EC 370
Intermediate Microeconomics II
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Suggested Solutions to Assignment 2 (Optional)

Total Marks: 50

Part A True/ False/ Uncertain Questions [20 marks]

Explain why the following statement is True, False, or Uncertain according to economic principles. Use diagrams and / or numerical examples where appropriate. Unsupported answers will receive no marks. It is the explanation that is important. Each question is worth 10 marks.

A1.

Imposing a quantity tax on a monopolist, which faces a linear demand curve and has constant marginal costs, will cause the market price to increase by the amount of the tax. [Diagrams Required]

False

Imposing a quantity tax on a monopolist, which faces a linear demand curve and has constant marginal costs, will cause the market price to increase by half the amount of the tax.

See Figure 24.3 in page 429 and the example discussed in pages 427-428 of Varian's textbook (7^{th} ed.).

A2.

Entry of more firms in a monopolistically competitive market leads to a decrease in market price. [Diagrams Required]

Uncertain

Entry of more firms in a monopolistically competitive market can lead to either a decrease or an increase in market price depending on the actual magnitudes of the shifts in the market demand curve faced by a monopolistically competitive firm.

See pages 509-512 and Figure 13.13, Figure 13.14 and Figure 13.16 of Besanko's textbook (2^{nd} ed.). You will find these pages in the handout I distributed in class.

Part B Problem Solving Questions [30 marks]

Read each part of the question very carefully. Show all the steps of your calculations to get full marks.

B1. [15 Marks]

You are the only European firm selling vacation trips to the North Pole. You know only three customers are in the market. You offer two services, round-trip airfare and a stay at the Polar Bear Hotel. It costs you 300 euros to host a traveler at the Polar Bear and 300 euros for the airfare. If you do not bundle the services, a customer might buy your airfare but not stay at the hotel. A customer could also travel to the North Pole in some other way (by private plane), but still stay at the Polar Bear. The customer has the following reservation prices for the services:

Reservation Prices (in euros)

Customer	**Airfare**	**Hotel**
1	**100**	**800**
2	**500**	**500**
3	**800**	**100**

(a) If you do not bundle the hotel and airfare, what are the optimal prices for airfare (P_A) and hotel (P_H)? What profits do you earn?

Without bundling, the best the firm can do is set the price of airfare at $800 and the price of hotel at $800. In each case the firm attracts a single customer and earns profit of $500 (=$800-$300) from each for a total profit of $1000. The firm could attract two customers for each service at a price of $500, but it would earn profit of $200 (=$500-$300) on each customer for a total of $800 profit, less profit than the $800 price.

(b) If you only sell the hotel and airfare in a bundle, what is the optimal price of the bundle (P_B) and what profits do you earn?

With bundling, the best the firm can do is charge a price of $900 for the airfare and hotel. At this price the firm will attract all three customers and earn $300 (=$900-$300-$300) profit on each for a total profit of $900. The firm could raise its price to $1000, but then it would only attract one customer and total profit would be $400 (=$1000-$300-$300).

Notice that with bundling the firm cannot do as well as it could with mixed bundling. This is because while a) the demands are negatively correlated, a key to increasing profit through bundling, b) customer 1 has a willingness-to-pay for airfare below marginal cost and customer 3 has a willingness-to-pay for hotel below marginal cost. The firm should be able to do better with mixed bundling.

(c) If you follow a strategy of mixed bundling, what are the optimal prices of the separate hotel, the separate airfare, and the bundle (P_H, P_A, and P_B, respectively) and what profits do you earn?

Because customer 1 has a willingness-to-pay for airfare below marginal cost and customer 3 has a willingness-to-pay for hotel below marginal cost, the firm can potentially earn greater profits through mixed bundling. In this problem, if the firm charges $800 for airfare only, $800 for hotel only, and $1000 for the bundle, then customer 1 will purchase hotel only, customer 2 will purchase the bundle, and customer 3 will purchase airfare only. This will earn the firm $1400 (=(800-300)+(1000-300-300)+(800-300)) profit, implying that mixed bundling is the best option in this problem.

