ECON 173 - Intermediate Microeconomic Analysis
Drake University, Fall 2024
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EXAMINATION #2 ANSWER KEY
"Consumers and Demand"

Version A

I. Multiple choice

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

II. Short answer

(1) a. inelastic. b. decrease. c. 3 %.
d. increase. e. 2 %.

(2) a. necessary good. b. increase. c. 2 %.
d. decrease. e. 3 %.

(3) Note: This graph is based on Slutsky's approach to income and substitution effects, not Hicks's approach.
a. \$6. b. 6 ice cream cones. c. \$3.
d. 3 ice cream cones. e. 3 ice cream cones. f. 2 ice cream cones.

(4) a. $\varepsilon^{comp} = -0.76$. b. decrease. c. 8 % (using ε).
d. decrease e. 7.6 % (using ε^{COMP}).

(5) a. Laspeyres = 160. b. Paasche = 150. c. $\sqrt{160 \times 150}$.

III. Problems

(1) [Budgets and choice]

a. Equation for budget line (income=spending): $150 = 10\, q_1 + 6\, q_2$.

b. $MRSC = MU_2/MU_1 = (q_1+3) / q_2$.

c. Solve the tangency condition ($MRSC = p_2/p_1 = 6/10$) jointly with equation for budget line (see part a) to get $q_1^* = 6$, $q_2^* = 15$.

(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:

$$\big((aI) + 3(ap_2)\big)(ap_1)^{-1} + 5$$
$$= a\big((I) + 3(p_2)\big)a^{-1}(p_1)^{-1} + 5$$
$$= (I + 3p_2)p_1^{-1} + 5.$$

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. $\frac{\partial q_1^*}{\partial p_1} = (I + 3p_2)(-1)p_1^{-2}$. This expression is negative, so good #1 is an ordinary good, not a Giffen good.

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

d. $\frac{\partial q_1^*}{\partial p_2} = 3\, p_1^{-1}$. This expression is positive, so goods #1 and #2 are substitutes, not complements.

(3) [Finding individual demand functions]

a. MRS = $MU_2/MU_1 = (q_1^2\, 4q_2^3) / (2\, q_1\, q_2^4) = (2q_1) / q_2$.

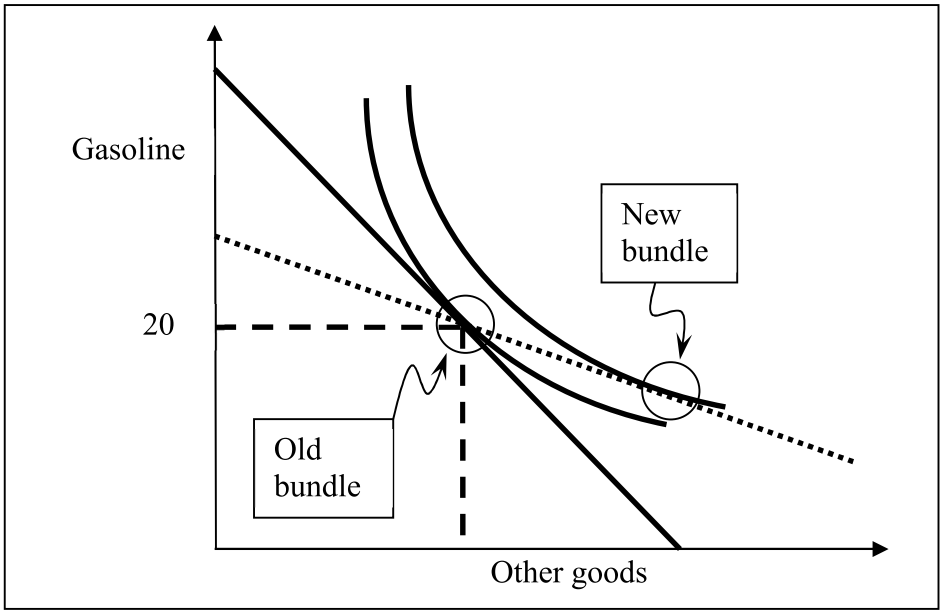
b. Solve MRS = $(2q_1) / q_2 = p_2/p_1$ (the tangency condition) jointly with $I = p_1q_1 + p_2q_2$ (the budget constraint) to get $q_1^* = \frac{I}{3\, p_1}$, and

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

[There are many ways to solve the equations jointly. One way to begin is to cross-multiply the tangency condition to get $2\, p_1\, q_1 = p_2\, q_2$. Then substitute into the budget constraint: $I = p_1\, q_1 + 2\, p_1\, q_1$. Then solve for q_1^* as a function of p_1 and I. Finally, substitute your expression for q_1^* into either the budget constraint or the tangency condition and solve for q_2^* as a function of p_2 and I.]

IV. Critical thinking

(1) Abby originally chose an old bundle at the tangency point between the old budget line (solid line in the graph below) and the indifference curve. The old bundle includes 20 gallons of gasoline, according to the question. Now, we are given that the price of gasoline has risen from \$3 to \$4, so Abby's budget line becomes flatter. However, with her \$20 increase in income, Abby can still exactly afford her old bundle including 20 gallons of gasoline per month. So, Abby's new budget line (dotted line) necessarily passes through her old bundle, but with a flatter slope. Evidently, Abby can now afford a more preferred bundle on the new budget line. That more preferred bundle must be below and to the right of her old bundle, with less gasoline and more other goods. So, conclude that Abby will buy *less gasoline* than before.



