ECON 173 - Intermediate Microeconomic Analysis
Drake University, Fall 2018
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FINAL EXAMINATION ANSWER KEY

Version A

I. Multiple choice

(1)b. (2)c. (3)b. (4)c. (5)d. (6)b. (7)a. (8)c. (9)a. (10)e.
(11)b. (12)b. (13)d. (14)c. (15)a. (16)a. (17)a. (18)c. (19)a. (20)c.

II. Short answer

(1) Note: This graph is based on Hal Varian's presentation of income and substitution effects in his intermediate microeconomics textbooks. Other textbooks offer different graphical presentations.
a. \$10. b. 3 mini-pizzas. c. \$3.
d. 9 mini-pizzas. e. 4 mini-pizzas. f. 2 mini-pizzas.

(2) a. elastic. b. decrease. c. 6 %.
d. decrease. e. 1 %.

(3) a. 0 thousand (because price is below shutdown price).
b. 8 thousand (using rule P=MC to find q).
c. 11 thousand (using rule P=MC to find q).
d. \$6 (because breakeven price = min(SATC)).
e. \$2 (because shutdown price = min(SAVC)).

(4) a. export. b. 5 million gallons. c. decrease.
d. \$7.5 million. e. increase. f. \$10 million.
g. increase. h. \$2.5 million.

(5) a. \$6 b. 10 thousand c. \$0
d. MR = 16 – 2Q
e. MR is straight line with P-intercept = \$16, slope = -2/thousand
f. \$10 g. 6 thousand h. \$12 thousand.

(6) a. 2 units of food b. 1/2 units of health care c. slope = -1/2
d. P_{food} = \$15, because slope of each consumer's budget line = $-P_{food}/P_{health}$ = -1/2.

(7) a. 150 units, because with no penalty, factories pollute until MB=0.
b. \$8. Set demand = $Q_{old}+Q_{new}$ = 30, substitute P for MB, and solve for P.
c. 20 permits, substituting \$8 for MB in Q_{old} = 100 – 10 MB.
d. 10 permits, substituting \$8 for MB in Q_{new} = 50 – 5 MB.
e. \$8. Again, set demand = $Q_{old}+Q_{new}$ = 30, substitute P for MB, and solve for P.

III. Problems

(1) [Budgets and choice]
a. Equation for budget line: $75 = 6\,q_1 + 3\,q_2$.
b. MRSC = $MU_2/MU_1 = \frac{q_1}{2(q_2-10)}$.

c. Solve the tangency condition (MRSC = p_2/p_1 = 2/1) jointly with equation for budget line (see part a) to get q_1^* = 5, q_2^* = 15.

(2) [Production functions]

a. $MP_1 = \frac{1}{2}(x_1 + x_2)^{-1/2} = \frac{1}{2(x_1+x_2)^{1/2}}$. YES, there are diminishing returns to input 1, because as x_1 increases (and x_2 is held constant), MP_1 decreases.

b. $MRSP = MP_2/MP_1 = \frac{\frac{1}{2}(x_1+x_2)^{-1/2}}{\frac{1}{2}(x_1+x_2)^{-1/2}} = 1$. No, this function does NOT have diminishing MRSP, because as x_1 decreases and x_2 increases, MRSP remains constant.

c. Check returns to scale:

$$f(ax_1, ax_2) = (ax_1 + ax_2)^{1/2} = \left(a(x_1 + x_2)\right)^{1/2} = a^{1/2}(x_1 + x_2)^{1/2},$$
$$= a^{1/2}\, q < a\, q \text{ , for all a>1.}$$

So this production function has DECREASING returns to scale.

(3) [Cournot duopoly]

a. $TR_1 = P\, q_1 = \mathbf{14q_1 - (q_1^2/50) - (q_1 q_2/50)}$ **.**

b. $MR_1 = \partial TR_1(q_1,q_2) / \partial q_1 = \mathbf{14 - 2q_1/50 - q_2/50}$ **.**

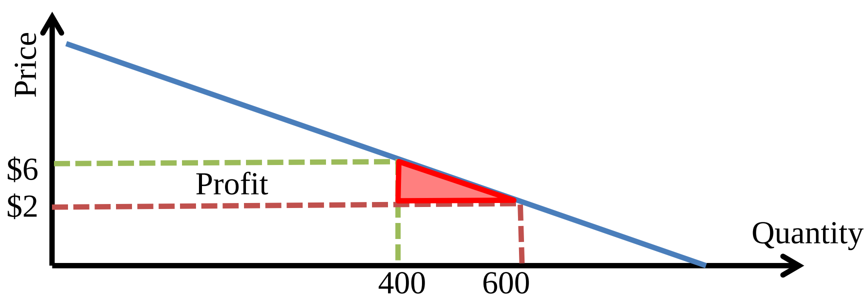
c. Set MR_1 = MC = \$2 and solve to get $\mathbf{q_1^* = 300 - q_2/2}$ **.**

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* = 14 – (400/50) = **\$6.**

f. Profit = (P*×Q*) – (AC×Q*) = (P*-AC)×Q* = (6-2)×400 = **\$1600.**

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/50) 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 **\$400**.



