ECON 173 - Intermediate Microeconomic Analysis
Drake University, Fall 2024
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EXAMINATION 4 ANSWER KEY

Version A

I. Multiple choice

(1)e. (2)b. (3)a. (4)c. (5)c. (6)d. (7)c. (8)e. (9)b. (10)a.
(11)b. (12)b. (13)b. (14)a.

II. Short answer

(1) a. 1/2 units of food. b. 2 units of clothing. c. slope = -1/2.
d. $P_{clothing}$ = \$2, because slope of each consumer's budget line = $-P_{clothing}/P_{food} = -1/2$.

(2) a. $P_A = MC / (1 + [1/\varepsilon_A]) = \$20$.
b. $P_C = MC / (1 + [1/\varepsilon_C]) = \$12$.

(3) a. $L = 1/|\varepsilon| = 1/2$. b. $L = 1/(n\,|\varepsilon|) = ¼$.

(4) a. \$5. b. 9 thousand. c. \$0 because P=MC.
d. MR = 14 – 2Q ("Same intercept, twice the slope as demand").
e. Plot MR as a straight line with P-intercept = \$14, slope = -2/thousand.
f. \$9. g. 5 thousand. h. \$10 thousand.

(5) a. Pareto optimal: yes, no, yes, yes.
b. Dominant-strategy equilibria: no, yes, no, no.
c. Nash equilibria in pure strategies: no, yes, no, no.

III. Problems

(1) [Exchange efficiency] Note that Xavier's $MRS_X = q_1/(5q_2)$ and Yolanda's $MRS_Y = 3q_1/q_2$.

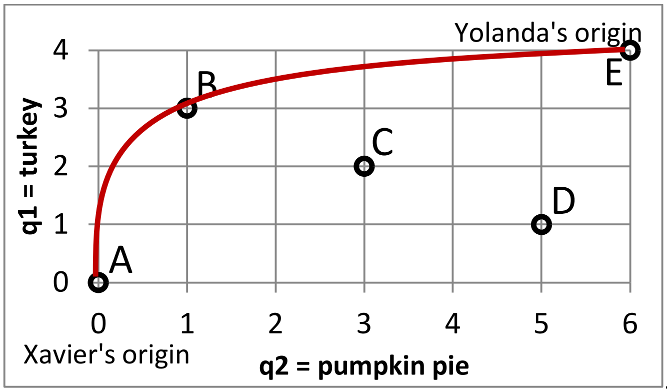
a. **Yes,** A is Pareto-efficient, because no one can be made better off without someone else being made worse off. Yolanda already has everything, so she cannot be made better off. Xavier has nothing, so he cannot be made better off without taking some of Yolanda's turkey or pumpkin pie, which would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

b. **Yes,** B is Pareto-efficient, because $MRS_X = 3/5 = MRS_Y = 3/5$.

c. **No**, C is not Pareto-efficient, because $MRS_X = 2/15 \neq MRS_Y = 2$.

d. **No**, D is not Pareto-efficient, because $MRS_X = 1/25 \neq MRS_Y = 9$.

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

f. 

(2) [Monopoly, profit maximization]

a. MC = dTC/dQ = **4 + (Q/10).**

b. AC = TC/Q = **4 + (Q/20).**

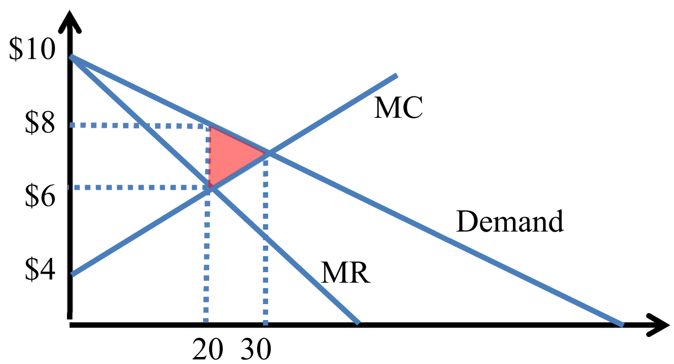
c. First find total revenue = P×Q = $10Q - (Q^2/10)$. So MR = dTR/dQ = **10 – (2Q/10).**

d. Set MC = MR and solve to get Q_M = **20**.

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

f. Profit = TR – TC = $(20\times8) - (4\times20 + 20^2/20) =$ **$60**.

g. The efficient level of output lies where marginal cost intersects demand ("marginal cost pricing"). Find this quantity by setting P = MC, or 10 – (Q/10) = 4 + (Q/10), which yields Q=30. Then find MC(20) = 4 + (20/10) = $6. Then evaluate DWL as the area of a triangle: **$10** (see red triangle below).



