ECON 173 - Intermediate Microeconomic Analysis
Drake University, Fall 2023
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FINAL EXAMINATION ANSWER KEY

Version A

I. Multiple choice

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

II. Short answer

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

(2) a. zero kilometers. b. MSB = 1000 × (100 – 10 Q) = 100,000 – 10,000 Q.
c. 4 kilometers.

(3) a. \$2. b. 10 units. c. \$8.
d. 2 units. e. -6 units. f. -2 units

(4) a. 12 thousand. b. zero. c. 11 thousand.
d. \$8. e. \$3.

(5) a. export. b. 8 million. c. decrease.
d. \$12 million. e. increase. f. \$20 million.
g. increase. h. \$8 million.

(6) a. 3 units of food. b. 1/3 units of clothing. c. -3.
d. \$18.

(7) a. Monopoly: NO, NO. b. Perfection competition: YES, YES.
c. Monopolistic competition: YES, NO.

(8) a. \$8. b. 6 thousand. c. \$0.
d. MR = 14 – 2Q. e. intercept = \$14, slope = -2.
f. \$10. g. 4 thousand. h. \$4 thousand.

III. Problems

(1) [Budgets and choice]

a. Equation for budget line (income=spending): $100 = 5\, q_1 + 4\, q_2$.

b. $MRSC = MU_2/MU_1 = \frac{q_1+4}{q_2}$.

c. Solve the tangency condition ($MRSC = p_2/p_1 = 4/5$) jointly with equation for budget line (see part a) to get $q_1^* = 8$, $q_2^* = 15$.

(2) [Input substitution; Returns to scale]

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

b. $MRSP = \frac{MP_2}{MP_1} = \frac{3 + 2\,x_1^{1/2}\,x_2^{-1/2}}{2 + 2\,x_1^{-1/2}\,x_2^{1/2}}$. YES, this function has diminishing MRSP, because as x_1 decreases and x_2 increases, the numerator decreases and the denominator increases. Therefore, MRSP decreases.

c. Check returns to scale:

$f(ax_1, ax_2) = 2(a\,x_1) + 3(a\,x_2) + 4\,(a\,x_1)^{1/2}\,(a\,x_2)^{1/2}$

$= a\,2x_1 + a\,3x_2 + 4\;a^{1/2}\,x_1^{1/2}\;a^{1/2}\,x_2^{1/2}$

$= a\,2x_1 + a\,3x_2 + a\,4\,x_1^{1/2}\,x_2^{1/2}$

$= a\left(2x_1 + 3x_2 + 4\,x_1^{1/2}\,x_2^{1/2}\right)$

$= a\,q$, for all a >1.

Thus, multiplying all inputs by the same factor (a) causes output to increase by the same factor. So, this production function has CONSTANT returns to scale.

(3) [Cournot duopoly]

a. $TR_1 = P\,q_1 = \mathbf{13q_1 - (q_1^2/20) - (q_1q_2/20)}$.

b. $MR_1 = \partial TR_1(q_1,q_2) / \partial q_1 = \mathbf{13 - (2q_1/20) - (q_2/20)}$.

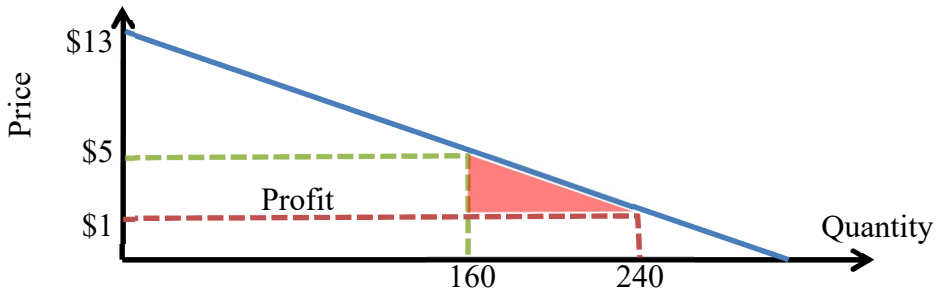
c. Set $MR_1 = MC = \$2$ and solve to get $\mathbf{q_1^* = 120 - (q_2/2)}$.

d. Since $q_1^* = q_2^*$, $q_1^* = 120 - q_1^*/2$. Solving yields $\mathbf{q_1^* = 80} = q_2^*$.

e. $Q^* = q_1^* + q_2^* = \mathbf{160}$. Substituting into demand equation: $P^* = 13 - (160/20) = \mathbf{\$5.}$

f. Profit = $(P^* \times Q^*) - (AC \times Q^*) = (P^* - AC) \times Q^* = (5-1) \times 160 = \mathbf{\$640.}$

g. The efficient level of output lies where marginal cost intersects demand ("marginal cost pricing"). Find this quantity by setting $MC = \$1 = P = 13 - (Q/20)$ 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** (see red triangle below).