(4) [External cost and Pigou tax]

a. Set $P_D = P_S$ and solve to get Q** = 1000, P = \$6.

b. MSC = P_S + MEC = 2 + (2Q/200).

c. Set MSC = P_D and solve to get Q* = 600.

d. DWL = (1/2) × (1000-600) × 6 = \$1200.

e. Pigou tax rate = MEC(600) = \$4.

(5) [Uncertainty, risk aversion, demand for insurance.]

a. E(I) = (0.75 × 120) + (0.25 × 40) = \$100 .

b. E(U) = 0.75 × (10-(240/120)) + 0.25 × (10-(240/40)) = 7 utils.

c. Set U(I) = 10 – (240/I) = 7 and solve to get I* = \$80 .

d. Willing to pay \$120 - \$80 = \$40.

e. Fair insurance premium = 0.25 × \$80 = \$20 .

(6) [Hidden characteristics and adverse selection]

a. $P_D = 40 + EL = 340 – 0.2\ Q$.

b. MC = EL = 300 – 0.2 Q.

c. If the market were efficient, everyone (Q=1000) would get insurance because everyone is willing to pay more than the marginal cost of insurance: $P_D > MC$ for all values of Q.

d. AC = 300 – 0.1 Q.

e. Set P_D = AC and solve to get Q = 400. P = AC(400) = \$260.

IV. Essay

A good answer should first give an example of a situation in which a market produces too much output, such as a government subsidy or an external cost. The answer should explain why too much output is produced and should describe an accompanying graph. At a minimum, the graph should show supply and demand, the socially-optimal output level, the actual output level, and the deadweight loss triangle.

Then the answer should give an example of a situation in which a market produces too little output, such as monopoly, collusion, Cournot oligopoly, external benefits, or adverse selection. Again, the answer should explain why too little output is produced and should describe an accompanying graph. Again, the graph should show supply and demand, the socially-optimal output level, the actual output level, and the deadweight loss triangle.

For full credit, both graphs must be accurate and intelligible. In particular, axes and curves should be labeled. So should optimal and actual output levels, and the deadweight loss triangle.

Version B

I. Multiple choice

(1)c. (2)c. (3)d. (4)d. (5)c. (6)d. (7)c. (8)d. (9)e. (10)b.
(11)c. (12)a. (13)b. (14)a. (15)b. (16)b. (17)b. (18)b. (19)d. (20)a.

II. Short answer

(1) Note: This graph is based on Hal Varian's presentation of income and substitution effects in his intermediate microeconomics textbooks. Other textbooks offer different graphical presentations.

a. \$3.	b. 11 sandwiches.	c. \$12.
d. 4 sandwiches.	e. -2 sandwiches.	f. -5 sandwiches.

(2)

a. inelastic.	b. decrease.	c. 4 %.
d. increase.	e. 1 %.	

(3) a. 9 thousand (using rule P=MC to find q).

b. 0 thousand (because price is below shutdown price).

c. 7 thousand (using rule P=MC to find q).

d. \$7 (because breakeven price = min(SATC)).

e. \$4 (because shutdown price = min(SAVC)).

(4)

a. import.	b. 5 million gallons.	c. increase.
d. \$8.5 million.	e. decrease.	f. \$6 million.

g. increase. h. \$2.5 million.

(5) 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.

(6) a. 3 units of food b. 1/3 units of health care c. slope = -1/3

d. P_{food} = \$10, because slope of each consumer's budget line = $-P_{food}/P_{health}$ = -1/3.

(7) a. 150 units, because with no penalty, factories pollute until MB=0.

b. \$6. Set demand = $Q_{old}+Q_{new}$ = 60, substitute P for MB, and solve for P.

c. 40 permits, substituting \$6 for MB in Q_{old} = 100 – 10 MB.

d. 20 permits, substituting \$6 for MB in Q_{new} = 50 – 5 MB.

e. \$6. Again, set demand = $Q_{old}+Q_{new}$ = 60, substitute P for MB, and solve for P.

