ECO 300 – MICROECONOMIC THEORY
Fall Term 2005
FINAL EXAMINATION ANSWER KEY

This was a very good performance and a great improvement on the midterm; congratulations to all. The distribution was as follows:

Range	Number
100	1
90-99	15
80-89	23
70-79	19
60-69	12
< 60	7

The mean was 77.8; the median 80. The distribution by question was as follows:

Question number	1	2	3	4	5	6	7
Average	7.7	14	10	12	13	11	10
Median	8	15	11	13	15	12	11
Max	10	16	15	15	16	16	16
Min	3	2	0	7	1	0	0

As a general principle of grading in Questions 2, 3, 4, and 5, note that numerical errors were treated quite generously, but conceptual errors were severely penalized.

QUESTION 1: (10 points, 1 each)

1. b (Prob. Set 2 Q. 1 item (2))
2. c (P-R p. 160, Handout Oct. 6 p. 4)
3. b (P-R pp. 70, 201, 207-8)
4. d (P-R pp. 357-8, Prob. Set 5 Q. 1 item (2))
5. b (Handout Dec. 6 p. 4)
6. c (P-R pp. 359-60, Handout Nov. 10 p. 3)
7. d (P-R p. 329)
8. a (P-R pp. 476-7, Handout Nov. 22 p. 1) (Not same matrix as in sample exam!)
9. c (P-R p. 621, Handout Dec. 1 p. 4)
10. d (P-R p. 642, Handout Jan. 10 p. 1)

QUESTION 2: (15 points)

(a) Here we use the Cobb-Douglas result that to maximize utility $U = X\,Y$ subject to the budget constraint $P_X X + P_Y Y = I$, you should choose $X = I/(2\,P_X)$ and $Y = I / (2\,P_Y)$. (2 points)

With $I = 20$, $P_X = 2$, and $P_Y = 1$, the optimal choices are $X = ½\ 20 / 2 = 5$, $Y = ½\ 20 / 1 = 10$. The resulting utility level is 50. (3 points)

(b) With I = 20, $P_X = 1$, and $P_Y = 1$, the optimal choices are X = ½ 20 / 1 = 10, Y = ½ 20 / 1 = 10. The resulting utility level is 100. (3 points)

(c) To consumer X = 5 and Y = 10, you now need 1*5 + 1 * 10 = 15 dollars per week. (2 points)

Suppose you need Z dollars each week to achieve utility 50. You will optimally spend Z/2 on each good, so 1 *X = Z/2, 1 * Y = Z/2, yielding $50 = X * Y = Z^2 / 4$. So $Z^2 = 200$, or $Z = 10\sqrt{2} = 14$ approximately. (4 points)

The latter is smaller, because substitution toward the good whose relative price has fallen enables you to achieve the same utility with a lower expenditure. (1 point)

QUESTION 3: (15 points)

Most people got this basically right, but lost a few points for loose or incomplete statements.

In the short run, the total avoidable cost is $TAC = 4 + Q^2$. So the average avoidable cost is AAC = 4/Q + Q. Marginal cost is MC = 2 Q.

AAC is minimized where $– 4 / Q^2 + 1 = 0$, or $Q^2 = 4$ or Q = 2 (alternatively, where AAC = MC so 4/Q + Q = 2 Q etc.) And the minimized AAC is 4/2 + 2 = 4.

Therefore the short run supply curve is given by P = MC or P = 2 Q or Q = ½ P when P > 4, and Q = 0 when P < 4. At P = 4, the firm is indifferent between producing Q = 2 and not producing (Q = 0). (6 points)

In the long run, the total (all of it avoidable) cost is $TC = 9 + Q^2$. So the average (avoidable) cost is AC = 9/Q + Q. Marginal cost is MC = 2 Q.

AC is minimized where $– 9 / Q^2 + 1 = 0$, or $Q^2 = 9$ or Q = 3 (alternatively, where AC = MC so 9/Q + Q = 2 Q etc.) And the minimized AC is 9/3 + 3 = 6.