(4) [External cost and Pigou tax]

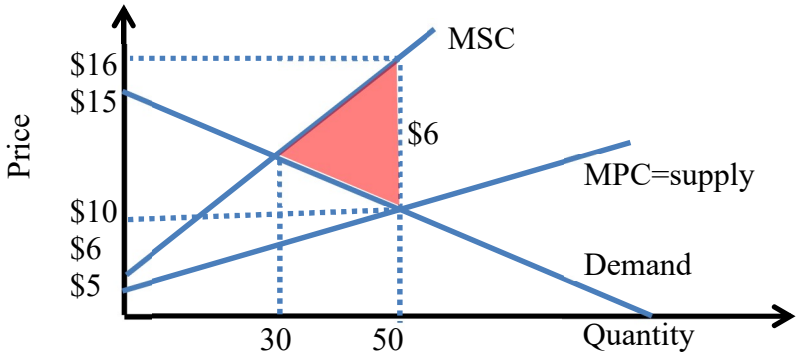
a. Set $P_D = P_S$ and solve to get $Q^{**} = 50$, $P^{**} = \$10$.

b. $MSC = P_S + MEC = 6 + (2Q/10)$.

c. Set $MSC = P_D$ and solve to get $Q^* = 30$.

d. $DWL = (1/2) \times (50-30) \times (16-10) = \$60$ (see red triangle below).

e. Pigou tax rate = $MEC(30) = \$4$.



(5) [Uncertainty, risk aversion, demand for insurance.] $U(I) = 9 - (100/I)$
a. $E(I) = (0.75 \times 100) + (0.25 \times 20) = \$80$.
b. $E(U) = 0.75 \times (9 - 100/100) + 0.25 \times (9 - 100/20) = 7$ utils.
c. Set $U(I) = 9 - 100/I = 7$ and solve to get $I^* = \$50$.
d. Willing to pay \$100 - \$50 = \$50.
e. Fair insurance premium = $0.25 \times \$80 = \$20$.

(6) [Hidden characteristics and adverse selection]
a. $P_D = 10 + EL = 310 - 0.1\ Q$.
b. $MC = EL = 300 - 0.1\ Q$.
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. $AC = 300 - 0.05\ Q$.
e. Set $P_D = AC$ and solve to get $Q^* = 200$. $P^{**} = AC(200) = \$290$.

V. Critical thinking

(1) The government would likely make a **loss.** The government cannot observe (or chooses not to observe) the current market value of the houses it is buying, so the current value of houses is a **hidden characteristic.** In response to the government's offer, homeowners would only sell to the government if the government's price were greater than the market price, so the government would make a loss when it resold those houses on the open market. This is an example of **adverse selection** because the government's offer would attract houses in poorer-than-average condition.

(2) The grade insurance program will likely make a **loss** for Drake. Students' effort to pass courses is not observed by Drake, so effort is a **hidden action.** Once insured, students might make less effort to pass courses if they are paid \$1000 when they fail, so the rate of failure would likely rise above 5 percent after the program is implemented. This is an example of **moral hazard** because insurance causes students to take less care to avoid failing courses.

Version B

I. Multiple choice

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

II. Short answer

(1) a. inelastic. b. increase. c. 3 %.
d. decrease. e. 1 %.

(2) a. zero kilometers. b. MSB = 1000 × (80 – 10 Q) = 80,000 – 10,000 Q.
c. 3 kilometers.

(3) a. \$4. b. 10 units. c. \$10.
d. 3 units. e. -5 units. f. -2 units

(4) a. zero. b. 8 thousand c. 11 thousand.
d. \$6. e. \$2.

(5) a. import. b. 4 million. c. increase.
d. \$9 million. e. decrease. f. \$7 million.
g. increase. h. \$2 million.

(6) a. 2 units of food. b. 1/2 units of clothing. c. -2.
d. \$12.

(7) a. Perfection competition: YES, YES. b. Monopoly: NO, NO.
c. Monopolistic competition: NO, YES.

(8) a. \$3. b. 9 thousand. c. \$0.
d. MR = 12 – 2Q. e. intercept = \$12, slope = -2.
f. \$7. g. 5 thousand. h. \$10 thousand.

III. Problems

(1) [Budgets and choice]
a. Equation for budget line (income=spending): $100 = 5\ q_1 + 4\ q_2$.
b. MRSC = $MU_2/MU_1 = q_1 / (q_2 - 5)$.
c. Solve the tangency condition (MRSC = $p_2/p_1 = 4/5$) jointly with equation for budget line (see part a) to get $q_1^* = 12$, $q_2^* = 10$.

