ECON 173 - Intermediate Microeconomic Analysis
Drake University, Fall 2013
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EXAMINATION #4 ANSWER KEY

Version A

I. Multiple choice

(1)a. (2)d. (3)c. (4)b. (5)d. (6)b. (7)a. (8)b. (9)d.

II. Short answer

(1)	a. 3 units of other goods	b. 1/3 units of food	c. slope = -3
	d. \$18.		
(2)	a. \$1.95	b. increase	c. \$0.95.
(3)	a. \$9	b. \$4.	
(4)	a. MR = 8 – Q	b. MR is straight line with P-intercept = \$8, slope = -1	
	c. \$6	d. 4 million	e. \$2 million
	f. \$5	g. 6 million	h. \$0 million.

III. Problems

(1) Note that Abby's $MRS_A = q_{1A} / (3\ q_{2A})$ and Brian's $MRS_B = 3\ q_{1B} / q_{2B}$.

a. **Yes** Pareto-efficient, because Abby has nothing, so she cannot be made better off without taking some of Brian's cheese or crackers, which would make Brian worse off.

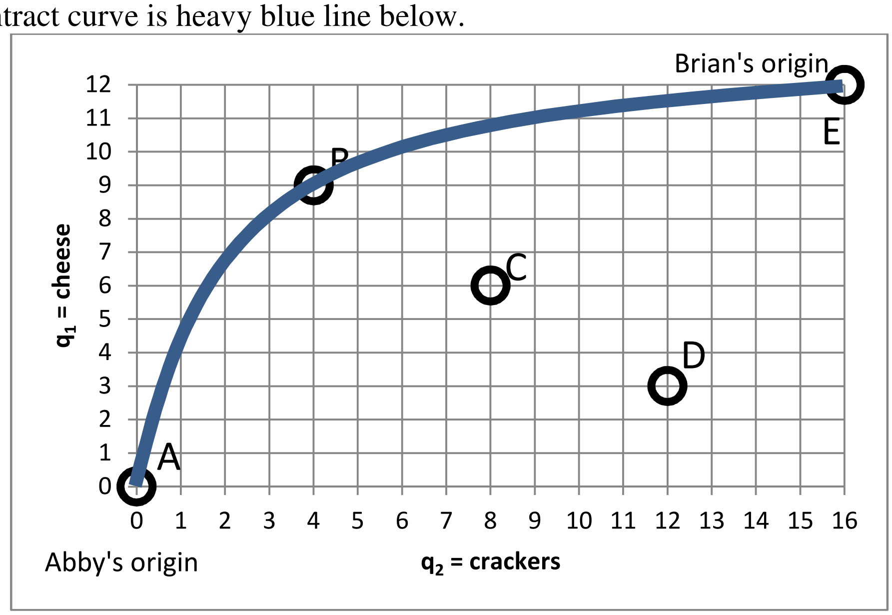
b. **Yes** Pareto-efficient, because $MRS_A = ¾ = MRS_B$.

c. **No**, not Pareto-efficient, because $MRS_A = 1/3 \neq MRS_B = 3$.

d. **No**, not Pareto-efficient, because $MRS_A = 1/12 \neq MRS_B = 27/4$.

e. **Yes** Pareto-efficient, because Brian has nothing, so he cannot be made better off without taking some of Abby's cheese or crackers, which would make Abby worse off.

f. Contract curve is heavy blue line below.



(2) a. To minimize total cost, marginal costs must be equal. Now $MC_A = dTC_A/dq_A = 5 + (q_A/20)$, and $MC_B = dTC_B/q_B = 4 + (q_B/10)$. So set $5 + (q_A/20) = 4 + (q_B/10)$. Then substitute $q_B = 100 - q_A$, to get $5 + (q_A/20) = 4 + ((100 - q_A)/10)$. Solve to get $\mathbf{q_A = 60}$ and $\mathbf{q_B = 40.}$

b. At these quantities, $MC_A = MC_B = \$8$. So if the market price were **\$8**, and each firm took this price as given, then Firm A would maximize its profit by producing $q_A = 60$ and Firm B would maximize its profit by producing $q_B = 40$.

