ECON 173 - Intermediate Microeconomic Analysis
Drake University, Fall 2016
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EXAMINATION #4 ANSWER KEY

Version A

I. Multiple choice

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

II. Short answer

(1) a. 3 units of food   b. 1/3 units of clothing   c. slope = -3
d. P_{food} = \$4, because slope of each consumer's budget line = $-P_{clothing}/P_{food} = -3$.
(2) a. \$1.90   b. increase   c. \$0.90.
(3) a. \$60   b. \$24.
(4) a. \$8   b. 12 thousand   c. \$0
d. MR = 14 – Q
e. MR is straight line with P-intercept = \$14, slope = -1/thousand
f. \$10   g. 8 thousand   h. \$8 thousand.
(5) a. no, no, yes, yes   b. no, no, no, no   c. no, no, yes, yes.

III. Problems

(1) [Exchange efficiency] Note that Ryan's $MRS_R = q_1 / (2q_2)$ and Samantha's $MRS_S = 3q_1 / q_2$.

a. **Yes,** A is Pareto-efficient, because no one can be made better off without someone else being made worse off. Samantha has everything, so she cannot be made better off. Ryan has nothing, so he cannot be made better off without taking some of Samantha's opera tickets or basketball tickets, which would make Samantha worse off.

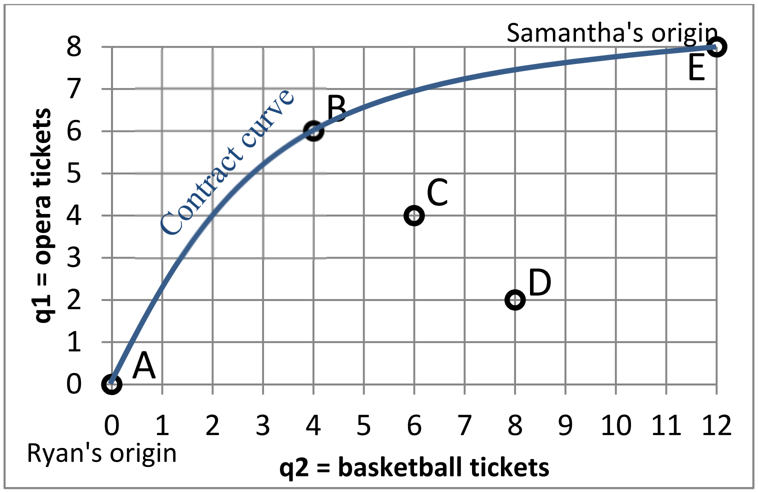
b. **Yes**, B is Pareto-efficient, because $MRS_R = 3/4 = MRS_S$.

c. **No**, C is not Pareto-efficient, because $MRS_R = 1/3 \neq MRS_S = 2$.

d. **No,** D is not Pareto-efficient, because $MRS_R = 1/8 \neq MRS_S = 9/2$.

e. **Yes,** E is Pareto-efficient, because no one can be made better off without someone else being made worse off. Ryan has everything, so he cannot be made better off. Samantha has nothing, so she cannot be made better off without taking some of Ryan's opera tickets or basketball tickets, which would make Ryan worse off.

f.



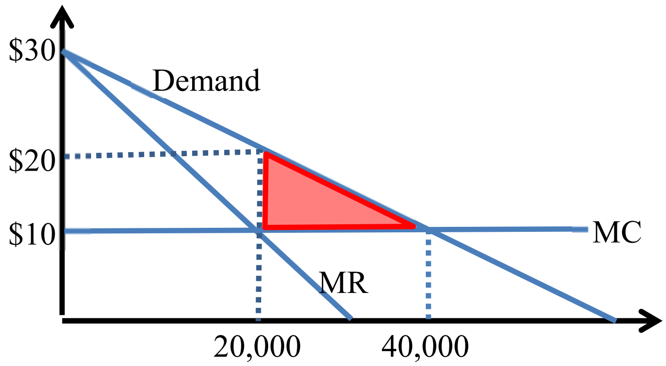
(2) [Monopoly pricing, deadweight loss]

a. First find MR. Total revenue = TR = P×Q = 30Q – (Q^2/2000). MR = dTR/dQ = 30 – (Q/1000). Now set MR equal to MC=10, and solve to get $\mathbf{Q_M}$**=2000**. Insert this value into the demand equation to get $\mathbf{P_M}$**=$20**.

b. Maximum up-front cost that the firm would be willing to pay for developing and patenting the chip = TR – production cost = (P×Q) – (10×Q) = **$20,000**.

c. When the market is competitive, $\mathbf{P_C}$**=MC=$10**. Insert this value into the demand equation to get $\mathbf{Q_C}$**=4000**.

d. Deadweight loss is the area of a triangle bounded by the demand curve, a vertical line at the monopoly quantity, and a horizontal line at the competitive price (see below). So deadweight loss = (1/2) (20-10) (40,000-20,000) = **$10,000**.



