ECON 173 - Intermediate Microeconomic Analysis
Drake University, Fall 2014
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EXAMINATION #4 ANSWER KEY

Version A

I. Multiple choice

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

II. Short answer

(1) a. 4 units of other goods b. 1/4 units of food c. slope = -4
d. \$8, because slope of each consumer's budget line = $-P_{food}/P_{other}$.

(2) a. \$2.95 b. increase c. \$0.95.

(3) a. \$30. b. \$12.

(4) a. MR = 13 – Q b. MR is straight line with P-intercept = \$13, slope = -1
c. \$9 d. 8 million e. \$8 million
f. \$7 g. 12 million h. \$0 million.

III. Problems

(1) Note that Jana's $MRS_J = q_1 / (4\ q_2)$ and Kirk's $MRS_K = q_1 / q_2$.

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

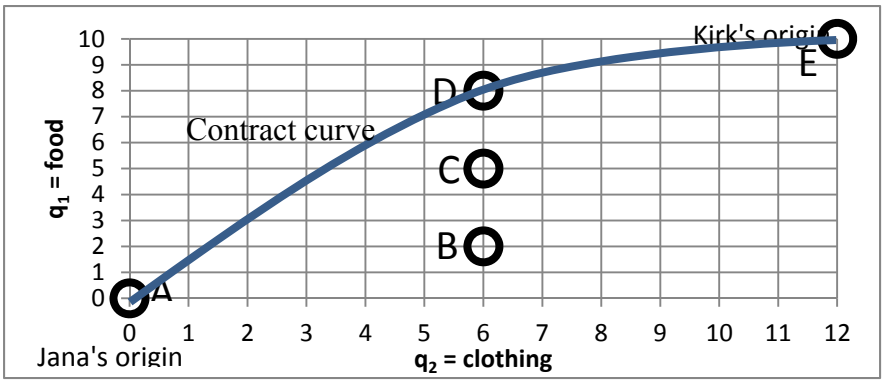
b. **No**, B is not Pareto-efficient, because $MRS_J = 1/12 \neq MRS_K = 4/3$.

c. **No**, C is not Pareto-efficient, because $MRS_J = 5/24 \neq MRS_K = 5/6$.

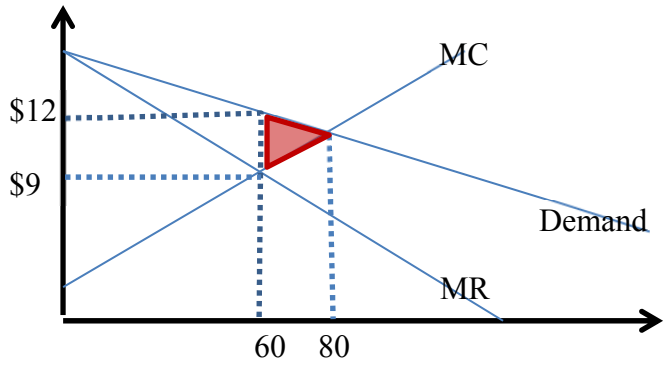
d. **Yes,** D is Pareto-efficient, because $MRS_J = 1/3 = MRS_K$.

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

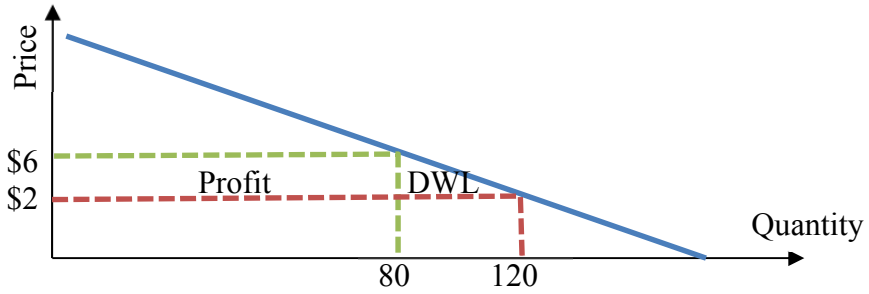
f.



(2) a. $MC(Q) = dTC/dQ = 3 + (Q/10)$.
b. $AC(Q) = TC/Q = 3 + (Q/20)$.
c. $Rev(Q) = P \times Q = 15Q - (Q^2/20)$, so $MR = dRev/dQ = 15 - (Q/10)$.
d. Set $MC(Q) = MR(Q)$ and solve to find $Q^* = 60$.
e. Substitute into demand curve: $P^* = 15 - (60/20) = \$12$.
f. Profit = Rev(Q) – TC(Q) = \$360.
g. The efficient level of output is where the marginal cost curve intersects the demand curve, that is, where MC=P. Set $3 + (Q/10) = 15 - (Q/20)$ and solve to find $Q = 80$. Deadweight loss is the area of the triangle bounded by the demand curve, the marginal cost curve, and a vertical line at the monopolist's quantity, 60. So DWL = \$30, the area of the red triangle below.



