Market and Information Economics
Preliminary Examination

Department of Agricultural Economics
Texas A&M University

May 2017

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 give you time to read the content of the exam at the beginning of the time period (9:00 am). He will answer general questions or questions relating to clarification. You have until 1:15 pm to complete the exam. Good Luck!

You Must Answer this Question

1. Suppose that there are two types of workers who are distinguished by their cost functions and the action of a worker is the amount of output he produces. A monopoly firm can perfectly observe the action of a worker, but it can't tell how costly those actions are to the worker.

   Let x_t and $c_t(x_t)$ be the output and cost function of a worker of type *t*. Let $s_t(x_t)$ be the payment that a type *t* worker receives from the film, which is a function of output. The worker *t*'s utility function is of the form $s_t(x_t) - c_t(x_t)$. The monopoly firm makes a profit P_t on a worker of type *t*, $P_t = x_t - s_t$. The firm is unsure of the type of worker it faces, but it attaches a probability of π_t that a worker is type *t*. Suppose that $c_t(x_t) = tx_t^2/2$ and $\pi_1 = \pi_2 = 0.5$.

a. Set up the film's optimization problem. What is the basic incentive problem here? Specify the participation and incentive compatibility constraints. If you need to make additional assumptions, make sure you note them.

b. Does the cost function satisfy the single-crossing property, and why? Discuss why this property is important in solving the optimal incentive contract.

c. Find the optimal incentive contract and calculate the profits of the monopolist. If you need to make additional assumptions, make sure you note them.

Answer four of the following five questions

2.

Consider an I.I.D. sample $\{Y_i, X_i\}, i = 1, \ldots, n$, where Y_i is a scalar and X_i is a K-dimensional vector. Suppose the relation between Y and X is given by

$$Y_i = X_i\beta + e_i, \tag{1}$$

where $\beta = (\beta_1, \ldots, \beta_K)'$, $E[e_i|X_i] = 0$ and $\text{Var}(e_i|X_i) = \sigma^2 < \infty$.

1. Denote the OLS estimate of (1) by $\hat{\beta}$ and a restricted estimate by $\tilde{\beta} = (\tilde{\beta}_1, \ldots, \tilde{\beta}_{K-1}, 0)'$, which is obtained under the constraint $\beta_K = 0$. Let $\hat{e}_i = Y_i - X_i\hat{\beta}$ and $\tilde{e}_i = Y_i - X_i\tilde{\beta}$. Define their corresponding estimates of the error term variance by $\hat{\sigma}^2 = 1/n\sum_{i=1}^{n}\hat{e}_i^2$ and $\tilde{\sigma}^2 = 1/n\sum_{i=1}^{n}\tilde{e}_i^2$ respectively. Show that $\hat{\sigma}^2 \leq \tilde{\sigma}^2$. What is the implication of this inequality on using R^2 as a criterion for model selection?

2. Further suppose that $e_i \sim N(0, \sigma^2)$, which is the normal distribution with mean zero and variance σ^2. Denote the MLE estimate by $\hat{\beta}_{MLE}$ and the restricted MLE by $\tilde{\beta}_{MLE}$. Denote their corresponding log-likelihoods by $\hat{l}$ and $\tilde{l}$. Show that $\hat{l} \geq \tilde{l}$. What is the implication of this inequality on using the maximized log likelihood for model selection in maximum likelihood estimation?

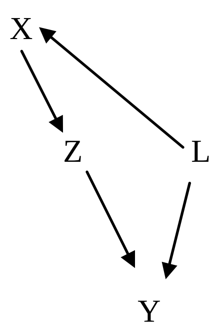
3. Propose some alternatives to R^2 in linear regressions and to maximized log likelihood in MLE for model selection, such that they are immune from the limitations suggested in parts 1 and 2.

3. Please use the following graphs to answer parts (i), (ii), (iii) and (iv).

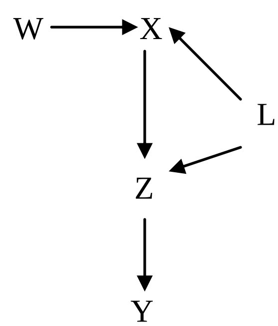
Argue why or why not the effect ∂Y/∂X is capable of being estimated (with ordinary least squares or some similar method to obtain unbiased and consistent estimates of ∂Y/∂X) from non- experimental observables (W, X, Y and Z) in the presence of the unobservable L, from the following three models.

Suggest a procedure (if any) for finding an unbiased estimate of this effect in each case (i, ii, iii, iv).

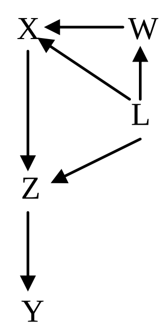
Suggest a procedure researchers may use to obtain an unbiased estimate of the desired effect (as stated above), if the defined model (i, ii, iii, iv), in its present form, does not allow unbiased estimation of the effect.



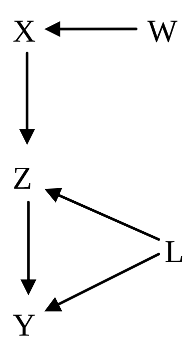
(i)



(ii)



(iii)



(iv)

4.Issued probabilities from both subjective (human beings) and objective (econometric models) sources can be judged as to “goodness” by probability calibration and proper scoring rules. Please answer the following:

i. Discuss probability calibration and proper scoring rules. Why it is important that we ask our probabilities to be well-calibrated and to show an ability to sort?

ii. Provide a hypothetical example that shows clearly a probability forecast that is well-calibrated but does no sorting.

iii. Provide a hypothetical example that shows clearly a probability forecast that is well-calibrated and does perfect sorting.

iv. Describe a test one can use for “well-calibration”.

5. In 2014, for the first time in the U.S., the expenditure share on food away from home (FAFH) surpassed the share spent on food at home (FAH). FAFH now accounts for over half of American households' food spending and has become a regular part of Americans' diets and habit, instead of an occasional treat.

There are several health concerns associated with increased FAFH consumption, since FAFH often has more calories, fat, and sodium than food prepared at home. To understand the Americans' food and eating choices and to gain more knowledge about the health implications of the increases in consumption of FAFH the USDA sent out a call for proposals for innovative policy-relevant research in this area.

You and your colleagues have decided to submit a proposal. Discuss data requirements by specifying dependent variable(s) and independent variables. Clearly specify the empirical model(s) that will be used, i.e. demand, SUR, OLS, treatment effect, etc., and discuss properties of model(s) and advantages and disadvantages of using the model(s). Be as specific as possible.

6.The School Nutrition Dietary Assessment Study (SNDA) conducted for the USDA Food and Nutrition Service (FNS) is a nationally representative, cross-sectional study of school age children in the United States along with the information regarding the National School Lunch Program (NSLP) and School Breakfast Program (SBP). Although, detailed student and school-level socio-economics variables are available from the SNDA, the only data that you have access is the data on elementary school students.

a. Given the above information, you are asked to estimate the effects of NSLP and SBP participation on the calcium intake from milk and cheese from school meals. Specify the empirical model and all the issues that need to be address in the estimation. If endogeneity is a problem, then make sure to propose an appropriate estimation method and instrument(s).

b. The concepts of truncation and censoring are often confused in the empirical literature.
    i. What is the difference between truncation and censoring?
    ii. Using the data provided above, please give the examples of truncation and censoring and draw graphs.

c. If you were to use a Bayesian approach in your estimation, then describe the choice of priors (which distributions you will assume for each of the random variables and why) and Gibbs sampling steps without deriving the conditional posteriors.