(c) (4 points) Discuss another candidate model that might also be considered and under which conditions it would be superior to the one suggested in part (b).

(d) (22 points) Government officials express to you that they are really only interested in whether inmates return to prison upon being released. To satisfy their needs, you create a new variable, *bindurat*, that is equal to 1 if the inmate returns to prison within 70 months and 0 if not. You specify the following model:

$$bindurat_i = x_i\beta + \varepsilon_i$$

i) (4 points) Describe the major differences between using the Linear probability model and the Probit model.

Table 1

	LPM	Probit
workprg	0.0139 (0.0258)	0.0542 (0.0740)
drugs	0.0737 (0.0290)	0.2062 (0.0823)
alcohol	0.1140 (0.0316)	0.3310 (0.0900)
age	-0.0008 (0.0001)	-0.0023 (0.0004)
$\phi(\bar{x}\beta)$		0.3674

ii) (8 points) Using the results in Table 1, carefully interpret your parameter estimate regarding *workprg* for each model at the mean levels of x. Based on your assessment, are additional worker programs effective in reducing inmate returns to prison?

iii) (4 points) You are interested in interpreting the influence of age on inmate returns to prison. What impact does an additional year have on the probability of returning to prison at the mean levels of x? (Hint: keep in mind that *age* is measured in months)

iv) (6 points) Discuss, as specifically as possible, how you expect for the relationship between *age* and *bindurat* to change for different levels of *age* in the Probit model. How is this different from the LPM case?

Question 3 (12 points). You obtain data from a survey conducted at 10 different fishing sites around Lubbock. In the survey, anglers provide you with the number of trips they made to each of the 10 sites of interest in the last year. Using this data, you can develop the following random utility model in order to evaluate preferences around different fishing sites:

$$U_{ij} = X_{ij}\beta + \varepsilon_{ij}$$

for $j = 1, \ldots, 10$ and $i = 1, \ldots, 258$. X contains the following variables:

Fishstock (fish per 1,000 feet of river),
Aesthetics (Measured on a scale from 0 (lowest) to 3 (highest)),
Guide (equal to 1 if listed in *Angler's Guide*, 0 otherwise)
campgrounds (number of campgrounds per square mile), and
Travel Cost (Total cost of traveling to site (unique to each individual))

(a) (4 points) Set up the Log Likelihood function for the conditional Logit model (show your work).

(b) (4 points) Discuss with the IIA property and why it might not hold for all 10 fishing sites.

(c) (4 points) Express the equation used to describe the probability that individual i chooses alternative j.