B2. [15 Marks]

Think of a game of discoordination in which each of two players chooses to attend 1 of 2 parties. One person (call her Sarah) wants to attend the same party as the other (call him Russell), while Russell wants to avoid Sarah (that is, Russell wants to attend the party Sarah does not attend). Figure 1 shows the payoff matrix of this game.

In this matrix, Party A means "go to the party at Amber's house," while Party B means "go to the party at Bob's house."

Figure 1: Payoff Matrix for a Discoordination Game

		Russell	
		Party A	**Party B**
Sarah	**Party A**	2, 0	0, 2
	Party B	0, 2	2, 0

(a) Find the best response strategies of each player. Plot the best response curves of each player in a diagram.

		Russell	
		Party A *(p)*	**Party B** *(1-p)*
Sarah *(q)*	**Party A**	2, 0	0, 2
(1-q)	**Party B**	0, 2	2, 0

p is the probability Russell chooses Party A. $(1-p)$ is the probability Russell chooses Part B. q is the probability Sarah chooses Party A. $(1-q)$ is the probability Sarah chooses Part B.

Given that Russell chooses Party A with probability *p*,
Sarah's expected payoff if she chooses Party A, $EV^S(A)$:
$EV^S(A) = 2p + 0(1-p) = 2p$
Sarah's expected payoff if she chooses Party B, $EV^S(B)$:
$EV^S(B) = 0(p) + 2(1-p) = 2(1-p)$.

$$EV^S(A) > EV^S(B) \text{ if } 2p > 2(1-p)$$
$$\Rightarrow p > 1-P$$
$$\Rightarrow 2p > 1$$
$$\Rightarrow p > \frac{1}{2} \qquad (1)$$

Similarly, $EV^S(A) < EV^S(B)$ if $p < \frac{1}{2}$ (2)

and $EV^S(A) = EV^S(B)$ if $p = \frac{1}{2}$. (3)

Using (1), (2) and (3), we can find Sarah's best response strategies:
Sarah will choose Party A (i.e. $q = 1$) if $p > \frac{1}{2}$.
Sarah will choose Party B (i.e. $q = 0$) if $p < \frac{1}{2}$.
Sarah will be indifferent between Party A or Party B (i.e. $0 \le q \le 1$) if $p = \frac{1}{2}$.

Using Sarah's best response strategies as outlined above, we plot her best response curve in Figure B2.

Now, given that Sarah chooses Party A with probability *q*,
Russell's expected payoff if he chooses Party A, $EV^R(A)$:
$EV^R(A) = 0(q) + 2(1-q) = 2(1-q)$
Russell's expected payoff if he chooses Party B, $EV^R(B)$:
$EV^R(B) = 2q + 0(1-q) = 2q$.

$$EV^R(A) > EV^R(B) \text{ if } 2(1-q) > 2q$$
$$\Rightarrow 1-q > q$$
$$\Rightarrow 1 > 2q$$
$$\Rightarrow q < \frac{1}{2} \qquad (4)$$

Similarly, $EV^R(A) < EV^R(B)$ if $q > \frac{1}{2}$ (5)

and $EV^R(A) = EV^R(B)$ if $q = \frac{1}{2}$. (6)

Using (4), (5) and (6), we can find Russell's best response strategies:
Russell will choose Party A (i.e. $p = 1$) if $q < \frac{1}{2}$.

Russell will choose Party B (i.e. $p = 0$) if $q > \frac{1}{2}$.

Russell will be indifferent between Party A or Party B (i.e. $0 \leq p \leq 1$) if $q = \frac{1}{2}$.

Using Russell's best response strategies as outlined above, we plot his best response curve in Figure B2.

(b) Find all the Nash equilibrium (pure strategy equilibrium as well as mixed strategy equilibrium) of this game and illustrate it in a diagram.

The best response curves of Sarah and Russell are shown in Figure B2. The intersections of the best response curves are Nash equilibria. In this case they intersect only at one place: (½, ½). So, there is only one Nash equilibrium in this game: $(q^*, p^*) = (½, ½)$, which is a mixed strategy Nash equilibrium. The intersection point *E* in Figure B2 illustrates this mixed strategy Nash equilibrium.