ECON 173 - Intermediate Microeconomic Analysis
Drake University, Fall 2021
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EXAMINATION #2 ANSWER KEY
"Consumers and Demand"

Version A

I. Multiple choice

(1)a . (2)c. (3)a. (4)b. (5)c. (6)a. (7)a. (8)c. (9)c. (10)d.

II. Short answer

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

(2) a. luxury or superior good. b. increase. c. 5 %.
d. increase. e. 1 %.

(4) Note: This graph is based on Slutsky's approach to income and substitution effects, not Hicks's approach.
a. \$3. b. 10 units. c. \$10.
d. 4 units. e. – 4 units. f. – 2 units.

(5) a. $\varepsilon^{comp} = -0.19$. b. decrease. c. 2.5 %.
d. decrease e. 1.9 %.

(6) a. Laspeyres = 140. b. Paasche = 120. c. $\sqrt{140 \times 120}$.

III. Problems

(1) [Budgets and choice]
a. Equation for budget line (income=spending): $60 = 3\ q_1 + 2\ q_2$.
b. $\text{MRSC} = MU_2/MU_1 = (\ ½\ q_2^{-1/2}\ ) / (\ ½\ q_1^{-1/2}\ ) = q_2^{-1/2} / q_1^{-1/2} = (q_1 / q_2)^{1/2}$.
c. Solve the tangency condition ($\text{MRSC} = p_2/p_1 = 2/3$) jointly with equation for budget line (see part a) to get $q_1^* = 8$, $q_2^* = 18$.

(2) [Properties of individual demand functions]
a. Homogeneity of degree zero means that if income and all prices are multiplied by the same factor, the quantity demanded never changes. Check homogeneity of the demand function by replacing I by (aI), replacing p_1 by (ap_1), and replacing p_2 by (ap_2), where a is an arbitrary factor:

$$5\ (a\ p_1)^{-0.8}\ (a\ I)^{1.2}\ (a\ p_2)^{0.1}$$
$$= a^{-0.8}\ a^{1.2}\ a^{0.1}\ (5\ p_1^{-0.8}\ I^{1.2}\ p_2^{0.1})$$
$$= a^{0.5}\ (5\ p_1^{-0.8}\ I^{1.2}\ p_2^{0.1})$$

Note that the "a" factor does *not* cancel. So multiplying income and prices by some arbitrary positive factor a *does* change the quantity demanded. The function is NOT homogeneous of degree zero in income and prices.

b. $\frac{\partial q_1^*}{\partial p_1} = -0.8\ (5\ p_1^{-1.8}\ I^{1.2}\ p_2^{0.1})$. This expression is negative, so good #1 is an ordinary good, not a Giffen good.

c. $\frac{\partial q_1^*}{\partial I} = \ 1.2\ (5\ p_1^{-0.8}\ I^{0.2}\ p_2^{0.1})$. This expression is positive, so good #1 is a normal good, not an inferior good.

d. $\frac{\partial q_1^*}{\partial p_2} = \ 0.1\ (5\ p_1^{-0.8}\ I^{1.2}\ p_2^{-0.9})$. This expression is positive, so goods #1 and #2 are substitutes, not complements.

(3) [Finding individual demand functions]

a. MRS = $MU_2/MU_1 = (2q_1) / q_2$.

b. Solve MRS = p_2/p_1 jointly with $I = p_1q_1 + p_2q_2$ to get

$q_1^* = \frac{I}{3\,p_1}$, and c. $q_2^* = \frac{2\,I}{3\,p_2}$.

III. Critical thinking

(1) The minimum amount of income that Ana must have to attain a target level of utility of $\bar{U}$= 300 utils is the cost of a bundle that is (a) on her target indifference curve and (b) at a tangency point with a budget line. Since Ana's utility function is given as $U= q_1\,q_2$, the equation for the target indifference curve is

(a) $300 = q_1\,q_2$.

The general formula for the tangency condition is MRSC = p_2/p_1 . Since Amanda's utility function is given here as $U= q_1\,q_2$, we have MRSC = $MU_2/MU_1 = q_1/q_2$. The price ratio is p_2/p_1 = \$4/\$3. So the tangency condition is

(b) $q_1/q_2 = 4/3$.

Solving (a) and (b) jointly gives $q_1^* = 20$ and $q_2^* = 15$. This bundle will cost 20×\$3 + 15×\$4 = **\$120**, answer.

