# Massachusetts Institute of Technology
## Department of Economics

## 14.01 Principles of Microeconomics
## Final Exam
## Wednesday, December 19th, 2007

Last Name (Please print):    _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

First Name:    _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

MIT ID Number:    _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

**Instructions. Please read carefully.**

The exam has a total of 100 points. Answers should be as concise as possible. This is a closed book exam. You are not allowed to use notes, equation sheets, books or any other aids. You are not allowed to use calculators. You must write your answers in the space provided between questions. DO NOT attach additional sheets of paper. This exam consists of (18) sheets (14 pages + 4 blank pages for scratch work).

**0. Circle Your Section/Recitation (1 point):**

Please circle the section or recitation which you are attending below. The marked exam will be returned to you, in the section or recitation that you indicate. You will loose 1 point if you leave it unselected.

| | | | | |
|---|---|---|---|---|
| S01: MWF9 | (Peter Schnabl) | | R01: F10 | (Rongzhu Ke) |
| S02: MWF10 | (Chia-Hui Chen) | | R02: F11 | (Rongzhu Ke) |
| S03: MWF11 | (Chia-Hui Chen) | | R03: F2 | (Rongzhu Ke) |
| S04: MWF1 | (Monica Martinez-Bravo) | | R04: F12 | (Marco Migueis) |
| | | | R05: F1 | (Marco Migueis) |
| | | | R06: F2 | (Marco Migueis) |

**DO NOT WRITE IN THE AREA BELOW:**

Question 1 _ _/25        Question 2 _ _/5

Question 3 _ _/25        Question 4 _ _/25

Question 5 _ _/19        Question 0   _/1

**Total   _ _/100**

1.  **True/False Questions** (*TOTAL: 20  points*)**:**

*In this section, write whether each statement is True or False.  Please fully explain your answer, using a diagram if appropriate. No credit will be given for an answer without an explanation.*

(a) (*5 points*) After Professor Wheaton promises that no one would fail, students never study and turn in problem sets again. This is an example of adverse selection problem.

(b) (*5 points*) When a firm chooses among different projects, the one which has the highest present value is always the one with the highest yield rate.

(c) (*5 points*) If the government guarantees a binding price floor for agricultural output by purchasing any surplus, then the demand for farm labor will be more elastic.

(d) (5 points) Exploitation Mining Co. is the only employer in the remote town of Uranium City and pays its workers $10.00/hour. If the government forces the company to raise its wage by a small amount—say to $10.10/hour—then it will hire more workers.

(e) (*5 points*) A factory that pollutes a river has negative externalities on residents along the river. If the factory and residents can negotiate, an efficient result can be achieved only if the property right of the river is assigned to the residents.

**Short Question:**

2.  (*5 points*) A and B play rock, paper, scissors. Their payoffs are as follows (the first number is A's payoff and the second number is B's payoff):

|   |   | B | | |
|---|---|---|---|---|
|   |   | Rock | Paper | Scissors |
| A | Rock | 0,0 | -1,1 | 1,-1 |
|   | Paper | 1,-1 | 0,0 | -1,1 |
|   | Scissors | -1,1 | 1,-1 | 0,0 |

How many Nash equilibria are there in the game? Explain.

**Long Questions:**

3. *(25 points)* Suppose that Intel has a monopoly in the market for computer chips. In order to produce $X$ computer chips, it costs Intel $C(X) = 2X^2$.

   (a) *(2 points)* Find the marginal cost of producing a computer chip for Intel.

   (b) *(6 points)* The demand for computer chips is $X_D = 12 - 0.25P$. Find the level of output that maximizes Intel's profits. What price is Intel charging?

(c) (*4 points*) What level of output would maximize total surplus in the computer chip market?

*(d)* (*4 points*) Suppose the government knew the demand and production functions. Find a price regulation the government could impose that would induce Intel to maximize total surplus, i.e., produce the efficient quantity from part (c).

*(e)* (*6 points*) If the government subsidized Intel *s* for every unit of computer chips produced, what quantity would Intel choose? Find the choice of subsidy that maximizes total surplus, i.e., induces Intel to produce the efficient quantity from part (c).

*(f)* (*3 points*) Both the price regulation policy from part (d) and the subsidy policy from part (e) maximize total surplus. Is there any reason someone might prefer one policy over the other?

4. (*25 points*) Firm 1 and firm 2 are the only producers of spring water in the market. The market demand for spring water is given by $P = 70 - Q_1 - Q_2$. Firm 1 and firm 2 compete by choosing quantities $Q_1$ and $Q_2$ respectively. Each firm has a marginal cost of 10 and no fixed cost.

   (a) (*5 points*) Find out firm 1's and firm 2's reaction functions.

   *(b)* (*5 points*) Suppose the two firms choose quantities simultaneously. What are the equilibrium price, quantities, and profits of the two firms in this market?

*(c)* (*5 points*) Suppose only firm 1 has a chance to bribe the government and get the right to choose the quantity first, what is the maximum amount of money that firm 1 is willing to pay? If firm 1 gets to move first, what are the equilibrium quantities and profits of firm 1 and firm 2? [*Hint: if firm 1 does not bribe the government, the two firms will choose quantities simultaneously as in (b).*]

*(d)* (*5 points*) Now back to the situation that the two firms choose quantities simultaneously. Suppose the two firms decide to collude and share the profit equally. Assume that both firms value their reputation and will behave according to their agreement. What are the quantities they will choose for each firm? What is the profit of each firm?

*(e)* (*5 points*) Suppose the two firms decide to collude and share the profit equally, but both firms do not care about their reputation and might try to take advantage of the other. Foreseeing this, they make a legally enforceable contract saying that if a firm does not produce the quantity agreed, it has to pay some penalty to the other firm. What is the minimum amount of penalty that ensures each firm producing the right quantity agreed in part (d).

5. (*19 points*) The country of Economia has two industries. In the Clothing industry, the marginal product of labor is always 1. In the Steel industry, the marginal product of labor is $12L_S^{-1/2} - 2$, where $L_S$ is the total number of workers employed in the Steel sector. The total supply of labor in Economia is fixed at $L_C + L_S = 25$, and the output price is 1 for both Clothing and Steel.

   (a) (*7 points*) Suppose that the labor market is competitive. How many workers will be employed in the Clothing sector, and how many in the Steel sector? What wage rate will workers in each sector receive? *[Hint: Workers can switch sectors at will. What does that imply about wages in the two sectors?]*

*(b)* (8 points) Suppose that workers in the Steel sector form a union, which acts as a monopolist in supplying labor to the Steel industry. The union chooses a level of employment that maximizes the total wages of its members (i.e., it maximizes $w_S L_S$). How many workers will the union allow to be employed in the Steel sector? How many will now be employed in the Clothing sector? What wage rate will workers in each sector receive? [*You should assume that the prices of Clothing and Steel remain 1.]*

*(c)* (4 points) If workers in Clothing had unionized in order to increase their wage rate instead of workers in Steel, what would have happened to employment and wages in each sector? Explain why. [*No calculations necessary; just describe the outcome qualitatively.*]

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14.01SC Principles of Microeconomics
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