Market and Information Economics
Preliminary Examination

Department of Agricultural Economics
Texas A&M University

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Instructions: This examination consists of six questions. You must answer the first question and you must answer four of the remaining five questions (i.e. answer four of the questions numbered 2-6). Each question answered (five in total) has a weight of 20% in the final examination score. Please read through the entire examination before making a decision on the particular set of five questions you actually answer. The examination proctor will review the content of the exam at the beginning of the time period (9:00 am). He or she will answer general questions for the entire set of students writing this prelim. You have until 1:15 pm to complete the exam. Good Luck!

You Must Answer this Question

1. In their AJAE 2010 paper "An Analysis of the Pricing of Traits in the U.S. Corn Seed Market", Guan et al. found that giant corporations in the seed industry often engaged in regional price discrimination, charging farmers in different parts of the country different amounts of money for the same seeds.

(a) Price discrimination can be categorized into three types: first degree price discrimination, second degree price discrimination, and third degree price discrimination. Define all three types of price discrimination. Which type of price discrimination does the example above belong to?

(b) Suppose a firm with costs $C(Q) = 1{,}000 + 60Q + 0.1Q^2$ is able to price-discriminate between two groups of customers, with demands $Q_1 = 3{,}000 - 2p$, and $Q_2 = 350 - 0.5p$, respectively. How much does it sell to each group, and at what price? What price would this firm set if it were forced to charge all its customers the same price?

Answer four of the following five questions

2. Let f be the physical density of S_T, the price of a financial asset at a future time T. Suppose that the present value of a derivative (e.g., an option) based on this financial asset is priced according to

$$V = \int C(S_T)p(S_T)dS_T,$$

where C is the payoff of the derivative at time T.

Denote by $K(S) = p(S)/f(S)$ the pricing kernel of the derivative.

(a) Propose an estimator of the pricing kernel. State clearly your data requirements and estimator procedure.

(b) A pricing kernel different from unity indicates that the market prices the derivative according to a probability measure different from the physical density of its underlying financial asset. Provide explanations to this deviation from the principle of pricing according to expectation.

(c) Does your answer to Part (b) depend on the existence of a risk free financial instrument? If no, explain why it is the case? If yes, show how your answer to Part (b) would change if there exists NO such a risk free financial instrument.

(d) Show that the above framework can be used to price a crop insurance policy. Explain what form the payoff function C will take in this case. (Hint: in this case, S_T is the random crop yield with density f, and the 'pricing kernel' reduces to unity such that $p(S) = f(S), \forall S$.)

3. Consider a panel data model

$$Y_{it} = X_{it}\beta + c_i + u_{it}, i = 1, \ldots, N, t = 1, \ldots, T.$$

Define $v_{it} = c_i + u_{it}$ and its variance $V_i = E[v_i v_i']$. Suppose that for $i = 1, \ldots, N$, we have

$$V_i = \begin{pmatrix} \sigma_c^2 + \sigma_i^2 & \sigma_c^2 & \ldots & \sigma_c^2 \\ \sigma_c^2 & & \ldots & \\ & & & \sigma_c^2 \\ \sigma_c^2 & & \sigma_c^2 & \sigma_c^2 + \sigma_i^2 \end{pmatrix}$$

where $Var(c_i) = \sigma_c^2$ and $Var(u_{it}) = \sigma_i^2$. Propose an estimator of V_i for $i = 1, \ldots, N$. [Note this variance covariance matrix may differ across i's.]

4. A sample of N respondents have to choose among J available alternatives. The utility person n derives from choosing alternative j is given by $U_{nj} = \beta_n' x_{nj} + \varepsilon_{nj}$. Assume that each ε_{nj} is independently and identically distributed extreme value so that the density for each unobserved component of utility is $f(\varepsilon_{nj}) = e^{-\varepsilon_{nj}} e^{-e^{-\varepsilon_{nj}}}$. The choice probability of $P_{ni}|\varepsilon_{ni}$ over all values of ε_{ni} weighted by its density takes the form:

$$P_{ni} = \int \left(\prod_{j \neq i} e^{-e^{-(\varepsilon_{ni} + V_{ni} - V_{nj})}} \right) e^{-\varepsilon_{ni}} e^{-e^{-\varepsilon_{ni}}} d\varepsilon_{ni} \tag{1}$$

In order to get credit, please make sure you provide an explanation to support your answers.

(a) Calculate a closed form expression for the unconditional choice probability of person n choosing i.

(b) What would be the log-likelihood function to estimate the parameters associated with P_{ni}?

5. Ordered Choice Model is typically motivated by assuming an underlying latent variable:

$$y^* = \beta' x_i - \eta_i$$

Observe:

$$y_i = \begin{cases} 1 & \mu_0 < y_i^* \leq \mu_1 \\ 2 & \mu_1 < y_i^* \leq \mu_2 \\ 3 & \mu_2 < y_i^* \leq \mu_3 \\ & \vdots \\ J & \mu_{J-1} < y_i^* \leq \mu_J \end{cases} \qquad \mu_j > \mu_{j-1} \quad \forall j$$

Typically: $\mu_0 = -\infty$ and $\mu_J = +\infty$

(a) Ordered responses arise in many empirical settings. Give at least three examples of cases when ordered choice models can be used. Please, be specific. Provide the plot of the distribution for one of the examples and label the axes.

(b) Specify the resulting choice probabilities, $\Pr[y_i = j]$, of the model provided above.

(c) Discuss the advantages and disadvantages of using Ordered Logit, Ordered Probit, OLS, and Multinomial Logit in estimating the above specified model.

(d) Provide the marginal effects of the model defined above and the plot.

6. The tobit model specifies a mixed discrete-continuous distribution for a censored outcome variable *y*. In most applications of tobit models, values of *y* are observed provided *y* is positive, while we simultaneously see a clustering of *y* values at zero.

(a) Write the tobit specification in terms of a latent variable model.

(b) Write down the likelihood function for the tobit model.

(c) Describe how data augmentation can be used in conjunction with the Gibbs sampler to carry out a Bayesian analysis of the tobit model.