Spring 2008

MICROECONOMIC THEORY COMPREHENSIVE EXAMINATION

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SECTION A (Answer all **9**. True or false or "it depends", taking the time to explain why in detail)

1. The theory of the consumer is a special case of the theory of the producer where inputs are called 'goods' and output is called 'utility.'

2. If marginal cost is a monotonically decreasing function in output, then the problem of profit maximization has a well defined solution under perfect completion, but not under monopoly.

3. If the price of the final product randomly fluctuates between \$1 and \$2 with equal probability, then the producer is better off with a stabilized pries that guarantees \$1.5 with certainty, because expected profit under stabilization exceeds expected profit in the absence of stabilization.

4. A risk-averse criminal will prefer a harsh but improbable punishment to a mild but more probable punishment if his expected income from the two is the same.

Use the following information to answer the next three (True/False) questions:
The college is considering renting space in the student union to one or two commercial textbook stores. The rent the college can charge per square foot of space depends on the profit (before rent) of the firms and hence on whether there is a monopoly or duopoly.

5. A monopoly is better for students but not for the university.

6. A duopoly is better for students but not for the university.

7. A Cournot's duopoly is better for students than a Stackleberg's duopoly.

Use the following information to answer the remaining 2 (True/False) questions in this section: Abe, Beth, and Carol each need a Pen and a Notebook for class. Pens and Notebooks come in three colors: Blue, Green, and Yellow. Abe, Beth, and Carol each get zero utility if they don't have at least one pen and notebook; 1 point of utility if they have at least one pen/notebook pair which does not match in color; and 2 points of utility if they have at least one pen/notebook pair which matches in color. *They get no additional utility for pens or notebooks beyond one each.*

Abe starts with the Blue Notebook and the Green Notebook. Beth starts with the Yellow Notebook and the Blue Pen. Carol starts with the remaining Green Pen and Yellow Pen. They trade. Consider the following claims about Walrasian equilibrium:

8. In any Walrasian equilibrium of this economy (with these initial allocations), all agents will end up with 1 notebook and 1 pen that match in color.

9. Suppose instead that Abe began with all three notebooks, and Beth with all three pens, and Carol with nothing. In any Walrasian equilibrium of this new economy, with these new initial allocations, all agents will end up with 1 notebook and 1 pen that match in color.

SECTION B (Answer **4** of 5. Short answers.)

10. Answer this question in two parts:
    (a) In general, if the cost function is linear in output, that is, $c(w,y) = yc(w,1)$, what can you say about the properties of the production function?

    (b) Specifically, given the cost function: $c(w_1,w_2,y) = y\left(w_1 + \sqrt{w_1 w_2} + w_2\right)$, derive the associated production function and verify your answer to part (a) above.

11. If Jenny chooses to become a teacher, her wealth (W) will be W = 10 with a probability = 1. If she choose to come an actress, her wealth will be W = 1000 with a probability = 0.01 and W = 1 with probability = 0.99. Being a teacher or an actress are her only two options.

    (a) Assuming that Jenny is risk neutral, which career should Jenny choose?

    (b) Merlin has a crystal ball that he can use to determine with probability = 1 what will happen if Jenny chooses to become an actress. What is the maximum about that Jenny would be willing to pay Merlin to find out what will happen if she chooses to become an actress?

12. Suppose the marginal costs for a monopolist are constant at $c > 0$ and the demand function is given by $D(p)=10/p$ if $p \leq 20$ and $D(p)= 0$ if $p > 20$. What is the profit-maximizing price? What is the output at the profit-maximizing price? What is the profit?

13. Suppose that a monopolist sells to two groups that have constant elasticity demand curves, with elasticity e_1 and e_2. The marginal cost of production is constant at $c > 0$. What price is charged to each group?

14. The residents of Brooklyn, USA, currently get rid of their household garbage by putting it in a garbage bin and placing the bin on the curb (street). The garbage is then collected by the Brooklyn Solid Waste Department. Brooklynites can put out as many bins of garbage as they like. There is currently no charge for the garbage collection. On average, a Brooklyn household currently puts out 3 garbage bins every week.

    Marty Markowitz, the Mayor of Brooklyn, is considering two alternative garbage policies.

    Policy 1: residents will be charged a *fixed weekly fee of $6* for garbage collection, and they are allowed to put out as many bins of garbage.

