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14.03
Applied Intermediate Microeconomics
Final Examination
Answer Key

Part I: Short Answer Questions

1. True. Hicksian demand reflects just the negative substitution effect while Marshallian demand reflects both the substitution and income effects, both of which are negative. Marshallian demand will therefore be more negatively sloped (flatter).

2. False. As the interest rate rises a saver will want to substitute away from first period consumption. But the saver is also richer (positive income effect) if savings is a normal good. We can't say whether current consumption will go up or down, and therefore we can't say what happens to savings either.

3. True. That's basically the definition of risk aversion.

4. True. Let $C = C(q, w, v) = wL + vK$ be the cost function. Increase q by a factor λ. This yields
$$C(\lambda q, w, v) = w\lambda L + v\lambda K$$
because constant returns to scale implies that you need to increase each factor input by λ to increase q by λ. This yields
$$C(\lambda q, w, v) = \lambda(wL + vK) = \lambda C(q, w, v)$$
which means C is linear in q; if C is linear then marginal and average cost are constant.

5. False. This is only true if all consumers are the same. If there are two types of consumers then the monopolist will want to set the entry fee according to the consumer surplus of the smaller consumer but raise the per-unit price above marginal cost to extract more surplus from the larger consumers.

6. False. If both average and marginal costs are U-shaped, then marginal cost cuts average cost from below at the minimum. Thus, average cost will be both decreasing and increasing over some range where marginal cost is increasing.

7. False. The adverse selection problem is worst if individuals buy insurance themselves. Once insurance is sold to groups formed for other reasons (like employment) the adverse selection problem will be less severe, and it will be less severe the larger the groups.

8. False. The monopolist will also reduce output, therefore profits will decrease by less than \$10 million.

Part II

9. American Widgetmakers

(a) In this case demand is just $P = 140 - Q$ so that

$$\pi_1 = (140 - q_1)q_1 - 20q_1$$

The first order condition is

$$\frac{\partial \pi_1}{\partial q_1} = 140 - q_1 - q_1 - 20 = 0$$

which yields

$$120 = 2q_1 \Longleftrightarrow q_1 = 60$$

$$P = 140 - 60 = 80$$

$$\pi_1 = (P - MC)q_1 = (80 - 20)60 = 60^2 = 3600$$

(b) Now

$$\pi_1 = (140 + A - q_1)q_1 - 20q_1 - A^2$$

The first order conditions are

$$\frac{\partial \pi_1}{\partial q_1} = 140 + A - 2q_1 - 20 = 0$$

$$\frac{\partial \pi_1}{\partial A} = q_1 - 2A = 0$$

Substitute the first order condition for A into the first order condition for q_1 to get

$$120 + \frac{q_1}{2} - 2q_1 = 0$$

or

$$q_1 = 80$$
$$A = 40$$
$$P = 140 + 40 - 80 = 100$$
$$\pi_1 = (100 - 20)80 - 40^2 = 6400 - 1600 = 4800$$

(c) Profits for American Widgetmakers are

$$\pi_1 = (140 + A - q_1 - q_2)q_1 - 20q_1 - A^2$$

which yields

$$\frac{\partial \pi_1}{\partial q_1} = 140 + A - 2q_1 - q_2 - 20 = 0$$

The first order condition for A is still the same and substituting yields

$$120 + \frac{q_1}{2} = 2q_1 + q_2$$

which gives the reaction function

$$240 = 3q_1 + 2q_2$$

Profits for TWIX are

$$\pi_2 = (140 + A - q_1 - q_2)q_2 - 50q_1$$

The first order condition is

$$\frac{\partial \pi_2}{\partial q_2} = 140 + A - 2q_2 - q_1 - 50 = 0$$

Substituting in for A yields

$$90 + \frac{q_1}{2} = 2q_2 + q_1$$
$$180 = 4q_2 + q_1$$

Subtract this from twice the reaction function for American Widgetmakers to get

$$480 - 180 = 6q_1 - q_1 + 4q_2 - 4q_2$$
$$300 = 5q_1$$
$$q_1 = 60$$

Use either reaction function to find

$$q_2 = 30$$

and remember that

$$A = \frac{q_1}{2}$$

This gives

$$P = 140 + A - q_1 - q_2 = 140 + 30 - 60 - 30 = 80$$
$$\pi_1 = (80 - 20)60 - 30^2 = 3600 - 900 = 2700$$
$$\pi_2 = (80 - 50)30 = 900$$

(d) American Widgetmakers advertises less when there is competition because advertising shifts out market demand but American Widgetmaker can only capture part of the additional demand (part goes to the competitor). On the other hand, American Widgetmakers still pays for all the advertising. Marginal benefit of advertising has decreased while marginal cost has stayed constant, therefore American Widgetmakers does less advertising.

