Market and Information Economics
Preliminary Examination

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Instructions: This examination consists of six questions. <u>You must answer the first question</u> and you must answer <u>four of the remaining five</u> 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. A monopoly with constant marginal costs of $50 can sell to three groups of potential consumers, with demands $Q_1 = 800 - 0.2p$, $Q_2 = 400 - p$, and $Q_3 = 700 - 0.4p$ respectively. Find the optimal price quantity combination in each market:

   (a) if the firm is able to price-discriminate;

   (b) if it is not able to price-discriminate.

Answer four of the following five questions

2. General Mills, Inc. is a top U.S. food manufacturer based in Minneapolis. Notable brands under the General Mills umbrella include breakfast cereals such as Cheerios, Cinnamon Toast Crunch, and Lucky Charms. As a recent hire of this company, your primary responsibility is to investigate the demand for the three aforementioned breakfast cereals as well as to forecast sales for these brands for the period 2010Q1 to 2020Q4.

   (a) Develop and justify a theoretical model to analyze the consumer demand of the aforementioned breakfast cereal brands. Describe the dependent variables as well as the explanatory factors.

   (b) What are the data requirements to accomplish this task?

   (c) How would you assess the sensitivity of consumers to changes in prices of the three respective cereal brands?

   (d) How would you assess the relationship among Cheerios, Cinnamon Toast Crunch, and Lucky Charms?

   (e) How would you assess the sensitivity of consumers to changes in disposable personal income?

   (f) How would assess the impact of COVID-19 on the demand for these cereal products?

   (g) Explain the process of providing ex-ante forecasts of the respective cereal brands for the period 2021Q1 to 2021Q4.

   (h) Suppose that after making these ex-ante forecasts, a year later you now know the actual sales of the three cereal brands for the period 2021Q1 to 2021Q4. How would you evaluate the accuracy of your ex-ante forecasts?

3. Covid-19 is one of the biggest challenges in modern history. Deaths are widespread worldwide. If you want to use a model to predict the probability of dying from COVID-19, that is Y=1 for an individual dying of COVID and Y=0 represents an individual surviving.

(a) What variables would you include in your model?

(b) What are the two main problems of estimation your model with an OLS regression?

(c) How would you fix the problems of estimating this model using OLS?

4. Washington D.C. area roads are the nation's one of the most congested, with drivers spending 104 extra hours a year in traffic. To get a better understanding of the traffic situation in Washington D.C. area on any given weekday, a survey was conducted asking 500 people who work in downtown D.C. how they get to work. The question was given as follows:

Q. How do you get to work on a typical morning?

   a. Walk
   b. A car
   c. The subway
   d. The bus

You also have information on five other variables for each commuter: X1 = distance they live from their job, X2 = years of education, X3 = married or not, X4 = gender, and from county records you have an estimate of the price of each on mode of transportation on a per mile basis.

Develop and describe in detail an underlying economic theory that leads naturally to an econometric model of how commuters would choose one of these types of transportation. A full answer will be one that starts with the economic theory and goes all the way through to how the model would be developed and estimated and any potential problems that could arise in implementing and interpreting the results.

5. Consider the following model

$$Y_t = \beta_0 + \beta_1 X_t + e_t, t = 1, \ldots, T, \qquad (1)$$

where T is an even number. Suppose

$$e_t = \rho e_{t-1} + u_t,$$
$$E[u_t] = 0,$$
$$Var[u_t] = \sigma_1^2, t = 1, \ldots, \frac{T}{2},$$
$$Var[u_t] = \sigma_2^2, t = \frac{T}{2} + 1, \ldots, T,$$
$$Cov[u_t, u_s] = 0 \text{ for } t \neq s.$$

(a) Propose a test for the hypothesis $H : \sigma_1^2 = \sigma_2^2$.

(b) Suppose the hypothesis in part (a) is rejected. Propose an asymptotically efficient estimator for model (1).

6. Consider a market of a homogeneous good, where all firms and consumers are assumed to be identical. The characteristics of the market are given below.

Consumers

- Consumers are identical with a unit demand and a reservation price r.
- Consumers know the distribution of price, but do not know the price charged by individual firms. They collect price information according to the following strategy: sample one firm with probability $1 - s$, and two firms with probability s, where $s \in (0, 1)$. In other words, each consumer visits either one firm or two, with the probability of the latter being s.
- Consumers randomly choose the firm(s) they visit and buy one unit if the observed lowest price is no greater than the reserve price r.
- Number of consumers $M > 0$

Firms

- Identical firms selling a homogeneous good
- Number of firms: $N > 0$; entry into the market is free.
- Common cost function: fixed cost $K > 0$ plus a constant marginal cost $k > 0$ such that $c(q) = K + kq$, where q is quantity.
- Firms compete only through price, taking other firms' prices as given
- Firms make equal profit $\pi = 0$ in the equilibrium.
- Let $\mu = M/N$. M and N can go to infinity, while $0 < \mu < \infty$.

Equilibrium

Symmetric Nash equilibrium in which firms have no incentives to deviate from a common pricing scheme.

Question

Suppose the search intensity, measured by the probability s of sampling two firms, is exogeneous and fixed. Derive the equilibrium price distribution. Specify all relevant aspects of the equilibrium.