(2) [Input substitution; Returns to scale]
a. $MP_1 = 2\ x_1^{-1/3}\ x_2^{2/3}$. Yes, there are diminishing returns to input 1, because as x_1 increases (and x_2 is held constant), MP_1 decreases.
b. $MRSP = MP_2/MP_1 = \frac{2\ x_1^{2/3}\ x_2^{-1/3}}{2\ x_1^{-1/3}\ x_2^{2/3}} = \frac{x_1}{x_2}$. Yes, this function does have diminishing MRSP, because as x_1 decreases and x_2 increases, MRSP diminishes.
c. Check returns to scale:
$f(ax_1, ax_2) = 3\ (ax_1)^{2/3}\ (ax_2)^{2/3} = 3\ a^{2/3}\ {x_1}^{2/3}\ a^{2/3}\ {x_2}^{2/3}$
$= a^{2/3}\ a^{2/3}\ \left(3\ {x_1}^{2/3}\ {x_2}^{2/3}\right) = a^{4/3}\ q > aq,$ for all a>1.

Thus, multiplying all inputs by the same factor (a) causes output to increase by a larger factor. So this production function has INCREASING returns to scale.

(3) [Cournot duopoly]

a. $TR_1 = P\ q_1 =$ **$20q_1 - (q_1^2/10) - (q_1q_2/10)$.**

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

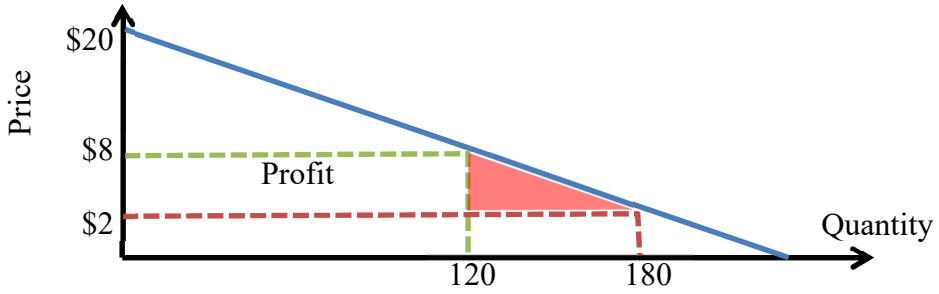
c. Set $MR_1 = MC = \$2$ and solve to get **$q_1^* = 90 - (q_2/2)$.**

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. Profit = $(P^* \times Q^*) - (AC \times Q^*) = (P^* - AC) \times Q^* = (8-2) \times 120 =$ **\$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 **\$80** (see red triangle below).



(4) [External benefit and Pigou subsidy]

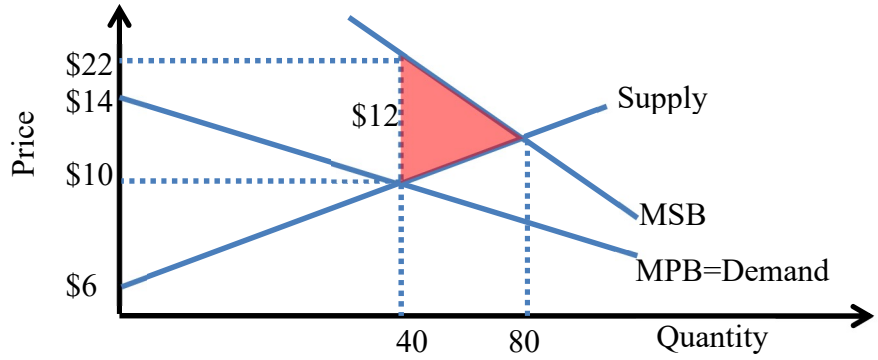
a. Set $P_D = P_S$ and solve to get $Q^{**} = 40$, $P^{**} = \$10$.

b. $MSB = P_D + MEB = 30 - (2Q/10)$.

c. Set $MSB = P_S$ and solve to get $Q^* = 80$.

d. DWL = $(1/2) \times (22-10) \times (80-40) = \$240$ (see red triangle below).

e. Pigou subsidy rate = $MEB(100) = \$3$.



(5) [Uncertainty, risk aversion, demand for insurance.] $U(I) = 10 - (80/I)$

a. $E(I) = (0.50 \times 40) + (0.50 \times 10) = \$25$.

b. $E(U) = 0.50 \times (10 - 80/40) + 0.50 \times (10 - 80/10) = 6$ utils.

c. Set U(I) = 10 – 80/I = 6 and solve to get I* = \$20 .
d. Willing to pay \$40 - \$20 = \$20.
e. Fair insurance premium = 0.50 × \$30 = \$15 .

(6) [Hidden characteristics and adverse selection]
a. $P_D = 50 + EL = 450 – 0.2\ Q$.
b. $MC = EL = 400 – 0.2\ Q$.
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. $AC = 400 – 0.1\ Q$.
e. Set $P_D = AC$ and solve to get Q* = 500. P** = AC(500) = \$350.

V. Critical thinking
Same as version A.

[end of answer key]