ECON 173 - Intermediate Microeconomic Analysis
Drake University, Fall 2019
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EXAMINATION #4 ANSWER KEY

Version A

I. Multiple choice

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

II. Short answer

(1) a. 3 units of food b. 1/3 units of clothing c. slope = -1/3
d. P_{food} = \$4, because slope of each consumer's budget line = $-P_{food}/P_{clothing}$ = -1/3.

(2) a. $L = 1/(|\varepsilon| n) = 1/2$. b. $L = 1/4$. c. $L = 1/10$.

(3) a. yes, yes. b. no, no. c. no, yes.

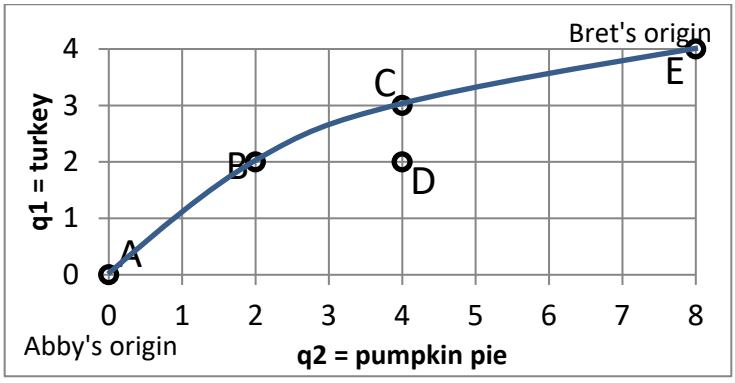
(4) a. \$5. b. 10 million. c. \$0.
d. $MR = 10 - Q$
e. MR is straight line with P-intercept = \$10, slope = -1/thousand
f. \$7. g. 6 million. h. \$6 million.

(5) a. no, yes, no, yes. b. no, no, no, no. c. no, no, no, yes.

III. Problems

(1) [Exchange efficiency] Note that Abby's $MRS_A = q_1/(3q_2)$ and Bret's $MRS_B = q_1/q_2$.
a. **Yes,** A is Pareto-efficient, because no one can be made better off without someone else being made worse off. Bret has everything, so he cannot be made better off. Abby has nothing, so she cannot be made better off without taking some of Bret's turkey or pumpkin pie, which would make Bret worse off. Put simply, since Bret already has everything, any feasible change would make Bret worse off.
b. **Yes**, B is Pareto-efficient, because $MRS_A = 1/3 = MRS_B$.
c. **Yes**, C is Pareto-efficient, because $MRS_A = 1/4 = MRS_B$.
d. **No,** C is not Pareto-efficient, because $MRS_A = 1/6 \neq MRS_B = 1/2$.
e. **Yes,** E is Pareto-efficient, because no one can be made better off without someone else being made worse off. Abby has everything, so she cannot be made better off. Bret has nothing, so he cannot be made better off without taking some of Abby's turkey or pumpkin pie, which would make Abby worse off. Put simply, since Abby already has everything, any feasible change would make Abby worse off.

f. .



(2) [Monopoly, profit maximization]

a. MC = dTC/dQ = **4 + (Q/20).**

b. AC = TC/Q = **4 + (Q/40).**

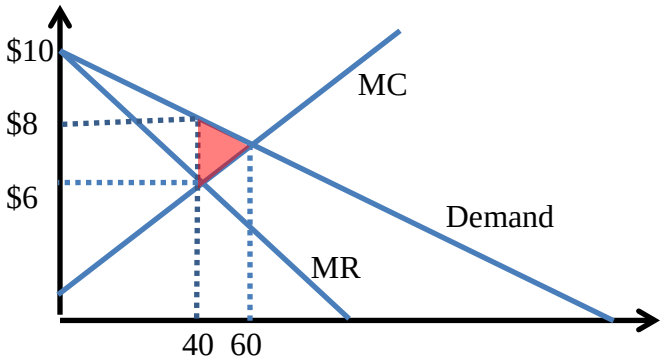
c. First find total revenue = P×Q = 10Q – (Q^2/20). So MR = dTR/dQ = **10 – (2Q/20).**

d. Set MC = MR and solve to get Q_M = **40**.

e. Substitute into demand function: P_M = 10 – (40/20) = **$8**.

f. Profit = TR – TC = (40×8) – (4×40 + 40^2/40) = **$120**.

g. The efficient level of output lies where marginal cost intersects demand ("marginal cost pricing"). Find this quantity by setting 10 – (Q/20) = 4 + (Q/20), which yields Q=60. Then find MC(40) = 4 + (40/20) = $6. Then evaluate DWL as the area of a triangle: **$20.**



