Solution for June, Micro
Part A
Each of the following questions is worth 5 marks.

1. Suppose demand for a monopolist's product is given by $P = 300 - 6Q$ while the monopolist's marginal cost is given by $MC = 3Q$. The profit-maximizing price for this monopolist is

   a) 100
   b) 180
   c) 60
   d) 150

Ans: B

2. Which of the following statements regarding a monopoly's first-degree price discrimination is correct?

   a) With first-degree price discrimination, consumer surplus is small, yet still greater than zero.
   b) With first-degree price discrimination, producer surplus is lower than with uniform pricing.
   c) With first-degree price discrimination, deadweight loss is large.
   d) With first-degree price discrimination, total surplus is greater than when the monopoly charges a uniform price.

Ans: D

3. In a duopoly, a residual demand curve

   a) Is the same as a market demand curve.
   b) Represents the demand curve that one firm faces given the output choice of the other firm.
   c) Is the same as a marginal revenue curve when determining output in the Cournot model.
   d) Is steeper than the market demand curve.

Ans: B

GAME X

		Coke	
		Ad	**No Ad**
Pepsi	**Ad**	2, 4	4, 2
	No Ad	0.4, 8	3, 6

4. Game X shows the payoff matrix in terms of profit (in millions of dollars) for two possible strategies: advertise or do not advertise. If they legally could, why might the two companies agree to not advertise?

   a) Because advertising is ineffective.

b) Because advertising is too expensive.
c) Because not advertising would lower the costs and therefore increase the profits to each firm.
d) Because not advertising would lower profits.

Ans: C

5. In a first-price sealed-bid auction when bidders have private values, the best bidding strategy is to bid

a) Your value for the object since this gives you the highest probability of winning the auction.
b) The value of the second highest bidder since this gives you the highest probability of winning while maximizing your surplus.
c) Something less than your maximum willingness to pay, although how much less depends on a variety of factors.
d) Continuing bidding until you win if you like the object.

Ans: C

6. A commonality between externalities and public goods is that

a) In each case, the markets are not likely to allocate resources efficiently, even though they might otherwise be competitive.
b) In each case, government agencies create the problems.
c) Both markets are examples of efficient, competitive markets.
d) Both markets involve the invisible hand (as discussed by Adam Smith).

Ans: A

<u>Part B</u>
Answer up to six out of seven questions. Each question is worth 10 marks.

1. Market demand is $P=64-(Q/7)$. A multiplant monopolist operates three plants, with marginal cost functions:

$$MC_1(Q_1) = 4Q_1$$
$$MC_2(Q_2) = 2 + 2Q_2$$
$$MC_3(Q_3) = 6 + Q_3$$

   i. Find the monopolist's profit-maximizing price and output at each plant
   ii. How would your answer to part (a) change if $MC_2(Q_2)=4$?

Solution:

a) Equating the marginal costs at MC_T, we have $Q = Q_1 + Q_2 + Q_3 = 0.25MC_T + 0.5MC_T - 1 + MC_T - 6$, which can be rearranged as $MC_T = (4/7)Q + 4$. Setting $MR = MC$ yields

b. $64 - (2/7)*Q = (4/7)*Q + 4$

or $Q = 70$ and $P = 54$. At this output level, $MC_T = 44$, implying that $Q_1 = 11$, $Q_2 = 21$, and $Q_3 = 38$.
b) In this case, using plant 3 is inefficient because its marginal cost is *always* higher than that of plant 2. Hence, the firm will use only plants 1 and 2. Moreover,

the firm will not use plant 1 once its marginal cost rises to $MC_2 = 4$, so we can immediately see that it will only produce $4Q_1 = 4$ or $Q_1 = 1$ unit at plant 1. Its total production can be found by setting $MR = MC_2$, yielding

c. $64 – (2/7)*Q = 4$

or $Q = 210$ and $P = 34$. So it produces $Q_1 = 1$ unit in plant 1 and $Q_2 = 209$ units in plant 2, while producing no units in plant 3 (i.e. $Q_3 = 0$).

2. Consider a market with 100 identical individuals, each with the demand schedule for electricity of $P = 10 - Q$. They are served by an electric utility which operates with a fixed cost 1200, and a constant marginal cost of 2. A regulator would like to introduce a two-part tariff, where *S* is a fixed subscription charge and *m* is a usage charge per unit of electricity consumed. How should the regulator set *S* and *m* to maximize the sum of consumer and producer surplus while allowing the firm to earn exactly zero economic profit?

Solution: To maximize the sum of consumer and producer surplus, the regulator must set the usage charge $m = 2$; this will induce consumers to buy units of electricity as long as their willingness to pay is at least as high as the marginal cost of providing electricity service. This means that each consumer will buy 8 units of electricity. There will be zero deadweight loss in the market.

If there were no subscription charge, each consumer would realize a consumer surplus of 0.5*(10 – 2)*8 = 32. This means that each consumer will be willing to buy electricity as long as the subscription charge is less than 32. With 100 consumers, the electric utility can then charge each customer a subscription fee of $12 to cover its fixed costs of $1200, leaving each consumer with a consumer surplus of 32 – 12 = 20. So the total revenue for the firm will be the sum of the revenue from the subscription charge (1200) and the revenue from the usage charge 100*8*2 = 200. Total revenue will just cover total cost, and the firm will earn zero economic profit.