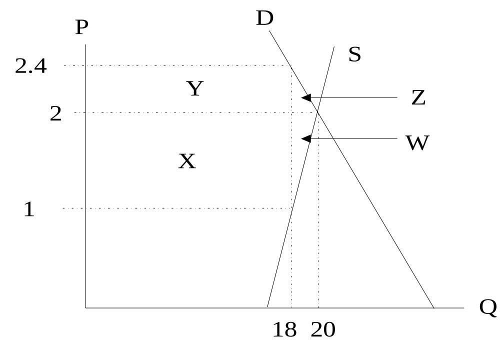
Therefore the firm's long run supply curve is given by P = MC or P = 2 Q or Q = ½ P when P > 6, and Q = 0 when P < 6. At P = 6, the firm is indifferent between producing Q = 3 and not producing (Q = 0). (6 points)

With many firms like this, the long run industry supply curve will be a horizontal line at P = 6 (or the set of points P = 6 and Q = 0, 3, 6, 9, 12, … if you want to be pedantic.) (3 points)

QUESTION 4: (15 points)

(See Pindyck-Rubinfeld pp. 304-5. Moral – it pays to read the book.)

(a) (5 points including marking the areas correctly) Figure:



(b) (2 points) Equilibrium: $30 - 5P = 16 + 2P$ gives $P = (30-16)/(2+5) = 2$, $Q = 20$.
(c) (2 points) Ceiling: With $P = 1$, $Q^S = 18$. When consumers consume 18, they are willing to pay $P = (30 - 18)/5 = 2.4$
(d) (2 points each for CS, PS, and DWL) If consumers paid 2.4, then as compared to the equilibrium they would lose consumer surplus areas Y and Z. But they pay only 1 for the restricted quantity, so they also gain Y and X. The total gain of consumer surplus is X – Z $= (2-1)*18 - \frac{1}{2}(2.4-2)(20-18) = 17.6$. The loss of producer surplus is X + W $= (2-1)*18 + \frac{1}{2}(2-1)(20-18) = 19$. The deadweight loss is therefore W + Z = 1 + 0.4 = 1.4. (This is trillions of cubic feet times dollars per thousand cubic feet, therefore billions of dollars.)

Some of you thought that the change in consumer surplus was the area to the left of the demand curve between prices 2 and 1, that is, $\frac{1}{2}(2-1)*(20+25) = 22.5$. That is not correct, because at the price of 1 consumers are not able to buy as much as they would like to, namely 25. They can only buy 18.

QUESTION 5: (15 points)

The profits of B.B. Lean, expressed as a function of the prices of both firms, are

$$\Pi_1 = P_1 Q_1 - 40 Q_1 = (P_1 - 40) Q_1 = (P_1 - 40) (780 - 18 P_1 + 16 P_2)$$

(1 point for this expression) In Bertrand competition, firm 1 chooses P_1 to maximize Π_1, taking the price P_2 of firm 2 as given. The condition for this is most easily found by using the product rule for differentiation:

$$\partial \Pi_1/\partial P_1 = 1 * (780 - 18 P_1 + 16 P_2) + (P_1 - 40) * (- 18) = 1500 - 36 P_1 + 16 P_2 = 0$$

Solving for P_1 in terms of P_2 gives firm 1's best response function

$$P_1 = (16/36)\ P_2 + (1500/36) = 0.4444\ P_2 + 41.6667$$

(4 points for this derivation). Similarly, for firm 2,

$$\Pi_2 = P_2 Q_2 - 20 Q_2 = (P_2 - 20) Q_2 = (P_2 - 20) (780 + 16 P_1 - 18 P_2) \quad (1 \text{ point})$$

$$\partial \Pi_2/\partial P_2 = 1 * (780 + 16 P_1 - 18 P_2) + (P_2 - 20) * (- 18) = 1140 + 16 P_1 - 36 P_2 = 0$$

$$P_2 = (16/36) P_1 + (1140/36) = 0.4444 P_1 + 31.6667 \quad (4 \text{ points})$$

To find the Bertrand equilibrium we solve the best response functions for the prices:

$$P_1 = 0.4444 (0.4444 P_1 + 31.6667) + 41.6667 = 0.1975 P_1 + 55.7408 \quad (2 \text{ points})$$

Therefore $P_1 = 55.7408 / (1 - 0.1975) = 69.4589$
And then $P_2 = 0.4444 * 69.4589 + 31.6667 = 62.5370$
Then a little more number-crunching gives $Q_1 = 530.3318$, $Q_2 = 765.6764$,
$\Pi_1 = 15622.9915$, $\Pi_2 = 32569.577$ (3 points for this lot)

We will accept answers within reasonable range of these, approximately + or – 1 for prices, + or – 10 for quantities, and + or – 300 for profits, so long as the method of derivation is correct.