(3) [Cournot duopoly]

a. TR_1 = P q_1 = **$14q_1 – (q_1^2/20) – (q_1q_2/20)$.**

b. $MR_1 = \partial TR_1(q_1,q_2) / \partial q_1$ = **$14 – 2q_1/20 – q_2/20$.**

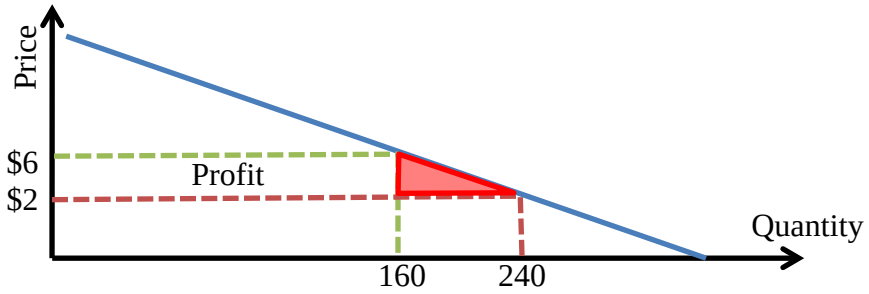
c. Set MR_1 = MC = $2 and solve to get **$q_1^* = 120 – q_2/2$.**

d. Since $q_1^* = q_2^*$, $q_1^* = 120 – q_1^*/2$. Solving yields **$q_1^* = 80 = q_2^*$** .

e. $Q^* = q_1^* + q_2^*$ = **160**. Substituting into demand equation: P* = 14 – (160/20) = **$6.**

f. Profit = (P*×Q*) – (AC×Q*) = (P*-AC)×Q* = (6-2)×160 = **$640.**

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/20) and solving to get Q = 240. Deadweight loss is the area between demand and marginal cost, from the Cournot equilibrium quantity Q*=160 to the efficient quantity = 240 (see below). This is the area of a triangle, equal to **$160**.



IV. Critical thinking

(1) Contract curve**.**

Yes, the contract curve will pass through the center of the box. At the center the two people have **identical bundles**. If the two people also have identical utility functions, they must also have identical marginal rate of substitution (MRS) functions. So the value of their **MRSs must be equal** and their indifference curves must be **tangent**.

(2) Pricing game

a. Firm B's best reply is to undercut Firm A's price very slightly, setting a price just less than \$10—say, \$9.99. Firm B will take the entire market, enjoying a profit of nearly (\$10-\$3) × Q. If Firm B instead were to match Firm A's price, Firm B will have a profit of only (\$10-\$3) × (Q/2). If Firm B were to exceed Firm A's price, Firm B will have zero profit.

b. Firm A's best reply is to undercut Firm B's price very slightly, setting a price of say, \$9.98. Same reasoning applies.

c. The Nash equilibrium is for both firms to set price equal to marginal cost (\$3). Although they enjoy zero profit in this solution, if either firm were to cut price below marginal cost, it would make losses. If either firm were to increase price by itself, it would lose all its customers and still enjoy zero profit..

Version B

I. Multiple choice

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

II. Short answer

(1) a. 4 units of food b. 1/4 units of clothing c. slope = -1/4

d. P_{food} = \$3, because slope of each consumer's budget line = $-P_{food}/P_{clothing}$ = -1/4.

(2) a. L = 1/(|ε| n) = 1/4 . b. L = 1/20 . c. L = 1/40 .

(3) a. no, no. b. no, yes. c. yes, yes.

(4) a. \$8. b. 6 million. c. \$0.

d. MR = 14 – 2Q

e. MR is straight line with P-intercept = \$14, slope = -2/thousand

f. \$10. g. 4 million. h. \$4 million.

(5) a. no, no, yes, yes. b. no, no, no, no. c. no, no, yes, yes.

III. Problems

(1) [Exchange efficiency] Note that Aaron's $MRS_A = 3q_1/q_2$ and Bethany's $MRS_B = q_1/q_2$.

a. **Yes,** A is Pareto-efficient, because no one can be made better off without someone else being made worse off. Bret has everything, so he cannot be made better off. Abby has nothing, so she cannot be made better off without taking some of Bret's turkey or pumpkin pie, which would make Bret worse off. Put simply, since Bret already has everything, any feasible change would make Bret worse off.