(3) a. $Rev = P \times Q = 50Q - (Q^2/100)$, so $MR = dRev/dQ = 50 - Q/50$. Set MR = MC = 10 and solve to get **Q = 2000**. Insert into demand equation to get P = 50 – (2000/100) = **\$30.**

b. Rev = P × Q = \$30 × 2000 = \$60,000. Production cost = \$10 × 2000 = \$20,000. Difference = maximum amount of up-front costs the company would pay for developing and patenting the chip = **\$40,000.**

c. Under competition, P = MC = **\$10**. Substituting into demand equation \$10 = 50 – Q/100, so Q = **4000.**

d. DWL = area of triangle = ½ × \$20 × 2000 = **\$20,000**.

(4) a. $Rev_1 = P\,q_1 = \mathbf{10q_1 - (q_1^2/100) - (q_1q_2/100)}$ **.**

b. $MR_1 = \partial Rev_1(q_1,q_2) / \partial q_1 = \mathbf{10 - 2q_1/100 - q_2/100}$ **.**

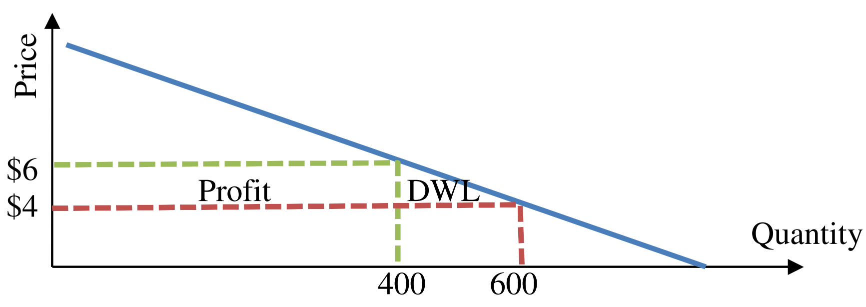
c. Set MR_1 = MC = \$4 and solve to get $\mathbf{q_1^* = 300 - q_2/2}$ **.**

d. Since $q_1^* = q_2^*$, $q_1^* = 300 - q_1^*/2$. Solving yields $\mathbf{q_1^* = 200} = q_2^*$.

e. $Q = q_1^* + q_2^* =$ **400**. Substituting into demand equation: P* = 10 – (400/100) = **\$6.**

f. Total revenue = P* × Q* = \$2400. Total cost = AC × Q* = \$1600. Total profit = total revenue – total cost = **\$800.**

g. The efficient level of output lies where marginal cost intersects demand. Find this quantity by setting MC = \$4 = P = 10 – (Q/100) and solving to get Q = 600. Deadweight loss is the area between demand and marginal cost, from the Cournot equilibrium quantity Q*=400 to the efficient quantity = 600. This is the area of a triangle, equal to **\$200**.



(5) This game resembles a “Battle of the Sexes” game in that there are two Pareto-optimal outcomes which are also Nash equilibria.

a. There are two Pareto-optimal outcomes of this game:

1. Retailer A locates uptown, Retailer B locates downtown.
2. Retailer A locates downtown, Retailer B locates uptown.

b. Neither player has a dominant strategy, so there are **no** dominant-strategy equilibria.

c. There are two Nash equilibria:

1. Retailer A locates uptown, Retailer B locates downtown.
2. Retailer A locates downtown, Retailer B locates uptown.

IV. Critical thinking

(1) This market is not a Cournot duopoly, because firms choose *prices* rather than quantities, but it may be solved using a similar approach.

a. Since Firm A maximizes its own revenue, taking as given the price of the other firm, we should begin by finding an expression for Firm A's revenue as a function of its own price P_A and the other firm's price P_B:

$$Rev_A = Q_A \times P_A = (120 - 20\, P_A + 10\, P_A) \times P_A = 120\, P_A - 20\, P_A^2 + 10\, P_A P_B \,.$$