(3) [Cournot duopoly]

a. $TR_1 = P\, q_1 =$ $\mathbf{15q_1 - (q_1^2/10) - (q_1q_2/10)}$ **.**

b. $MR_1 = \partial TR_1(q_1,q_2) / \partial q_1 =$ $\mathbf{15 - (2q_1/10) - (q_2/10)}$ **.**

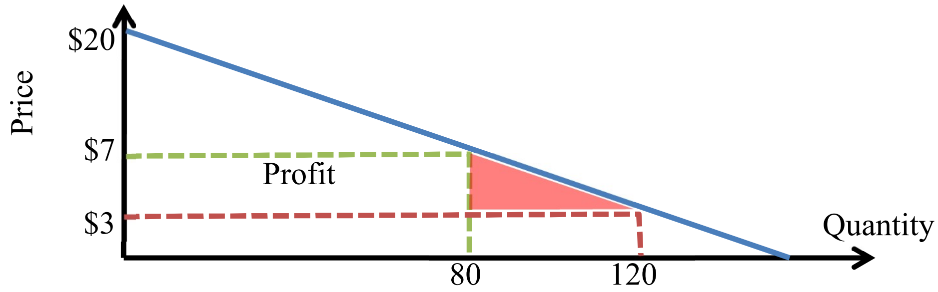
c. Set MR_1 = MC = $3 and solve to get $\mathbf{q_1^* = 60 - (q_2/2)}$ **.**

d. Since $q_1^* = q_2^*$, $q_1^* = 60 - q_1^*/2$. Solving yields $\mathbf{q_1^* = 40}$ $= q_2^*$.

e. $Q^* = q_1^* + q_2^* =$ **80**. Substituting into demand equation: P* = 15 – (80/10) = **$7.**

f. Profit = (P*×Q*) – (AC×Q*) = (P*-AC)×Q* = (7-3)×80 = **$320.**

g. The efficient level of output lies where marginal cost intersects demand ("marginal cost pricing"). Find this quantity by setting P = MC, or P = 15 – (Q/10) = 3 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 (see below). This is the area of a triangle, equal to **$80** (see red triangle below).



IV. Critical thinking

(1) Edgeworth box.

If two people have identical utility functions, then they will have identical MRSC functions as well, since MRSC = $MU_2/MU_1 = \frac{\partial U/\partial q_2}{\partial U/\partial q_1}$. Moreover, at the center of the Edgeworth box, the two people have equal quantities of q_1 and q_2. Therefore, the values of their MRSC functions will be equal at the center of the box. The contract curve connects all points in the box where the values of the two people's MRSC functions are equal. So, the contract curve must pass through the center of the box if two people have identical utility functions.

(2) Marginal revenue and elasticity.

Marginal revenue can be written $MR = P\left(1+\frac{1}{\varepsilon}\right)$, where P denotes the price and ε denotes the price elasticity of demand (negative). If demand is inelastic, then $-1 < \varepsilon < 0$, which implies that $\frac{1}{\varepsilon} < -1$, and *MR is negative*. If MR is negative, the monopolist can increase revenue by *decreasing* quantity. Now, decreasing quantity will most likely decrease cost (and certainly will not increase cost) so, if demand is inelastic, the monopolist can increase profit by decreasing quantity. The monopolist will surely continue to decrease quantity until profit no longer increases, which can occur only if demand is no longer inelastic.

Version B

I. Multiple choice

(1)a. (2)e. (3)b. (4)a. (5)d. (6)b. (7)b. (8)d. (9)a. (10)b.
(11)d. (12)d. (13)c. (14)a.

II. Short answer

(1) a. 4 units of food. b. 1/4 units of clothing. c. slope = -4.
d. $P_{clothing}$ = \$16, because slope of each consumer's budget line = $-P_{clothing}/P_{food}$ = -4.

(2) a. $P_A = MC / (1 + [1/\varepsilon_A])$ = \$15.
b. $P_C = MC / (1 + [1/\varepsilon_C])$ = \$6.

(3) a. $L = 1/|\varepsilon| = 1/4$. b. $L = 1/(n\ |\varepsilon|) = 1/20$.

(4) a. \$7. b. 6 thousand. c. \$0 because P=MC.
d. MR = 13 – 2Q ("Same intercept, twice the slope as demand").
e. Plot MR as a straight line with P-intercept = \$13, slope = -2/thousand.
f. \$9. g. 4 thousand. h. \$4 thousand.

(5) a. Pareto optimal: no, no, yes, yes.
b. Dominant-strategy equilibria: no, no, no, no.
c. Nash equilibria in pure strategies: no, no, yes, yes.

III. Problems

(1) [Exchange efficiency] Note that Xavier's $MRS_X = 3q_1/q_2$ and Yolanda's $MRS_Y = q_1/(5q_2)$.