(2) If all prices exactly double, then $p_1^{new} = 2\,p_1^{old}$ and $p_2^{new} = 2\,p_2^{old}$. Substituting in the formulas for the three price indexes gives the following:

$$Laspeyres = \frac{p_1^{new}q_1^{old}+p_2^{new}q_2^{old}}{p_1^{old}q_1^{old}+p_2^{old}q_2^{old}} \times 100 = \frac{2p_1^{old}q_1^{old}+2p_2^{old}q_2^{old}}{p_1^{old}q_1^{old}+p_2^{old}q_2^{old}} \times 100 = 2\,\frac{p_1^{old}q_1^{old}+p_2^{old}q_2^{old}}{p_1^{old}q_1^{old}+p_2^{old}q_2^{old}} \times 100 = 200\,.$$

$$Paasche = \frac{p_1^{new}q_1^{new}+p_2^{new}q_2^{new}}{p_1^{old}q_1^{new}+p_2^{old}q_2^{new}} \times 100 = \frac{2p_1^{old}q_1^{new}+2p_2^{old}q_2^{new}}{p_1^{old}q_1^{new}+p_2^{old}q_2^{new}} \times 100 = 2\,\frac{p_1^{old}q_1^{new}+p_2^{old}q_2^{new}}{p_1^{old}q_1^{new}+p_2^{old}q_2^{new}} \times 100 = 200\,.$$

$$Fisher = \sqrt{\text{Laspeyres} \times \text{Paasche}} = \sqrt{200 \times 200} = 200\,.$$

Thus all three price indexes are *identical*, showing *exactly the same increase* in the cost of living.

Version B

I. Multiple choice

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

II. Short answer

(1)	a. elastic.	b. increase.	c. 9 %.
	d. increase.	e. 4 %.	
(2)	a. luxury or superior good.	b. increase.	c. 7 %.
	d. increase.	e. 2 %.	

(3) Note: This graph is based on Slutsky's approach to income and substitution effects, not Hicks's approach.
a. \$3. b. 12 hamburgers. c. \$6.
d. 6 hamburgers. e. -2 hamburgers. f. -4 hamburgers.

(4) a. $\varepsilon^{comp} = -0.8$. b. decrease. c. 9 % (using ε).
d. decrease e. 8 % (using ε^{comp}).

(5) a. Laspeyres = 170. b. Paasche = 155. c. $\sqrt{170 \times 155}$.

III. Problems

(1) [Budgets and choice]
a. Equation for budget line (income=spending): $80 = 5\ q_1 + 2\ q_2$.
b. $MRSC = MU_2/MU_1 = q_1 / (q_2+10)$.
c. Solve the tangency condition ($MRSC = p_2/p_1 = 2/5$) jointly with equation for budget line (see part a) to get $q_1^* = 10$, $q_2^* = 15$.

(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:

$$5\,(a\,I)^{2.0}\,(a\,p_1)^{-0.3}\,(a\,p_2)^{-0.1}$$
$$= a^{2.0}\,a^{-0.3}\,a^{-0.1}\,(5\,I^{2.0}\,p_1^{-0.3}\,p_2^{-0.1})$$
$$= a^{1.6}\,(5\,I^{2.0}\,p_1^{-0.3}\,p_2^{-0.1})$$

Note that the "a" factor does *not* cancel out. 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. $\frac{\partial q_1^*}{\partial p_1} = -0.3\,(5\,I^{2.0}\,p_1^{-1.3}\,p_2^{-0.1})$. This expression is negative, so good #1 is an ordinary good, not a Giffen good.

c. $\frac{\partial q_1^*}{\partial I} = 2\,(5\,I^{1.0}\,p_1^{-0.3}\,p_2^{-0.1})$. This expression is positive, so good #1 is a normal good, not an inferior good.

d. $\frac{\partial q_1^*}{\partial p_2} = -0.1\,(5\,I^{2.0}\,p_1^{-0.3}\,p_2^{-1.1})$. This expression is negative, so goods #1 and #2 are complements, not substitutes.

(3) [Finding individual demand functions]
a. $MRS = MU_2/MU_1 = (5\ q_1^3\ q_2^4) / (3\ q_1^2\ q_2^5) = (5q_1) / (3q_2)$.
b. Solve $MRS = (5q_1) / (3q_2) = p_2/p_1$ (the tangency condition) jointly with $I = p_1q_1 + p_2q_2$ (the budget constraint) to get $q_1^* = \frac{3\,I}{8\,p_1}$, and
c. $q_2^* = \frac{5I}{8\,p_2}$.
[There are many ways to solve the equations jointly. One way to begin is to cross-multiply the tangency condition to get $(5/3)\ p_1\ q_1 = p_2\ q_2$. Then substitute into the

budget constraint: $I = I = p_1q_1 + (5/3)\ p_1\ q_1$. Then solve for q_1* as a function of p_1 and I. Finally, substitute your expression for q_1* into either the budget constraint or the tangency condition and solve for q_2* as a function of p_2 and I.]

IV. Critical thinking

Same as Version A.

[end of answer key]