Maximize this function with respect to P_A by setting its partial derivative equal to zero:

$$0 = \partial Rev_A / \partial P_A = 120 - 40\, P_A + 10\, P_B \,.$$

Solve for P_A in terms of P_B to get Firm A's best reply function:

$$\mathbf{P_A = 3 + (1/4)\, P_B} \,.$$

b. Following the same procedure for Firm B gives its best reply function:

$$P_B = 3 + (1/4)\, P_A \,.$$

Solving these two best reply functions jointly gives $P_A =$ **\$4** and $P_B =$ **\$4**.

Version B

I. Multiple choice

(1)b. (2)a. (3)e. (4)d. (5)b. (6)c. (7)c. (8)a. (9)e.

II. Short answer

(1) a. 2 units of other goods — b. 1/2 units of food — c. slope = -2
d. \$12.

(2) a. \$0.95 — b. decrease — c. \$0.05.

(3) a. \$8 — b. \$5.

(4) a. MR = 9 – 2Q — b. MR is straight line with P-intercept = \$9, slope = -2
c. \$6 — d. 3 million — e. \$3 million
f. \$4 — g. 5 million — h. \$0 million.

III. Problems

(1) Note that Abby's $MRS_A = 3\, q_{1A} / q_{2A}$ and Brian's $MRS_B = q_{1B} / (3\, q_{2B})$.

a. **Yes** Pareto-efficient, because Abby has nothing, so she cannot be made better off without taking some of Brian's cheese or crackers, which would make Brian worse off.

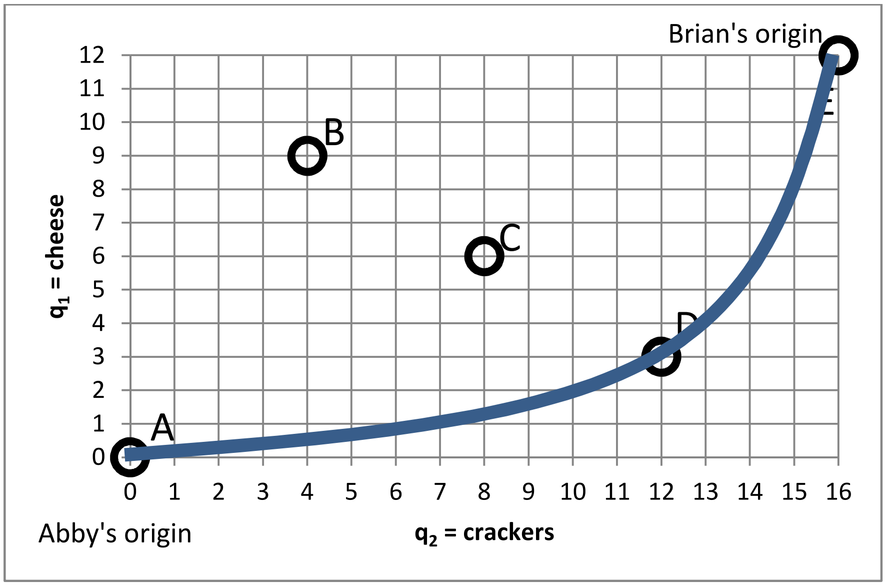
b. **No**, not Pareto-efficient, because $MRS_A = 27/4 \neq MRS_B = 1/12$.

c. **No**, not Pareto-efficient, because $MRS_A = 3 \neq MRS_B = 1/3$.

d. **Yes** Pareto-efficient, because $MRS_A = 3/4 = MRS_B$.

e. **Yes** Pareto-efficient, because Brian has nothing, so he cannot be made better off without taking some of Abby's cheese or crackers, which would make Abby worse off.

f. Contract curve is heavy blue line below.



