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. There is a long history of concerns over market concentration and abuse of market power in meat (beef) packing in the US. The industry has experienced a steady trend throughout the past two decades of consolidation through mergers and acquisitions. However, recently the US Department of Justice challenged a proposed merger. Suppose you have been asked to investigate competitiveness of the US meat packing industry. You suspect that manufacturers may be exercising market power in both the output (beef) market and input (fed cattle) market and want to test that possibility using NEIO modeling. You have been given aggregate annual data (1970-2009) for output quantity and price data and input quantity and price data for materials, labor, and capital for fed cattle producers and separately the same variables for meat packers. There is relatively little inventory adjustment so you do not need to consider inventories.

   a. Carefully state any assumptions you make in developing your model paying particular attention to how you will handle the possibility of technological change that has almost certainly occurred over the time horizon of the data.

   b. Write out all estimating equations assuming Generalize Leontief functional forms for both cattle feeders (fed cattle production) and meat packing.

   c. Demonstrate important properties of the estimating equations (homogeneity, symmetry, and others you think important). Discuss additional checks and tests you will need to perform to make sure that the model fully complies with assumptions that were maintained when specifying the model.

   d. Describe all transformations of the data you would use to estimate the model (i.e. how will separate fed cattle from material inputs in the meat packing data). List any additional data you would need for estimation and how it would be used (e.g. in estimating demand, for instrumental variables, etc.)

   e. Describe the procedures you would use to estimate this model and explain why you selected this estimator.

   f. Describe specific hypothesis tests that you would perform to make sure the model complies with assumptions that were maintained for estimation.

   g. Suppose that you believe that market power exertion may have changed after a major merger that occurred in 2002. Describe specific adjustments that you would make in the model developed above and specific tests that you would perform to test for this possibility.
ANSWER FOUR OF THE FOLLOWING SIX QUESTIONS.

2. Consider the following the graph that generates variables on Agricultural Supply as directly a function of Soil Moisture, Input Levels, and a macro latent variable (LATENT). In turn these variables are generated by the variables Research Expenditures, Price Expectations, and Interest Rates. Price Expectations are also latent (unobserved), but do cause Futures Prices, which are observed.

Assume all variables that are measured are observational (non-experimental). Propose a method, if any, to obtain consistent and unbiased estimates of:

i. \( \frac{\partial \text{AGRICULTURAL SUPPLY}}{\partial \text{PRICE EXPECTATIONS}} \)

ii. \( \frac{\partial \text{AGRICULTURAL SUPPLY}}{\partial \text{RESEARCH EXPENDITURES}} \)

iii. \( \frac{\partial \text{AGRICULTURAL SUPPLY}}{\partial \text{SOIL MOISTURE}} \)

iv. Discuss how an experimentalist would modify the graph given above to obtain (internally valid [unbiased and consistent]) estimate of the derivative \( \frac{\partial \text{AGRICULTURAL SUPPLY}}{\partial \text{RESEARCH EXPENDITURES}} \). Do not worry about the feasibility of such an experiment, but merely describe its structure in an “ideal” environment.
3. Since the 1960's agricultural economists have followed John Muth in the study of producers’ subjective probability distributions. Since about the same time, commercial econometrics groups have marketed probability forecasts of important macroeconomic and aggregate agriculturally-related variables.

i. What prior, ex ante, restrictions do we (or should we) put on these probabilities (both individual subjective distributions and the forecasts of the macro-models)?

ii. Ex post we can judge elicited probability according to calibration and sorting. Describe what such judgments attempt to accomplish. Why is calibration important? Why is sorting deemed important?

iii. Consider a regression model of the issued probabilities, \( p_{it} \), from a model (or a person) on the zero-one outcome variable (\( d_{it} = 1 \) if the event occurs; \( d_{it} = 0 \) if the event does not occur) measured over a sequence of binary outcomes \( (i=1,2) \) over \( t \) trials, \( t = 1, 2, \ldots, T \).

\[
p_{it} = \beta_0 + \beta_1 d_{it} + \varepsilon_{it}
\]

Here \( \varepsilon_{it} \) is an unobserved error or disturbance term.

a. What estimated values on \( \beta_0 \) and \( \beta_1 \) do we expect to see for a “good” probability forecaster?

b. Plot this estimated relationship for a probability forecaster who does no sorting. On the same graph plot this function for a perfect probability forecaster.

b. Say we have two forecasters (different people or different models), each issuing probability forecasts over the same \( t=1, \ldots, T \) events, where each event has two possible outcomes \( (i=1,2) \). How might we test whether the probability forecasts from one forecaster sort differently than the forecasts from the other forecaster?
4. An entrepreneur has cash $A$ and wants to finance a project involving investment cost $I > A$. The project yields $R$ if it is successful and $0$ if it is not successful. The entrepreneur may either behave and enjoy no private benefit, in which case the probability of success is $p_{th}$ or misbehave and enjoy private benefit $B$, in which case the project fails for certain (i.e., $p_L = 0$). Assume that $p_{th} R > 1$ and $B < I$, i.e., the Net Present Value (NPV) is positive if and only if the entrepreneur behaves.