(3) a. $Rev_1 = P\ q_1 = \mathbf{14q_1 - (q_1^2/10) - (q_1q_2/10)}$.
b. $MR_1 = \partial Rev_1(q_1,q_2) / \partial q_1 = \mathbf{14 - 2q_1/10 - q_2/10}$.
c. Set $MR_1 = MC = \$2$ and solve to get $\mathbf{q_1^* = 60 - q_2/2}$.
d. Since $q_1^* = q_2^*$, $q_1^* = 60 - q_1^*/2$. Solving yields $\mathbf{q_1^* = 40} = q_2^*$.
e. $Q = q_1^* + q_2^* = \mathbf{80}$. Substituting into demand equation: $P^* = 14 - (80/10) = \mathbf{\$6.}$
f. Total revenue = $P^* \times Q^* = \$4800$. Total cost = $AC \times Q^* = \$160$. Total profit = total revenue – total cost = **\$320.**
g. The efficient level of output lies where marginal cost intersects demand ("marginal cost pricing"). Find this quantity by setting $MC = \$2 = P = 14 - (Q/10)$ and solving to get $Q = 120$. Deadweight loss is the area between demand and marginal cost, from the Cournot equilibrium quantity $Q^*=80$ to the efficient quantity = 120. This is the area of a triangle, equal to **\$80**.



(4) a. There are two Pareto-optimal outcomes of this game:
1. Old Firm chooses high price, New Firm enters market.
2. Old Firm chooses high price, New Firm stays out.
b. Neither player has a dominant strategy, so there are **no** dominant-strategy equilibria.
c. There is one Nash equilibria:
1. Old Firm chooses high price, New Firm enters market.

IV. Critical thinking

(1) a. Let D be the distance between a customer and Yum-Yum. Then (1000-D) must be the distance to Tasty Treat. The customer is indifferent between the two ice cream stands if the *total* prices are the same:

$$P_Y + 0.02\ D = P_T + 0.02\ (1000\text{-}D).$$

Now, we are given that $P_T = 6$. So substitute and solve to get

$$D = 650 - 25\ P_Y.$$

Now D is the location of the customer who is indifferent, but D is also the number of customers who prefer Yum-Yum because customers are scattered evenly—one person per yard. So,

$$\mathbf{q_Y = 650 - 25\ P_Y.}$$

b. Yum-Yum's revenue is

$$Rev_Y = q_Y \times P_Y = \mathbf{650\ P_Y - 25\ P_Y^2\ .}$$

c. Maximize Yum-Yum's total revenue by setting the derivative of Rev_Y with respect to P_Y equal to zero:

$$0 = 650 - 50\ P_Y\ ,$$

which can be solved to get $P_Y^* = \mathbf{\$13}$.
d. If no one minds walking, then all customers choose the stand with the lowest money price. Yum-Yum can then maximize its revenue by undercutting Tasty Treat's price just slightly to $P_Y = \mathbf{\$5.99}$.

Version B

I. Multiple choice

(1)a. (2)a. (3)b. (4)a. (5)c. (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. \$1 because slope of each consumer's budget line = $-P_{food}/P_{other}$.
(2) a. \$0.85 b. decrease c. \$1.15.
(3) a. \$24. b. \$14.
(4) a. MR = 15 – 2Q b. MR is straight line with P-intercept = \$15, slope = -2
c. \$9 d. 6 million e. \$12 million
f. \$5 g. 10 million h. \$0 million.

III. Problems

Note that Jana's $MRS_J = q_1 / q_2$ and Kirk's $MRS_K = 3q_1 / q_2$.

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

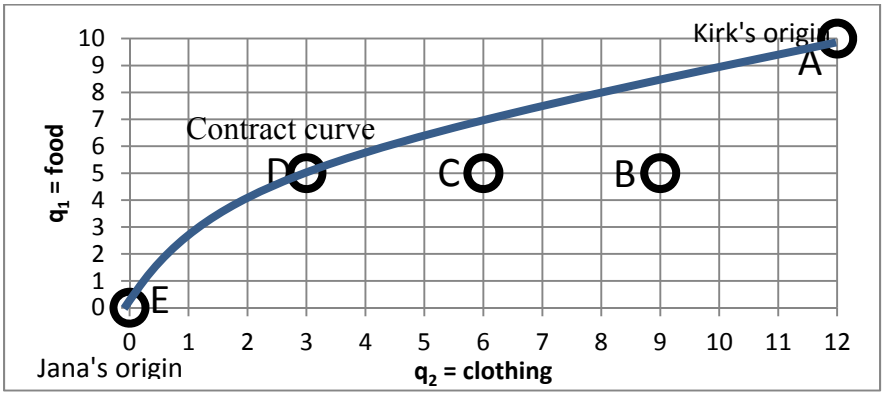
b. **No**, B is not Pareto-efficient, because $MRS_J = 5/9 \neq MRS_K = 5$.

c. **No**, C is not Pareto-efficient, because $MRS_J = 5/6 \neq MRS_K = 5/2$.

d. **Yes,** D Pareto-efficient, because $MRS_J = 5/3 = MRS_K$.