(3) [Cournot duopoly]

a. $Rev_1 = P\, q_1 = \mathbf{10q_1 - (q_1^2/100) - (q_1 q_2/100)}$ **.**

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

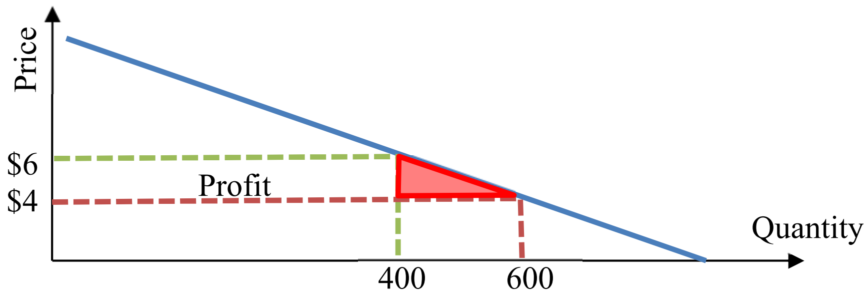
c. Set MR_1 = MC = $4 and solve to get $\mathbf{q_1^* = 300 - q_2/2}$ **.**

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 ("marginal cost pricing"). 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 (see below). This is the area of a triangle, equal to **\$200**.



IV. Critical thinking

(1) Efficient allocation of turkey and pumpkin pie

Efficiency requires that Adam, Becky, and Caleb have the same marginal rates of substitution—otherwise there would be a trade that would make both traders better off. Recall that MRS = $MU_2 / MU_1 = (\partial U/\partial q_2) / (\partial U/\partial q_1)$. Therefore

$$\text{Adam's } MRS_A = q_{1A}^{1/2} / q_{2A}^{1/2},$$
$$\text{Becky's } MRS_B = q_{1B} / q_{2B},$$
$$\text{Caleb's } MRS_C = q_{1C}^{2} / q_{2C}^{2}.$$

So two more equations that an efficient allocation must satisfy are

$$\mathbf{q_{1A}^{1/2} / q_{2A}^{1/2} = q_{1B} / q_{2B}} \quad \textbf{and} \quad \mathbf{q_{1B} / q_{2B} = q_{1C}^{2} / q_{2C}^{2}}.$$

(2) Monopoly pricing

A monopolist would **never** set price and quantity on the inelastic part of its demand curve because as long as demand is inelastic, the monopolist can increase profit by increasing price and decreasing output.

One way to show this is to note that if demand is inelastic, then by definition, $|\varepsilon| = |\ \%\ \text{chg } Q / \%\ \text{chg } P\ | < 1$. So if price is increased, quantity will decrease more slowly than price is increased, and therefore revenue will increase because $\%\ \text{chg Revenue} \approx \%\ \text{chg } P + \%\ \text{chg } Q$. Now if quantity decreases, cost will surely decrease. Since revenue increases and cost decreases, profit will increase.

Another way to show this is to note that $MR = P\,[1 + (1/\varepsilon)]$. If $-1<\varepsilon<0$, then $(1/\varepsilon) < -1$, which implies that $[1 + (1/\varepsilon)]$ is negative, which implies MR is negative. But then MR is less than MC, since marginal cost cannot be negative. Since MR is less than MC, the monopolist can increase profit by decreasing output.

Version B

I. Multiple choice

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

II. Short answer

(1) a. 2 units of food b. 1/2 units of clothing c. slope = -2
d. P_{food} = \$6, because slope of each consumer's budget line = $-P_{clothing}/P_{food}$ = -2.
(2) a. \$0.80 b. decrease c. \$0.20.
(3) a. \$40 b. \$25.
(4) a. \$9 b. 6 thousand c. \$0
d. MR = 15 – 2Q
e. MR is straight line with P-intercept = \$15, slope = -2/thousand
f. \$11 g. 4 thousand h. \$4 thousand.
(5) a. yes, no, yes, yes b. no, yes, no, no c. no, yes, no, no.

III. Problems

(1) [Exchange efficiency] Note that Ryan's $MRS_R = q_1 / q_2$ and Samantha's $MRS_S = q_1 / (3q_2)$.

a. **Yes,** A is Pareto-efficient, because no one can be made better off without someone else being made worse off. Samantha has everything, so she cannot be made better off. Ryan has nothing, so he cannot be made better off without taking some of Samantha's opera tickets or basketball tickets, which would make Samantha worse off.