    Policy 2: a *pay-as-you-go* policy under which *each* garbage bin must have a 'trash tag' affixed to it, or it will not be collected. *Trash tags cost $2 each*. So long as each bin has this trash tag, a household can put out as many garbage bins per week as they like.

    (a) What effect will the introduction of each of these two policies will have on the total quantity of garbage collected in Brooklyn? Explain.

    (b) If Marty Markowitz wants to maximize the total 'garbage revenue' earned, which policy should he implement? Explain.

SECTION C (Answer 2 of 3. Longer answers.)

15. Given the payoff table for the game

		Player II		
		t_1	t_2	t_3
Player I	s_1	4, 6	0, 0	1, 12
	s_2	3, 18	1, 21	2, 12

    (a) Find all pure-strategy points of Nash equilibrium (if any).

    (b) Show that the following strategy pair is a mixed- strategy point of Nash equilibrium.

$$s = \left(\tfrac{1}{3}, \tfrac{2}{3}\right), \qquad t = \left(\tfrac{1}{2}, \tfrac{1}{2}, 0\right)$$

    (c) What are the players' expected payoffs in this case?

    (d) Is there any other mixed-strategy points of Nash equilibrium in this game? If any, what is it?

16. There are two goods in this economy: money (x) and raincoats (r), and two agents, A and B. Today (t=0), A and B know that the weather tomorrow (t=1) will either be rainy (state 1) or sunny (state 2.) As one would expect, raincoats are only useful if it is rainy (state 1). The two states are equally likely.

    With that in mind, these are the agents' (identical) utility functions:

    $$\text{In state 1, } u(x,r) = .5\ln(x) + .5\ln(r). \quad \text{In state 2, } u(x,r) = \ln(x).$$

    A has an initial endowment of (1,0)—that is, one unit of x. B has an initial endowment of (0,1)—that is, one raincoat. (As usual, please assume that agents can trade and enjoy fractional raincoats.)

    (a) Suppose A and B trade in x and r at t=0. Find the Walrasian equilibrium prices and allocations of x and r. Also find A and B's final utilities in each state.

    (b) This is a Walrasian equilibrium under uncertainty. Explain briefly how this equilibrium is similar to an Arrow-Debreu or Radner equilibrium.

    (c) Suppose, instead of trading in x and r at t=0, they trade in assets a_1 and a_2. As one would expect, a_i has a price q_i and, at t=1, pays off 1 unit of x if state i occurs, nothing if the other state occurs. Compared to part (a) of this problem, how will the final allocations of x and r in each state, and agents' final utility in each state, change? Explain.

17. A friend of yours sells novels. New novels are much more valuable to his customers than novels that have been out for a while. He is interested in maximizing total profits, and, for simplicity, we assume the cost of producing books is zero. Unlike his customers, your friend is unconcerned about the passage of time.

    Your friend has two types of customers. His customers wish to buy at most one book each. Customer Type A values new novels at $2 each, and are very impatient: every week after the novel comes out, if they don't buy it right away, their value of the novel drops by $1 (that is, after one week, they would only pay $1 for the novel; after 2 weeks, nothing.) Customer Type B values new novels at only $1, but they are much more patient: every week they wait, their value of a new novel drops by only $.50. (For simplicity, assume that there is one customer of type A and one of type B.)

    If your friend could do so, he would require that Type A's pay $2 each, and Type B's pay $1 each. But, of course, he cannot.

    (a) Draw indifference curves of the two customers in price (p) and weeks-until-purchase space (time t). (Drawing one indifference curve each is sufficient.) Denote with arrows the direction of increasing utility for customers. Denote with a labeled arrow the direction of increasing profits for your friend the bookseller.

(b) Suppose that your friend can sell books at only one price p_0. What price p_0 should he select? Explain.

(c) Suppose that your friend can sell his books at one price p_1, and then, at a time t*, drop the price to a lower level, p_2. Explain how this could increase his profits compared to those received in part (b).

(d) If Type A customers, instead of being *more* impatient, were *less* impatient than Type B customers. Could he still use this method to increase his profits compared to part (b)? Explain.

(e) Return to the original formulation, in which Type A's are more impatient. Find the optimal values for p_1, t*, and p_2. What are your friend's profits?

(f) At those optimal values, which customers, if any, are getting surplus? Explain.