Some of you hastily assumed that $P_1 = P_2$. A moment's thought would have told you that since the two firms have unequal costs and their products are not *perfect* substitutes, they would charge unequal prices.

QUESTION 6:

Moral hazard in insurance arises when the insured party can take an action that lowers the probability of the event (loss or damage) being insured against, but this action cannot be accurately monitored by an insurance company (or cannot be proved to a third party such as a court or an arbitrator that would enforce the contract in the event of a dispute). Then the existence of insurance reduces the insured's incentive to take such actions. This problem is known as moral hazard. (P-R pp. 624-5, Lecture Handout of Nov. 29, p. 2).

The economic efficiency cost of moral hazard can be thought of as an externality: the insured individual does not bear the full social cost of his lack of care or his failure to take other risk-reducing actions. (P-R p. 626)

If competitive insurance market offers statistically fair insurance and people can choose level of coverage, they will choose full insurance and then not exert any effort to reduce risk. Solutions have evolved in the insurance industry to mitigate moral hazard include deductibles, limited coverage or percentage coinsurance. All of these entail incomplete insurance, to create *some* incentive for the insured to take the appropriate action. (Of course the insured would like to have fuller coverage, and may try to circumvent the limitations by purchasing several policies from different companies. The companies are aware of this and prevent such evasion by imposing exclusivity requirements in their policies, whereby each makes its payment secondary, to kick in only after all the others have paid up.) (Lecture Handout of Nov. 29, p. 2)

The incompleteness of insurance is another way of looking at the social cost of the information asymmetry inherent in moral hazard. Without it, a large population could essentially eliminate all individual risks by pooling. But because of moral hazard, the pooling must be incomplete: the constrained optimal insurance balances two objectives: insuring the risk-averse consumer, and creating incentive for consumer to make effort to reduce the level of the risk. (Lecture handout of Nov. 29, p. 2).

Your credit on this problem will depend on how well you cover the various points and the organization of your answer. This is Martin's judgment call.

Several people confused moral hazard and adverse selection, and talked of screening mechanisms etc. That is not relevant in the context of moral hazard. Also some people were not clear about the social cost of moral hazard. The problem is not that insurance premiums would be higher. Rather, it is that efficient levels of precautionary or risk-reducing expenditures are not undertaken.

QUESTION 7:

Use either the Lecture Overheads handout of January 10, pp. 2-3, or Pindyck-Rubinfeld pp. 660-661. For full credit or close, you must give the full geometric (overhead handout) or arithmetic (P-R) analysis of how the efficient resolution is feasible under both assignments of property rights. The last part – that who is initially assigned the property rights does not affect efficiency – is key.

A vague general statement such as "rational bargainers with no negotiation costs will never stop short of an efficient outcome" will get only 5 or 6 points. Even a statement like "Suppose A emits pollution that affects B. If B has the right to clean air, A can compensate B to induce him to accept some pollution; if A has the right to pollute, B can compensate A to induce him to reduce pollution" gets only 8 or 9 points; it does not prove efficiency. So you have to take the next steps in the argument – as long as A's marginal gain from polluting a little more exceeds B's marginal loss from this extra pollution … , preferably accompanied by a figure or a numerical example.

If you mention that this is a statement of the Coase Theorem, you get 1 bonus point.

Some people drew the standard exchange Edgeworth box. This does not necessarily involve any externalities. You can use it to analyze externalities, but it needs a lot of careful explanation of how indifference curves can be modified to capture these.

Some people examined a simpler context where the only choice is whether to pollute. That is not adequate; you need to discuss whether the efficient level of pollution is achieved.

Again these conceptual errors and inadequacies were graded quite severely.