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Microeconomics Comprehensive Exam Questions

Procedural Instructions:

(1) Write your answers only on the paper we will provide.

(2) We will be distributing a numbered sign-in sheet in a moment. The number next to your signature will be your student number.

(3) Every sheet of paper you turn in to us must have your student number written at the top center of the sheet and circled.

(4) Every sheet of paper you turn in to us must have a page number written at the top-right corner of the sheet.

(5) When you have finished, or when time is up (whichever comes first), prepare a cover sheet for your exam. This cover sheet should not have a page number, but must have the following things on it:

(a) Your student number at the top-center, circled.

(b) The phrase "Microeconomics Comprehensive Exam August 2022".

(c) The sentence "My last page is page number X," where X is your total number of pages of answers.

Read all questions carefully before you begin. You should plan to spend approximately one minute per point. Good luck!

1. *60 pts. What's on the menu?* Let C the number of unique consumer types θ in the population where $\theta \in [\underline{\theta}, \overline{\theta}]$ and the distribution of θ has an increasing hazard. Let N be the number of unique menu options that can be offered where an option is an ordered pair of price and quality of output. Assume that demand for quality is increasing in θ and decreasing in price, the cost of providing quality is non-decreasing in quality, and the supplier has a prior belief $\beta(\theta)$ of the distribution of types in the population.

   For each statement, you will answer "Sometimes", "Always" or "Never" and explain your answer in detail. Your explanation should use formal mathematical arguments and/or well-reasoned discussion. Each question is worth 10 points.

   (a) If $N > C$, then the number of options offered in equilibrium is greater than C.

   (b) If $N < N' < C$, then every consumer is better off under N' than under N.

   (c) If $N < N' < C$, then every consumer is at least as well off under N' than under N.

   (d) If $N < N' < C$, then the producer is better off under N' than under N.

   (e) If $N < N' < C$, then total welfare is higher under N' than under N.

   (f) If $\beta(\theta) \succ \beta'(\theta)$ in the sense of first order stochastic dominance (i.e., if producers believe that consumer types tend to be higher under β than under β') then consumer welfare is higher *ex post* under β than under β'.

2. *60 pts. Real Estate Agency.* You are trying to buy a house. For simplicity, there are only two types of houses: high quality ($q = H$) and low quality ($q = L$). A high-quality house will give you a utility of 1 (net of price), whereas a low-quality house will give you a utility of -1 (net of price). If you don't buy a house at all, you get a utility of 0. Your prior $P(q = H) = \lambda$.

   In order to make an informed decision, you decide to hire a real estate agent. They invest effort e at a cost of $c(e)$ to learn about the quality of the house. (To make your life easier, assume $c', c'', c''' > 0$ and $c'(0) = c''(0) = 0$ and $\lim_{e \to \frac{1}{2}} c(e) = \infty$.) In return for this effort, the agent gets a signal $s \in \{G, B\}$ that is accurate with probability:

$$P(s = G|q = H) = P(s = B|q = L) = \frac{1}{2} + e \quad (1)$$

The agent can't lie to you about the signal that they get. Once you get the signal, you decide whether to buy or not. Note that if the agent exerts any effort, it is optimal to buy if $s = G$ and not buy if $s = B$. (You should be able to prove that to yourself.)

(a) *4 pts.* Suppose we are in the first-best world, i.e., effort is observable. Show that the total (yours+agent's) welfare maximizing effort must satisfy $c'(e) = 1$.

Now, and for the remainder of the problem, assume that we are in the second-best world and effort is unobservable to you. Consider contracts of the form (w_G, w_B) where a wage of w_i is paid if the the agent signals i.

(b) *6 pts.* Write down the agent's problem and show that the optimal effort satisfies $(w_G - w_B)(2\lambda - 1) = c'(e)$.

(c) *5 pts.* Is it always possible to induce positive effort from the agent? Explain carefully in 2-3 sentences why or why not.

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(d) *10 pts.* Suppose $\lambda > \frac{1}{2}$. Show that optimal effort satisfies

$$1 = c''(e)\left[e + \frac{1}{2(2\lambda - 1)}\right] + c'(e) \quad (2)$$

(e) *10 pts.* Draw a carefully labeled plot of $e^*(\lambda)$ under the first best and under the second best for $\lambda \in [0,1]$. Provide intuition for this plot in a few sentences.

(f) *10 pts.* Assume that signals are always informative ($P(s = G|q = H), P(s = B|q = L) >$ $\frac{1}{2}$) by they are asymmetric in their accuracy. If good signals were more informative than bad signals, would you induce more effort, less effort, or the same amount of effort than if bad signals were more informative than good signals? Explain.

(g) *15 pts.* What if the agent could lie to you about the signal that they got? How would that complicate the problem? Which of your answers would say the same, and which ones would change? How could you adapt the model to accommodate this? Would you need to add any assumptions? Explain this in 6-10 sentences/equations. You don't need to solve anything, but you do need to write intelligently.