Instructions: This examination consists of seven questions. You must answer the first question and you must answer four of the remaining six questions (i.e. you must answer four of the questions numbered 2-7). 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 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!
ANSWER THE FOLLOWING QUESTION.

1. In recent months retail gasoline prices have risen dramatically in the United States. During this period of rising retail gasoline prices, consumption of gasoline in the US has actually fallen. A number of explanations have been suggested by the press including: 1) the possibility that speculators are withholding supplies because they anticipate even higher prices in the months ahead, 2) reduced supply of crude oil due to political instability in export oriented production regions, and 3) increased market power exertion by refiners and retailers in the United States market.

   i. Discuss the steps, researcher methods, and specific models and hypothesis tests you would undertake to determine what role, if any, each possible explanation (1-3 above) for the run up in retail gasoline prices actually played. Be sure to include the details of any models and hypothesis tests you might use to answer this question. Also discuss any assumptions that you might make when conducting your analysis.

      In answering this question consider the gasoline industry as being comprised of four parts: 1) producers of crude oil, 2) logistic (shipping) and storage providers, 3) an integrated refining and retailing sector, and 4) consumers. Each production stage requires inputs of labor, capital, and purchased materials (oil or gasoline).

   ii. Discuss how you would validate your model and any underlying assumptions that you utilized in your analysis.
ANSWER FOUR OF THE FOLLOWING SIX QUESTIONS.

2. Consider the following DAGs on variables A, B, C, D and E for which economists have an interest in understanding:

(a)  
\[ \begin{align*} 
A & \rightarrow B \\
B & \rightarrow C \\
D & \rightarrow E \\
E & \rightarrow D \\
\end{align*} \]

(b)  
\[ \begin{align*} 
A & \rightarrow B \\
B & \rightarrow C \\
D & \rightarrow E \\
E & \rightarrow D \\
\end{align*} \]

i. Assuming the Causal Markov condition, demonstrate the DAGs (a) and (b) have the same joint probability distribution on data A, B, C, D and E.

ii. Given the results in part i, how might an economist go about distinguishing whether the causal structure on data A, B, C, D and E is from model a or b? Short of knowing the “true” model, what other types of information might she seek out?
3. The recent nuclear reactor accident in Japan has been a point of interest to economists. Some say markets for products produced in both Japan and the US will be (or have been) affected by the event. Design a study to determine if markets for one or more agricultural products produced in Japan or the US will be affected by the events in Japan.

   i. Provide a theoretical argument summarizing your thoughts on this issue.

   ii. Outline a study to assess possible benefits or costs to various actors (consumers and producers and others) in various markets.

   iii. What variables will you attempt to find measures?

   iv. What estimation techniques will you suggest for use?

   v. What evidence will you report to convince US governmental officials that your estimates of the effects of the accident on markets are reliable?
4. Consider a demand function for a certain good:

\[ Q = a + p \cdot b, \]

where \( Q \) denotes the quantity, \( p \) denotes the price, and \( a \) is a constant. Design estimators for the demand function under the following conditions respectively. State clearly the statistical assumptions and data requirements such that your proposed estimators identify the demand function.

i. The slope \( b \) is a constant.

ii. The slope \( b \) is determined by a set of variables \( z \), which are uncorrelated with the price \( p \).

iii. The slope \( b \) is determined by a set of variables \( z \), which includes the price. The correlation between \( b \) and \( p \) is different from zero.
5. The AIDS model of Deaton and Muellbauer (1980) is given as:

\[ w_i = \alpha_t + \sum_k \gamma_{ik} \ln p_k + \beta_t \ln (x/P) \]

where \( w_i \) is the expenditure share for good \( i \), \( i = 1, 2, 3, \ldots, I \), \( p_k \) is the price for good \( k \), \( x \) is the total expenditure on all goods, and \( \alpha_t, \gamma_{ij}, \) and \( \beta_t \) are parameters.

In the estimation of the above specified model it is quiet common to claim that the intercept is a function of demographic variables, such as age, gender, household size, income, race, etc. Let these variables be denoted by the vector \( z \). Then the intercept can be written as:

\[ \alpha_i = \pi_{i0} + \sum_m \pi_{im} z_m, \text{ for } m = 1, 2, 3, \ldots, M. \]

where \( \pi_{i0} \) and \( \pi_{im} \) are parameters.

i. Show what this specification implies about the underlying cost (expenditure) function and price index function for \( P \).

ii. What additional restrictions are needed for the properties of demand to be satisfied?

iii. Show how this would affect the own price elasticities.
6. Two of the most commonly estimated demand systems are the exactly aggregated Transcendental Logarithmic (Translog) system of Christensen, Jorgenson and Lau (1975) and the Almost Ideal Demand System (AIDS) of Deaton and Muellbauer (1980)

i. Discuss the similarities and differences between these two models.

ii. Using the definition of share, show how the AIDS and Translog Demand models can be nested within a single model.
7. The owner of Cool Cows, a company selling ice cream located in New England, is interested in hiring a manager for her outlet store. Cool Cows is a privately held company and the owner is aware of the importance of incentives. She wants to setup a contract for the outlet manager that results in strong incentives to perform tasks with minimal need to monitor the outlet manager. The owner has done considerable research and testing of potential outlet managers and found that the potential manager selected has utility function:

\[ U(x,y) = 20 \ln(x+1) + y, \]

where \( x \) is leisure consumption and \( y \) is expenditure on all other goods. Units have been chosen so that the individual is endowed with 3 units of \( x \) and zero units of \( y \). The potential manager’s best alternative opportunity is to consume 3 units of leisure and not work. If the manager supplies \( e \) units of effort, then the outlet’s revenue will be:

\[ R = 10e + \varepsilon, \]

where \( \varepsilon \) is a random variable with expected value zero. (Note, \( R \) is outlet profit before deducting the manager’s pay.)

i. Suppose that the owner offers the potential manager the wage contract \( w = \theta R + F \), where \( \theta \) and \( F \) are parameters (contract terms) set by the owner. Determine the manager’s effort supply function. Show that effort \( (e) \) increases when \( \theta \) increases.

ii. Solve for the contract that maximizes the owner’s expected profit.

iii. Solve for the optimal full information contract where the owner can observe the manager’s effort.

iv. From what you know about contract theory, interpret your results in part ii and iii.