3. Good 1 is produced by firm 1 and good 2 by firm 2. Both goods are perfect complements. Marginal costs for both products are constant and equal c=4. Both firms set simultaneously prices $P_1$and P_2. Then the consumers buy equal amounts of both goods. The amount they buy is $14-P_1-P_2$. Calculate the Nash equilibrium for the model and compare it situation where both firms form a cartel. What is better for the consumer?

Solution: Firm 1 maximizes $(14-P_1-P_2)(P_1-4)$ and so $0=18-2P_1-P_2$. Using that $P_1=P_2$ in the symmetric equilibrium, $18=2P_1$; $P_1=P_2=6$. Demand is 2. Each firm makes the profit 2*2=4. A monopoly would maximize $(14-P_1-P_2)(P_1-4)+(14-P_1-P_2)(P_2-4)$ which give the first order condition $0=22-2P_1-2P_2$ for both prices. If we assume that the monopoly charges identical prices we obtain $P_1=P_2=5.5$. The quantity demanded would be 3. The monopolist would earn 3*1.5=4.5 on each item which is more than when the firm compete. Consumers are better off under monopoly because they get more at a lower price.

4. A homogeneous products duopoly faces a market demand function given by $P = 500 - 10Q$. Both firms have a constant marginal cost of $MC = 200$.

   i. What would the equilibrium price in this market be if it were perfectly competitive?

Answer:

If this market were perfectly competitive, then equilibrium would occur at the point where $P = MC$. Assuming two firms, this will occur where

$$500 - 10Q_1 - 10Q_2 = 200.$$

Since in equilibrium $Q_1 = Q_2$,

$$500 - 20Q_1 = 200$$
$$300 = 20Q_1$$
$$Q_1 = 15$$

Since both firms will produce the same level of output in equilibrium, both firms will produce 15 units. At this level of output, price will be

$$P = 500 - 10(15) - 10(15) = 200$$

ii. What would the equilibrium price in this market be if the two firms colluded to set the monopoly price?

Answer:

If the firms colluded to set the monopoly price, then

$$500 - 20Q = 200$$
$$300 = 20Q$$
$$Q = 15$$
$$P = 500 - 10Q$$
$$P = 350$$

iii. What is the Bertrand equilibrium price in this market?

Answer

If the firms acted as Bertrand oligopolists, the equilibrium would coincide with the perfectly competitive equilibrium of $P = 200$ and $Q = 30$, with each firm producing one-half of the market output of 15 units each. If either firm tried to raise its price, it would lose its entire market share.

5. Consider the following game, where $x > 0$:

		Firm 2	
		High Price	**Low Price**
Firm 1	**High Price**	140, 140	20, 160
	Low Price	$90 + x$, $90 - x$	50, 50

i. For what values of *x* do both firms have a dominant strategy? Find the Nash equilibrium in this case. For what values of *x* does only one firm have a dominant strategy?

Solution:

i) For $x > 50$, both firms have a (strictly) dominant strategy.

ii) The unique NE is (*Low*, *Low*).

ii) For 40 < x <= 50 only Firm 2 has a (strictly) dominant strategy. (The unique NE in this case is still (*Low*, *Low*)). For x < 40, there are zero (strictly) dominant strategies. (No NE in pure strategies exists.)

6. You have a utility function given by $U = 10 \ln I$, where I represents the monetary payoff from an investment. You are considering making an investment which, if it pays off, will give you a payoff of $100,000, but if fails, it will give you a payoff of $20,000. Each outcome is equally likely. What is the risk premium for this lottery?

Solution: The expected payoff of this lottery is given by 0.5(100,000) + 0.5(20,000) = 60,000.

The risk premium *RP* of for this lottery is the solution to the equation

0.5[10*ln(100,000)] + 0.5[10*ln(20,000)] = 10*ln(60,000 – *RP*)

which is equivalent to

107.08 = 10*ln(60,000 – *RP*)

Solving this equation tells us that *RP* = $15,278.64.

7. Ted and Joe each consume peaches, x, and plums, y. The consumers have identical utility functions, with $MRS^{\text{Joe}}_{x,y} = 10y_J / x_J$. $MRS^{\text{Ted}}_{x,y} = 10y_T / x_T$. Together, they have 10 peaches and 10 plums. Verify whether each of the following allocations is on the contract curve:
   1. Ted: 8 plums and 9 peaches; Jack: 2 plums and 1 peach.
   2. Ted: 1 plum and 1 peach; Jack: 9 plums and 9 peaches.
   3. Ted: 4 plums and 3 peaches; Jack: 6 plums and 7 peaches.
   4. Ted: 8 plums and 2 peaches; Jack: 2 plums and 8 peaches.

Solution: To be on the contract curve, an allocation must yield identical marginal rates of substitution for each consumer.

a) MRS^{Ted} = 80/9 < MRS^{Joe} = 20/1. Not on the contract curve.
b) MRS^{Ted} = 10/1 = MRS^{Joe} = 90/9. On the contract curve.
c) MRS^{Ted} = 40/3 > MRS^{Joe} = 60/7. Not on the contract curve.
d) MRS^{Ted} = 80/2 > MRS^{Joe} = 20/8. Not on the contract curve.