III. Problems

(1) [Budgets and choice]

a. Equation for budget line: $42 = 3\ q_1 + 2\ q_2$.

b. $MRSC = MU_2/MU_1 = (2\ q_1^{1/2}) / q_2^{1/2}$.

c. Solve the tangency condition ($MRSC = p_2/p_1 = 2/1$) jointly with equation for budget line (see part a) to get $q_1^* = 2$, $q_2^* = 18$.

(2) [Production functions]

a. $MP_1 = 2(x_1 + x_2)$. No, there are no diminishing returns to input 1, because as x_1 increases (and x_2 is held constant), MP_1 increases.

b. $MRSP = MP_2/MP_1 = \frac{2\,(x_1+x_2)}{2\,(x_1+x_2)} = 1$. No, this function does NOT have diminishing MRSP, because as x_1 decreases and x_2 increases, MRSP remains constant.

c. Check returns to scale:

$$f(ax_1, ax_2) = (ax_1 + ax_2)^2 = \big(a(x_1 + x_2)\big)^2 = a^2(x_1 + x_2)^2,$$
$$= a^2\, q > a\, q\ , \text{ for all a>1.}$$

So this production function has INCREASING returns to scale.

(3) [Cournot duopoly]

a. $TR_1 = P\ q_1 =$ $\mathbf{15q_1 - (q_1^2/100) - (q_1q_2/100)}$ **.**

b. $MR_1 = \partial TR_1(q_1,q_2) / \partial q_1 =$ $\mathbf{15 - 2q_1/100 - q_2/100}$ **.**

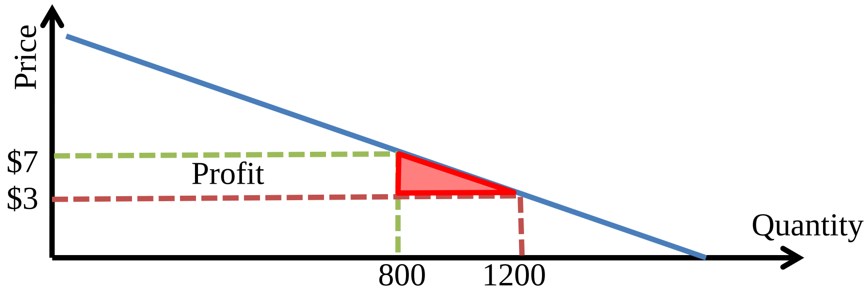
c. Set MR_1 = MC = \$3 and solve to get $\mathbf{q_1^* = 600 - q_2/2}$ **.**

d. Since $q_1^* = q_2^*$, $q_1^* = 600 - q_1^*/2$. Solving yields $\mathbf{q_1^* = 400}$ $= q_2^*$.

e. $Q^* = q_1^* + q_2^* =$ **800**. Substituting into demand equation: P* = 15 – (800/100) = **\$7.**

f. Profit = (P*×Q*) – (AC×Q*) = (P*-AC)×Q* = (7-3)×800 = **\$3200.**

g. The efficient level of output lies where marginal cost intersects demand ("marginal cost pricing"). Find this quantity by setting MC = \$3 = P = 15 – (Q/100) and solving to get Q = 1200. Deadweight loss is the area between demand and marginal cost, from the Cournot equilibrium quantity Q*=800 to the efficient quantity = 1200 (see below). This is the area of a triangle, equal to **\$800**.



(4) [External benefit and Pigou subsidy]

a. Set $P_D = P_S$ and solve to get Q** = 100, P = $7.

b. MSB = P_D + MEB = 26 – (3Q/20).

c. Set MSB = P_S and solve to get Q* = 120.

d. DWL = (1/2) × (120-100) × 4 = $40.

e. Pigou subsidy rate = MEB(120) = $3.

(5) [Uncertainty, risk aversion, demand for insurance.]

[This question assumes ridiculously small dollar values to make calculations easier.]

a. E(I) = (0.75 × 40) + (0.25 × 8) = $32 .

b. E(U) = 0.75 × (9-(40/40)) + 0.25 × (9-(40/8)) = 7 utils.

c. Set U(I) = 9 – (40/I) = 7 and solve to get I* = $20 .

d. Willing to pay $40 - $20 = $20.

e. 0.25 × $32 = $8 .

(6) [Hidden characteristics and adverse selection]

a. P_D = 60 + EL = 560 – 0.2 Q.

b. MC = EL = 500 – 0.2 Q.

c. If the market were efficient, everyone (Q=1000) would get insurance because everyone is willing to pay more than the marginal cost of insurance: P_D > MC for all values of Q.

d. AC = 500 – 0.1 Q.

e. Set P_D = AC and solve to get Q = 600. P = AC(600) = $440.

IV. Short Essay

Same as version A.

[end of answer key]