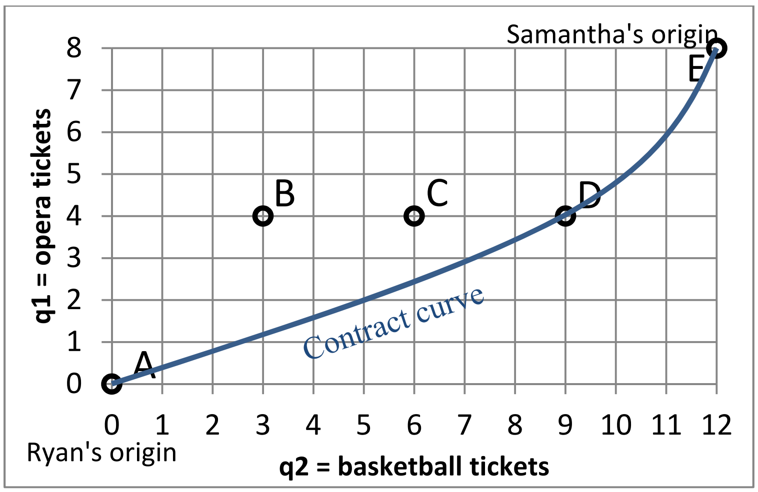
b. **No**, B is not Pareto-efficient, because $MRS_R = 4/3 \neq 4/27 = MRS_S$.

c. **No**, C is not Pareto-efficient, because $MRS_R = 2/3 \neq MRS_S = 2/9$.

d. **Yes,** D is Pareto-efficient, because $MRS_R = 4/9 = MRS_S = 4/9$.

e. **Yes,** E is Pareto-efficient, because no one can be made better off without someone else being made worse off. Ryan has everything, so he cannot be made better off. Samantha has nothing, so she cannot be made better off without taking some of Ryan's opera tickets or basketball tickets, which would make Ryan worse off.

f.



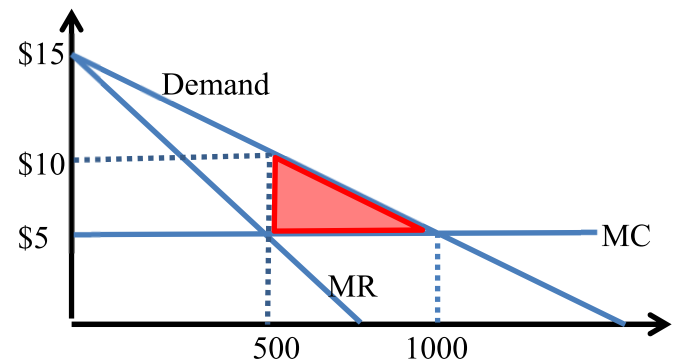
(2) [Monopoly pricing, deadweight loss]

a. First find MR. Total revenue = TR = P×Q = 15Q – (Q^2/100). MR = dTR/dQ = 15 – (2Q/100). Now set MR equal to MC=5, and solve to get **Q_M=500**. Insert this value into the demand equation to get **P_M=$10**.

b. Maximum up-front cost that the firm would be willing to pay for developing and patenting the chip = TR – production cost = (P×Q) – (10×Q) = **$2500**.

c. When the market is competitive, **P_C=MC=$5**. Insert this value into the demand equation to get **Q_C=1000**.

d. Deadweight loss is the area of a triangle bounded by the demand curve, a vertical line at the monopoly quantity, and a horizontal line at the competitive price (see below). So deadweight loss = (1/2) (10-5) (1000-500) = **$1250**.



(3) [Cournot duopoly]

a. Rev_1 = P q_1 = **$20q_1 - (q_1^2/10) - (q_1 q_2/10)$.**

b. $MR_1 = \partial Rev_1(q_1,q_2) / \partial q_1$ = **$20 - 2q_1/10 - q_2/10$.**

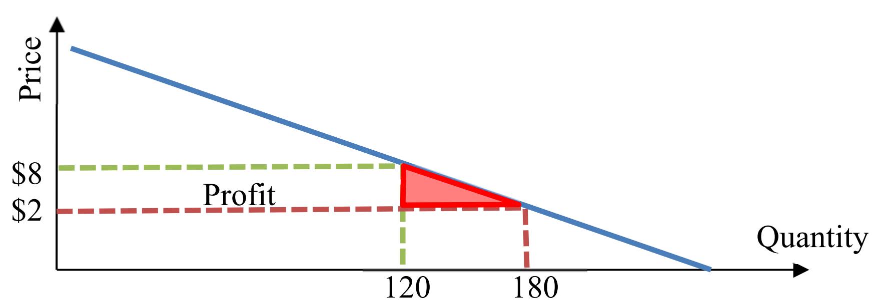
c. Set MR_1 = MC = $2 and solve to get **$q_1^* = 90 - q_2/2$.**

d. Since $q_1^* = q_2^*$, $q_1^* = 90 - q_1^*/2$. Solving yields **$q_1^* = 60$** = q_2^* .

e. Q* = $q_1^* + q_2^*$ = **120**. Substituting into demand equation: P* = 20 – (120/10) = **$8.**

f. Total revenue = P* × Q* = $960. Total cost = AC × Q* = $240. Total profit = total revenue – total cost = **$720.**

g. The efficient level of output lies where marginal cost intersects demand ("marginal cost pricing"). Find this quantity by setting MC = $2 = P = 20 – (Q/10) and solving to get Q = 180. Deadweight loss is the area between demand and marginal cost, from the Cournot equilibrium quantity Q*=120 to the efficient quantity = 180 (see below). This is the area of a triangle, equal to **$180**.



IV. Critical thinking
Same as Version A.

[end of answer key]