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

f.



(2) a. $MC(Q) = dTC/dQ = 1 + (Q/10)$.

b. $AC(Q) = TC/Q = 1 + Q/20$.

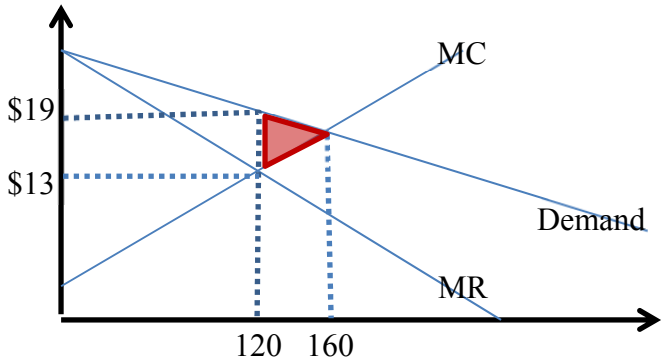
c. $Rev(Q) = P \times Q = 25Q - (Q^2/20)$, so $MR = dRev/dQ = 25 - (Q/10)$.

d. Set $MC(Q) = MR(Q)$ and solve to find $Q^* = 120$.

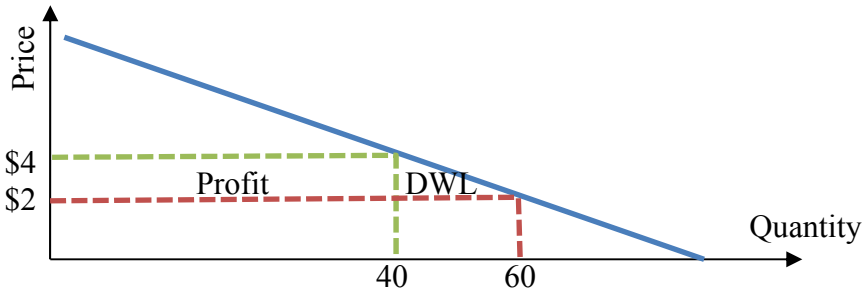
e. Substitute into demand curve: $P^* = 25 - (120/20) = \$19$.

f. Profit = $Rev(Q) - TC(Q) = \$1440$.

g. The efficient level of output is where the marginal cost curve intersects the demand curve, that is, where MC=P. Set $1 + (Q/10) = 25 - (Q/20)$ and solve to find $Q = 160$. Deadweight loss is the area of the triangle bounded by the demand curve, the marginal cost curve, and a vertical line at the monopolist's quantity, 120. So DWL = \$120, the area of the red triangle below.



(3) a. $Rev_1 = P\ q_1 = \mathbf{8q_1 - (q_1^2/10) - (q_1q_2/10)}$.
b. $MR_1 = \partial Rev_1(q_1,q_2) / \partial q_1 = \mathbf{8 - 2q_1/10 - q_2/10}$.
c. Set $MR_1 = MC = \$2$ and solve to get $\mathbf{q_1^* = 30 - q_2/2}$.
d. Since $q_1^* = q_2^*$, $q_1^* = 60 - q_1^*/2$. Solving yields $\mathbf{q_1^* = 20} = q_2^*$.
e. $Q = q_1^* + q_2^* = \mathbf{40}$. Substituting into demand equation: $P^* = 8 - (40/10) = \mathbf{\$4.}$
f. Total revenue = $P^* \times Q^* = \$160$. Total cost = $AC \times Q^* = \$80$. Total profit = total revenue – total cost = **$80.**
g. The efficient level of output lies where marginal cost intersects demand ("marginal cost pricing"). Find this quantity by setting $MC = \$2 = P = 8 - (Q/10)$ and solving to get $Q = 60$. Deadweight loss is the area between demand and marginal cost, from the Cournot equilibrium quantity $Q^*=40$ to the efficient quantity = 60. This is the area of a triangle, equal to **$20**.



(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. Awsome Burgers locates uptown, Big Burgers locates downtown.
2. Awsome Burgers locates downtown, Big Burgers locates uptown.
b. Neither player has a dominant strategy, so there are **no** dominant-strategy equilibria.
c. There are two Nash equilibria:
1. Awsome Burgers locates uptown, Big Burgers locates downtown.
2. Awsome Burgers locates downtown, Big Burgers locates uptown.

IV. Critical thinking
Same as Version A.

[end of answer key]