(2) Because all prices increase at the same rate, all three of Bob's COL indices increase at exactly the *same rate*. *Justification with algebra:*

Bob's Laspeyres COL index

$$= \frac{p_s^{new}q_s^{old}+p_g^{new}q_g^{old}}{p_s^{old}q_s^{old}+p_g^{old}q_g^{old}} \times 100 = \frac{2p_s^{old}q_s^{old}+2p_g^{old}q_g^{old}}{p_s^{old}q_s^{old}+p_g^{old}q_g^{old}} \times 100$$
$$= 2\left(\frac{p_s^{old}q_s^{old}+p_g^{old}q_g^{old}}{p_s^{old}q_s^{old}+p_g^{old}q_g^{old}}\right) \times 100 = 2 \times 100 = 200\ .$$

Bob's Paasche COL index

$$= \frac{p_s^{new}q_s^{new}+p_g^{new}q_g^{new}}{p_s^{old}q_s^{new}+p_g^{old}q_g^{new}} \times 100 = \frac{2p_s^{old}q_s^{new}+2p_g^{old}q_g^{new}}{p_s^{old}q_s^{new}+p_g^{old}q_g^{new}} \times 100$$
$$= 2\left(\frac{p_s^{old}q_s^{new}+p_g^{old}q_g^{new}}{p_s^{old}q_s^{new}+p_g^{old}q_g^{new}}\right) \times 100 = 2 \times 100 = 200\ .$$

Bob's Fisher COL index

$$= \sqrt{Laspeyres\ \times Paasche} = \sqrt{200 \times 200} = 200\ .$$

Version B

I. Multiple choice

(1)b . (2)c. (3)f. (4)a. (5)c. (6)b. (7)b. (8)d. (9)c. (10)b.

II. Short answer

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

(2) a. necessary good. b. increase. c. 2 %.
d. decrease. e. 6 %.

(4) Note: This graph is based on Slutsky's approach to income and substitution effects, not Hicks's approach.
a. $2. b. 10 units. c. $6.
d. 2 units. e. – 6 units. f. – 2 units.

(5) a. $\varepsilon^{comp} = -1.2$. b. decrease. c. 15 %.
d. decrease e. 12 %.

(6) a. Laspeyres = 160. b. Paasche = 130. c. $\sqrt{160 \times 130}$.

III. Problems

(1) [Budgets and choice]

a. Equation for budget line (income=spending): $60 = 4\, q_1 + 9\, q_2$.

b. MRSC = $MU_2/MU_1 = \frac{q_2^{-2}}{q_1^{-2}} = \left(\frac{q_1}{q_2}\right)^2$.

c. Solve the tangency condition (MRSC = $p_2/p_1 = 9/4$) jointly with equation for budget line (see part a) to get $q_1^* = 6$, $q_2^* = 4$.

(2) [Properties of individual demand functions]

a. Homogeneity of degree zero means that if income and all prices are multiplied by the same factor, the quantity demanded never changes. Check homogeneity of the demand function by replacing I by (aI), replacing p_1 by (ap_1), and replacing p_2 by (ap_2) , where a is an arbitrary factor:

$$\frac{0.1(a\,I)+(ap_2)}{(a\,p_1)} + 6 = \frac{a(0.1\,I + p_2)}{a\,(p_1)} + 6 = \frac{(0.1\,I + p_2)}{(p_1)} + 6\,.$$

Note that the "a" factor cancels. So multiplying income and prices by some arbitrary positive factor a *does not* change the quantity demanded. The function <u>is homogeneous of degree zero</u> in income and prices.

b. $\frac{\partial q_1^*}{\partial p_1} = (0.1\,I + p_2)(-1)p_1^{-2} < 0$. This expression is negative, so good #1 is an <u>ordinary good</u>, not a Giffen good.

c. $\frac{\partial q_1^*}{\partial I} = \frac{0.1}{p_1} > 0$. This expression is positive, so good #1 is a <u>normal good</u>, not an inferior good.

d. $\frac{\partial q_1^*}{\partial p_2} = \frac{1}{p_1} > 0$. This expression is positive, so goods #1 and #2 are <u>substitutes</u>, not complements.

(3) [Finding individual demand functions]
a. MRS = MU_2/MU_1 = q_1 / ($3q_2$).
b. Solve MRS = p_2/p_1 jointly with $I = p_1q_1 + p_2q_2$ to get
$q_1^* = \frac{3\,I}{4\,p_1}$, and c. $q_2^* = \frac{I}{4\,p_2}$.

III. Critical thinking

Same as Version A.

[end of answer key]