(a) Given an incentive constraint of $(p_{th} - p_L) R_y \geq B$, show that the entrepreneur can obtain financing if and only if:

$$p_{th} R - I \geq B - A \quad (1)$$

Further show that the entrepreneur’s utility or NPV is:

$$U_b = p_{th} R - I \quad (2)$$

(b) Suppose now that the entrepreneur, with probability $0 < \lambda < 1$, has an interesting outside investment opportunity. To profit from this opportunity, the entrepreneur must receive cash (exactly) equal to $r > 0$ before the final outcome on the initial project is realized. With probability $(1 - \lambda)$, no such opportunity arises. Whether the opportunity arises is not observable by the investors, so the entrepreneur can “fake” a liquidity need and strategically exit. If the opportunity arises and the entrepreneur is able to invest $r$ in it, the entrepreneur receives $\mu r$, where $\mu > 1$. This payoff is also unobservable by investors. The timing is as follows:

- **Stage 0.** The investors bring $I - A$ (provided they are willing to finance the project), and investment occurs.
- **Stage 1.** The entrepreneur chooses between $p_{th}$ and $p_L$.
- **Stage 2.** The entrepreneur privately learns whether she faces an investment opportunity (and therefore needs cash $r$ not to forgo the opportunity).
- **Stage 3.** The project’s outcome ($R$ or $0$) is publicly observed. The entrepreneur receives $\mu r$ if she had an investment opportunity (but only $r$ if she faked the investment opportunity) at stage 2 and invested $r$.

Consider a contract in which the entrepreneur is offered a choice for stage 2 between:

(i) Receiving $r$ at stage 2 and nothing at stage 3, and

(ii) Receiving nothing at stage 2 and $R_y$ in the case of success (and $0$ in the case of failure) at stage 3.

Note that this class of contracts is actually optimal. The menu is designed so that she chooses (i) at stage 2 if and only if she has an investment opportunity.

Show that this incentive constraint at stage 1 is:

$$(1 - \lambda) (p_{th} R_y - r) \geq B$$

To prove this, argue that, were the entrepreneur to misbehave, she would always select option (i), while if she behaves, then necessarily $p_{th} R_y > r$.

(c) Keeping within the framework of (b) and assuming that
\[ \mu r \geq r + \frac{B}{1 - \lambda} \]  

(3)

show that the project is financed if and only if

\[ p_{it} R - I \geq B - A + r \]  

(4)

and the entrepreneur’s utility (where she has a liquid claim) is then

\[ U_{p}^{L} = p_{it} R - I + \lambda(\mu - 1) r \]  

(5)

Compare (4) and (5) with (1) and (2) and discuss the desirability and feasibility of such liquid compensation contracts. Finally, interpret (3).
5. Consider an entrepreneur with a project of variable investment $I$. He has initial wealth $A$, is risk neutral, and is protected by limited liability. Investors are risk neutral and demand a rate of return equal to 0. The project comes in two versions:

**Risky.** The project costs $I$ and ends up (potentially) productive only with probability $x < 1$. The timing goes as follows:

1. The scale of investment $I$ is selected.
2. After the investment has been sunk, news accrues as to the profitability of the project. With probability $1 - x$, the project stops and yields 0. With probability $x$ the project continues (without any need for reinvestment).

In the latter case, (3) the entrepreneur chooses an effort; good behavior confers no private benefit on the entrepreneur and yields subsequent probability of success $p_{II}$; misbehavior confers private benefit $B/I$ and yields probability of success $p_{I}$.

Finally, (4) the outcome accrues: success yields $RI$ and failure 0.

**Safe.** The investment cost, $XI$ with $X > 1$ is higher for a given size $I$. But the project is always productive: $x = 1$. The moral hazard and outcome stages are as in the case of a risky choice. Assume that the contract aims at inducing good behavior. Letting

$$q_1 = p_{II}R\text{ and } q_0 = p_{II}[R - B/(p_{II} - p_{I})],$$

one will further assume that $x > 1/q_1$ and $X < q_1$. Assume that entrepreneur and investors contract on which version will be selected.

(a) Show that the *safe version* is chosen if and only if: $xX < 1$.

(b) Interpret this condition in terms of a “cost of bringing 1 unit of investment to completion.”
6. Consider an English auction under the independent private value paradigm (IPVP). Suppose both seller and bidders are risk neutral. Let $v_0$ be the expected utility of seller retaining the object, $F$ be the bidder value distribution with a density function $f$ defined on $[0; l]$, and $N$ be number of bidders.

(a) Derive the seller's expected utility.

(b) Suppose the seller wants to set a reserve price. Derive the optimal reserve price.

(c) Derive the optimal reserve price for $F$ being the standard uniform distribution on $[0, 1]$. Discuss the consequence of setting the reserve price higher or lower than the optimal reserve price.
7. Show that Revenue Equivalence Proposition (REP) does not hold under risk averse bidders. State clearly the assumptions you need for your derivation.