(e) You have calculated all the entries necessary to construct a payoff matrix for this game except the case where American Widgetmakers does no advertising and TWIX enters (if TWIX stays out it will make zero profits). Also notice that the addition of fixed costs only changes the level of profits TWIX earns but not the quantities or prices calculated above. For the remaining Cournot case the reaction functions are

$$120 = 2q_1 + q_2$$

and

$$90 = q_1 + 2q_2$$

They yield

$$q_1 = 50$$

$$q_2 = 20$$

$$P = 140 - 50 - 20 = 70$$

$$\pi_1 = (70 - 20)50 = 2500$$

$$\pi_2 = (70 - 50)20 = 400 - 800 = -400$$

Profits for TWIX when it enters and American Widgetmakers advertises were 900 from (c) minus the fixed costs of 800 leaving 100. The payoff matrix is

		TWIX	
		enter	stay out
American Widgetmakers	advertise	2700,100	4800,0
	don't advertise	2500,-400	3600,0

Advertising is a dominant strategy for American Widgetmakers. When American Widgetmakers advertises TWIX will want to enter because it can make positive profits.

Part III:

10. The subsidy lowers the price of day care P_D to $P_D - s$. To parents this is just a regular price change. If they put their child in day care for D_A days originally and consumed at point A they will move to point B now and put the child in day care for D_B days. This costs the government $s \cdot D_A$. If they give this amount to parents in a lump sum subsidy the budget constraint moves right from its original position so that it also goes through point B but remains parallel to the original constraint. I.e. parents will just be able to buy the bundle at B with the lump sum subsidy as well. But this budget constraint has to intersect the indifference curve through B so parents can reach a

higher utility level at point C. Therefore parents prefer the lump sum subsidy. Point C necessarily involves less day care than point B. Therefore day care providers prefer the subsidy because it lets them sell more day care.

11. Assume that there are two levels of quality, high and low. They can be made at constant marginal and average cost c_h and c_l, repectively. Assume competitive firms offer both quality levels in the market and there are some consumers willing to buy the low quality good at price c_l and others who are willing to buy the high quality good at price c_h. If firms offered the two qualities at their marginal cost they would make no profit. A firm could make a profit by offering the low quality good at price c_h. But consumers will realize that firms have an incentive to do so, thus they will not buy any goods at a price above c_l (at which price they just expect the lowest quality). Now assume that manufacturers can offer warranties. A warranty guarantees replacement of the product if it breaks within a year. For simplicity, assume that high quality products never break while low quality product break with probability p. Thus, the costs of making the goods including the replacement costs for defectives are $(1+p)c_l$ for the low quality and c_h for the high quality, where no replacements are ever needed. If $(1+p)c_l > c_h$ only high quality producers have an incentive to offer warranties and charge a price of c_h. Low quality producers would have to offer warranties too if they wanted to conceal their low quality. But they can't get a price above c_h, so this is not worthwhile. Warranties act as a signal. The condition $(1+p)c_l > c_h$ needed for a

separating equilibrium in the signalling case just says that the costs of sending the signal are so much higher for the low quality producers than for the high quality producers that separation is possible. If this condition is satisfied and the government required all firms to offer warranties the low quality producers would leave the market. This is not a good idea because there are consumers who would like to buy the low quality product at the cheaper price. These consumers will be worse off when warranties are required.

12. This is called a hold-up problem. The buyer makes an investment in an asset that is specific to the contract, e.g. instructing the supplier about the specifications needed for the part. Once the investment is made, this creates some rents. The suppliers can "hold-up" the buyer for these rents. The solution to this by offering a price premium is similar to the idea of price premia for high quality products which you analyzed in problem set 6, question 5. Suppose buyers have to make arrangement with suppliers one year in advance. The rents generated from the arrangement during year are R. Suppose the market for the part is otherwise competitive, i.e. other firms are willing to supply it at a price P. For simplicity assume the buyer only buys one part during the year. The maximum price the supplier can therefore charge is $P + R$. If it charged anything higher, the buyer would just shut down operations for a year. Suppose the buyer offers a price $P' > P$. If the supplier sells at this price the buyer will continue the relationship. The present value of profits for the supplier is therefore

$$PV(honest) = \sum_{i=0}^{\infty} \frac{P' - P}{(1+r)^i} = \frac{1+r}{r}(P' - P)$$

If the supplier cheats and asks for $P + R$ the buyer will pay the higher price for a year but discontinue the contract afterwards. The supplier is now scarred, and no one else will want to purchase from this firm any more. It therefore makes a profit of R once. Thus

$$PV(cheat) = R$$

In order to make it in the supplier's interest to behave honestly we have to have

$$PV(honest) > PV(cheat)$$

$$\frac{1+r}{r}(P' - P) > R$$

$$P' - P > \frac{r}{1+r}R$$

$P' - P$ is the value of the price premium. It has to be larger than the implied interest from cheating and getting the rent R once. The buyer has an interest to pay this premium and have an honest supplier rather than having to find a new supplier every year since this involves new spending on instructing the supplier about the correct specification for the part.