ECON 173 - Intermediate Microeconomic Analysis
Drake University, Fall 2018
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EXAMINATION #2 ANSWER KEY
"Consumers and Demand"

Version A

I. Multiple choice

(1)b . (2)b. (3)d. (4)c. (5)d.

II. Short answer

(1) Monotonicity implies that bundles above and to the right of X are more preferred, while bundles below and to the left of X are less preferred
a. cannot be determined. b. more preferred. c. more preferred.
d. less preferred. e. less preferred.

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

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

(4) 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.

(5) a. $\varepsilon^{comp} = -0.9$. b. decrease. c. 7.2 %.
d. 1.8 %. e. 5.4 %.

(6) a. Laspeyres = 160. b. Paasche = 145. c. $\sqrt{160 \times 145}$.

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 = $p_2/p_1 = 2/3$) jointly with equation for budget line (see part a) to get $q_1^* = 2$, $q_2^* = 18$.

(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):

$$
\begin{aligned}
&20\ (a\ p_1)^{-0.7}\ (a\ I)^{1.5}\ (a\ p_2)^{-0.1} \\
&= a^{-0.7}\ a^{1.5}\ a^{-0.1}\ (20\ p_1^{-0.7}\ I^{1.5}\ p_2^{-0.1}) \\
&= a^{0.7}\ (20\ p_1^{-0.7}\ I^{1.5}\ p_2^{-0.1})
\end{aligned}
$$

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. $\frac{\partial q_1^*}{\partial p_1} = -0.7\ (20\ \ p_1^{-1.7}\ \ I^{1.5}\ \ p_2^{-0.1})$. This expression is negative, so good #1 is an ordinary good, not a Giffen good.

c. $\frac{\partial q_1^*}{\partial I} = 1.5\ (20\ \ p_1^{-0.7}\ \ I^{0.5}\ \ p_2^{-0.1})$. This expression is positive, so good #1 is a normal good, not an inferior good.

d. $\frac{\partial q_1^*}{\partial p_2} = \ -0.1\ (20\ \ p_1^{-0.7}\ \ I^{1.5}\ \ p_2^{-1.1})$. This expression is negative, so goods #1 and #2 are complements, not substitutes.

(3) [Finding individual demand functions]

a. MRS = MU_2/MU_1 = $q_1 / (3\ q_2)$.

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

b. $q_1^* = \frac{3I}{4\ p_1}$, and c. $q_2^* = \frac{I}{4\ p_2}$.

III. Critical thinking

(1) Demand for this good is inelastic because spending rises when the price increases. To compute the price elasticity of demand, recall that for small percent changes,

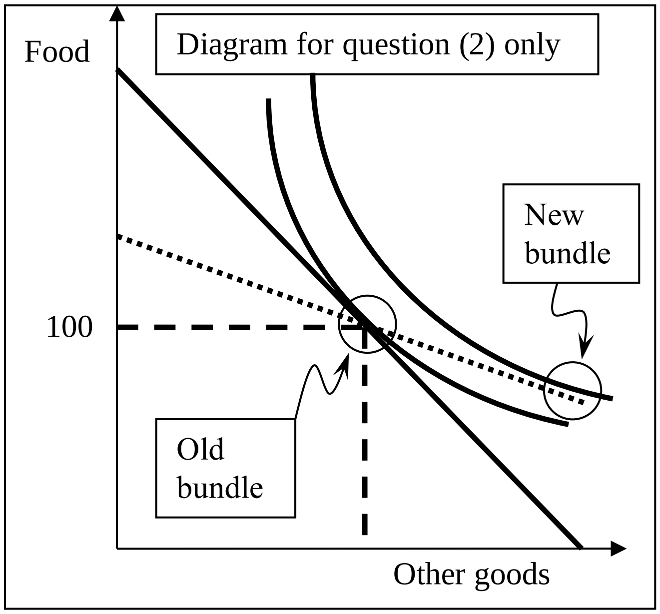
$$\%\ change\ spending = \%\ change\ price + \%\ change\ quantity$$

Substituting the numbers given in the problem:

$$7\% = 10\% + \%\ change\ quantity$$

So the percent change in quantity is -3%. The price elasticity of demand equals percent change in quantity divided by percent change in price = -3%/10% = -0.3.

(2) **Diagram proof:** Abby originally chose the tangency point between the budget line and the indifference curve. Now the price of food has risen, so Abby's budget line becomes flatter. However, with her $300 increase in income, Abby can still afford her old bundle including 100 units of food per month. So Abby's new budget line passes through her old bundle, but with a flatter slope. Abby can now afford a more preferred bundle, below and to the right of her old bundle, with less food and more other goods. So Abby will buy *less food* than before.



(2) **Algebraic proof:** With only a price increase, the total effect on Abby's demand would be given by the Slutsky equation—that is, income effect plus substitution effect:

$$\Delta q = -\Delta p \; q \; \frac{\partial q*}{\partial I} + \Delta p \; \frac{\partial q*}{\partial p}\bigg|_{sub} = -\$3 \times 100 \; \frac{\partial q*}{\partial I} + \$3 \; \frac{\partial q*}{\partial p}\bigg|_{sub} = -\$300 \; \frac{\partial q*}{\partial I} + \$3 \; \frac{\partial q*}{\partial p}\bigg|_{sub} .$$

Simultaneously, however, Abby's income increases by \$300. This change in income, by itself, would have an effect on Abby's demand given by $+\$300 \; \frac{\partial q*}{\partial I}$.

So Abby's increase in income exactly cancels the income effect above, leaving only the substitution effect,

$$\Delta q = \$3 \; \frac{\partial q*}{\partial p}\bigg|_{sub} .$$

Since the substitution-effect partial derivative is always negative, Δq in this expression is negative. So Abby will buy *less food* than before.

Version B

I. Multiple choice

(1)c . (2)a. (3)c. (4)c. (5)b.

II. Short answer

(1) Monotonicity implies that bundles above and to the right of X are more preferred, while bundles below and to the left of X are less preferred

a. more preferred. b. more preferred. c. cannot be determined.
d. less preferred. e. less preferred.

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

(3) a. luxury or superio good. b. increase. c. 6 %.
d. increase. e. 2 %.

(4) 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.

(5) a. $\varepsilon^{comp} = -0.7$. b. decrease. c. 9 %.
d. 2 %. e. 7 %.

(6) a. Laspeyres = 112. b. Paasche = 108. c. $\sqrt{108 \times 112}$.

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) [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):

$$\frac{(a\ I)+2\ (ap_2)}{(a\ p_1)} = \frac{a\ (I+2\ p_2)}{a\ (p_1)} = \frac{I+2\ p_2}{p_1}\ .$$

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 is homogeneous of degree zero in income and prices.
b. $\frac{\partial q_1^*}{\partial p_1} = -(I + 2\ p_2)\ p_1^{-2}$. This expression is negative, so good #1 is an ordinary good, not a Giffen good.
c. $\frac{\partial q_1^*}{\partial I} = 1/p_1$. This expression is positive, so good #1 is a normal good, not an inferior good.
d. $\frac{\partial q_1^*}{\partial p_2} = 2/p_2$. This expression is positive, so goods #1 and #2 are substitutes, not complements.

(3) [Finding individual demand functions]
a. MRS = $MU_2/MU_1 = (3\ q_1) / (2\ q_2)$.
Solve MRS = p_2/p_1 jointly with $I = p_1q_1 + p_2q_2$ to get
b. $q_1^* = \frac{2\ I}{5\ p_1}$, and c. $q_2^* = \frac{3\ I}{5\ p_2}$.

III. Critical thinking

Same as Version A.

[end of answer key]