(2) a. To minimize total cost, marginal costs must be equal. Now $MC_A = dTC_A/dq_A = 12 + (q_A/20)$, and $MC_B = dTC_B/q_B = 13 + (q_B/40)$. So set $12 + (q_A/20) = 13 + (q_B/40)$. Then substitute $q_B = 200 - q_A$, to get $12 + (q_A/20) = 13 + ((200 - q_A)/40)$. Solve to get $\mathbf{q_A = 80}$ and $\mathbf{q_B = 120}$.

b. At these quantities, $MC_A = MC_B = \$16$. So if the market price were **\$16**, and each firm took this price as given, then Firm A would maximize its profit by producing $q_A = 80$ and Firm B would maximize its profit by producing $q_B = 120$.

(3) a. Rev = P × Q = 25Q – $(Q^2/50)$, so MR = dRev/dQ = 25 – Q/25. Set MR = MC = 5 and solve to get **Q = 500**. Insert into demand equation to get P = 25 – (500/50) = **\$15.**

b. Rev = P × Q = \$15 × 500 = \$7500. Production cost = \$5 × 500 = \$2500. Difference = maximum amount of up-front costs the company would pay for developing and patenting the chip = **\$5000.**

c. Under competition, P = MC = **\$5**. Substituting into demand equation \$10 = 25 – Q/50, so Q = **1000.**

d. DWL = area of triangle = ½ × \$20 × 2000 = **\$2500**.

(4) a. $Rev_1 = P\,q_1 = \mathbf{20q_1 - (q_1^2/100) - (q_1q_2/100)}$ **.**

b. $MR_1 = \partial Rev_1(q_1,q_2) / \partial q_1 = \mathbf{20 - 2q_1/100 - q_2/100}$ **.**

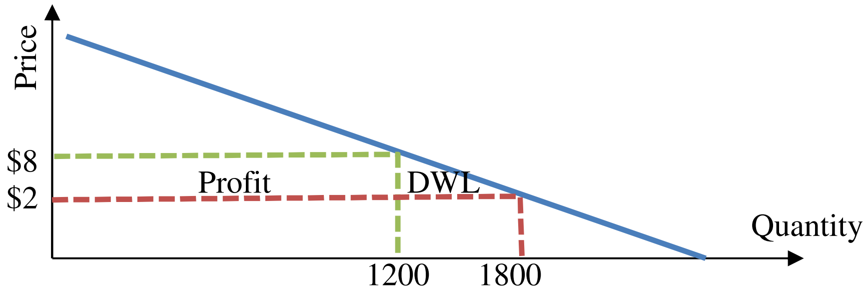
c. Set MR_1 = MC = \$2 and solve to get $\mathbf{q_1^* = 900 - q_2/2}$ **.**

d. Since $q_1^* = q_2^*$, $q_1^* = 900 - q_1^*/2$. Solving yields $\mathbf{q_1^* = 600} = q_2^*$.

e. $Q = q_1^* + q_2^* =$ **1200**. Substituting into demand equation: P* = 20 – (1200/100) = **\$8.**

f. Total revenue = P* × Q* = \$9600. Total cost = AC × Q* = \$2400. Total profit = total revenue – total cost = **\$7200.**

g. The efficient level of output lies where marginal cost intersects demand. Find this quantity by setting MC = \$2 = P = 20 – (Q/100) and solving to get Q = 1800. Deadweight loss is the area between demand and marginal cost, from the Cournot equilibrium quantity Q*=1200 to the efficient quantity = 1800. This is the area of a triangle, equal to **\$1800**.



(5) This game resembles a "Prisoners' Dilemma" game in that there are three Pareto-optimal outcomes, but the dominant-strategy equilibrium is not one of them.

a. There are three Pareto-optimal outcomes of this game:

1. Firm A advertises, Firm B does not advertise.
2. Firm A does not advertise, Firm B advertises.
3. Neither firm advertises

b. Each firm's dominant strategy is to advertise, so the dominant-strategy equilibrium is

1. Both firms advertise.

c. The only Nash equilibrium is the dominant-strategy equilibrium:

1. Both firms advertise.

IV. Critical thinking

Same as Version A.

[end of answer key]