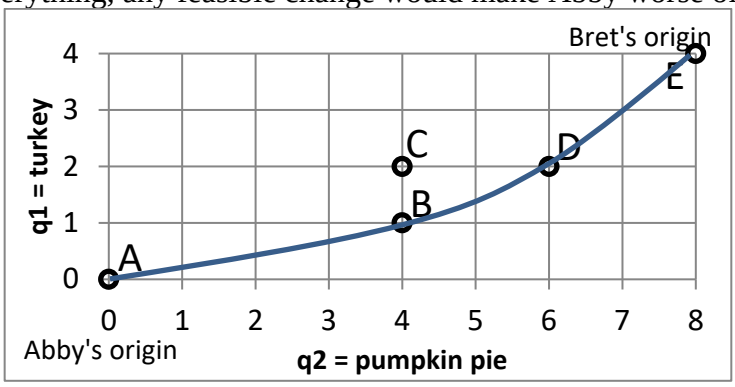
b. **Yes**, B is Pareto-efficient, because $MRS_A = 3/4 = MRS_B$.

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

d. **Yes**, A is Pareto-efficient, because $MRS_A = 1 = MRS_B$.

e. **Yes,** E is Pareto-efficient, because no one can be made better off without someone else being made worse off. Abby has everything, so she cannot be made better off. Bret has nothing, so he cannot be made better off without taking some of Abby's turkey or pumpkin pie, which would make Abby worse off. Put simply, since Abby already has everything, any feasible change would make Abby worse off.

f.



(2) [Monopoly, profit maximization]

a. MC = dTC/dQ = 2 + (**Q/20).**

b. AC = TC/Q = 2 + **(Q/40).**

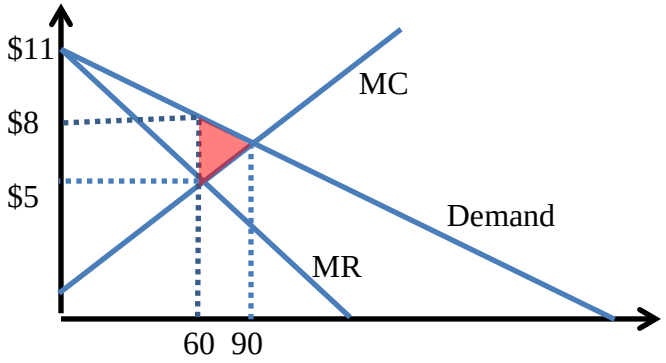
c. First find total revenue = P×Q = 11Q – (Q^2/20). So MR = dTR/dQ = **11 – (2Q/20).**

d. Set MC = MR and solve to get Q_M = **60**.

e. Substitute into demand function: P_M = 11 – (60/20) = **$8**.

f. Profit = TR – TC = (60×8) – [60×2 + (60^2/40)] = **$270**.

g. The efficient level of output lies where marginal cost intersects demand ("marginal cost pricing"). Find this quantity by setting 11 – (Q/20) = 2 +(Q/20), which yields Q=90. Then find MC(60) = 2 + (60/20) = $5. Then evaluate DWL as the area of a triangle: **$45.**



(3) [Cournot duopoly]

a. $TR_1 = P\ q_1 =$ **$10q_1 – (q_1^2/100) – (q_1q_2/100)$.**

b. $MR_1 = \partial TR_1(q_1,q_2) / \partial q_1 =$ **$10 – 2q_1/100 – q_2/100$.**

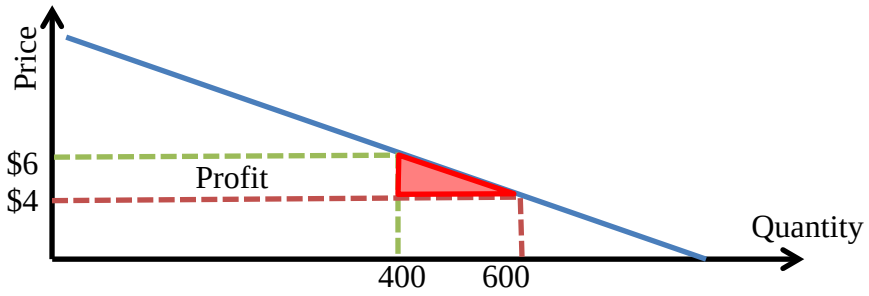
c. Set $MR_1 = MC = \$4$ and solve to get **$q_1^* = 300 – q_2/2$.**

d. Since $q_1^* = q_2^*$, $q_1^* = 300 – q_1^*/2$. Solving yields **$q_1^* = 200$** $= q_2^*$.

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

f. Profit = $(P^* \times Q^*) – (AC \times Q^*) = (P^* - AC) \times Q^* = (6-4) \times 400 =$ **$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

Same as version A.

[end of answer key]