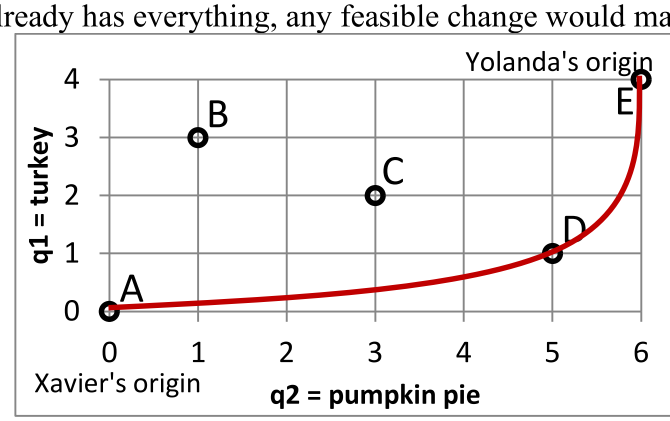
a. **Yes,** A is Pareto-efficient, because no one can be made better off without someone else being made worse off. Yolanda already has everything, so she cannot be made better off. Xavier has nothing, so he cannot be made better off without taking some of Yolanda's turkey or pumpkin pie, which would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

b. **No**, B is not Pareto-efficient, because $MRS_X = 9 \neq MRS_Y = 1/25$.

c. **No**, C is not Pareto-efficient, because $MRS_X = 2 \neq MRS_Y = 2/15$.

d. **Yes,** D is Pareto-efficient, because $MRS_X = 3/5 = MRS_Y = 3/5$.

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

f. 

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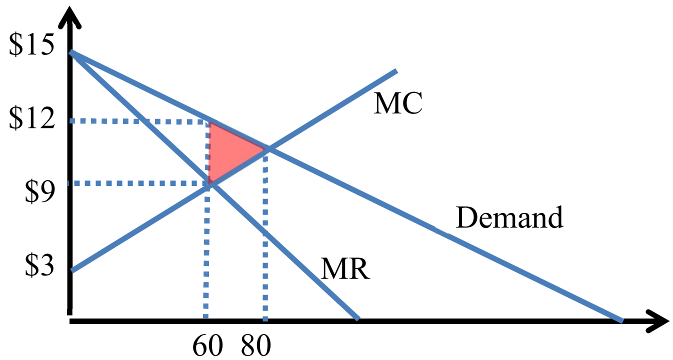
(2) [Monopoly, profit maximization]

a. MC = dTC/dQ = **3 + (Q/10).**

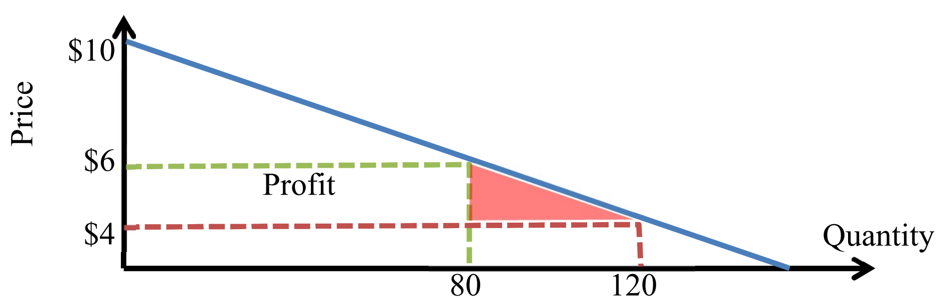
b. AC = TC/Q = **3 + (Q/20).**

c. First find total revenue = P×Q = 15Q – (Q^2/20). So MR = dTR/dQ = **15 – (Q/10).**

d. Set MC = MR and solve to get Q_M = **60**.
e. Substitute into demand function: $P_M = 15 - (60/20)$ = **$12**.
f. Profit = TR – TC = $(12\times60) - (3\times60 + 60^2/20)$ = **$360**.
g. The efficient level of output lies where marginal cost intersects demand ("marginal cost pricing"). Find this quantity by setting P = MC, or $15 - (Q/20) = 3 + (2Q/20)$, which yields Q=80. Then find MC(60) = 3 + (2×60/20) = $9. Then evaluate DWL as the area of a triangle: **$30** (see red triangle below).



(3) [Cournot duopoly]
a. $TR_1 = P\,q_1 = \mathbf{10q_1 - (q_1^2/20) - (q_1q_2/20)}$ **.**
b. $MR_1 = \partial TR_1(q_1,q_2) / \partial q_1 = \mathbf{10 - (2q_1/20) - (q_2/20)}$ **.**
c. Set MR_1 = MC = $4 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. $Q^* = q_1^* + q_2^*$ = **80**. Substituting into demand equation: $P^* = 15 - (80/10)$ = **$6.**
f. Profit = $(P^*\times Q^*) - (AC\times Q^*) = (P^*-AC)\times Q^* = (6-4)\times80$ = **$160.**
g. The efficient level of output lies where marginal cost intersects demand ("marginal cost pricing"). Find this quantity by setting P = MC, or $P = 10 - (Q/20) = 4$ 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 (see below). This is the area of a triangle, equal to **$40** (see red triangle below).



IV. Critical thinking
Same as version A.

[end of answer key]