ECON 173 - Intermediate Microeconomic Analysis
Drake University, Fall 2019
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EXAMINATION #2 ANSWER KEY
"Consumers and Demand"

Version A

I. Multiple choice

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

II. Short answer

(1) a. less preferred, because bundle A is directly below bundle X (and directly to the left of bundle Y). Monotonicity implies that a bundle that has less of one good and the same of another good must be less preferred.
b. cannot be determined, because an indifference curve passing through bundles X and Y might pass either above bundle B or below bundle B.
c. more preferred, because an indifference curve passing through bundles X and Y must pass below bundle C due to diminishing MRS.

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

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

(4) 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. 11 ice cream cones. e. 3 ice cream cones. f. 2 ice cream cones.

(5) a. $\varepsilon^{comp} = -0.34$. b. decrease. c. 4.0 %.
d. 0.6 %. e. 3.4 %.

(6) a. Laspeyres = 140. b. Paasche = 130. c. $\sqrt{140 \times 130}$.

III. Problems

(1) [Budgets and choice]
a. Equation for budget line (income=spending): $150 = 5\ q_1 + 10\ q_2$.
b. $MRSC = MU_2/MU_1 = (q_1 - 4) / (q_2 - 5)$.
c. Solve the tangency condition ($MRSC = p_2/p_1 = 10/5$) jointly with equation for budget line (see part a) to get $q_1^* = 12$, $q_2^* = 9$.

(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):

$$\frac{(a\ I)}{5(a\ p_1)} + \frac{2(a\ p_2)}{(a\ p_1)} + 6 = \frac{a\ (I)}{a\ (5p_1)} + \frac{a(2p_2)}{a(p_1)} + 6 = \frac{I}{5p_1} + \frac{2p_2}{p_1} + 6\ .$$

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 is homogeneous of degree zero in income and prices.

b. $\frac{\partial q_1^*}{\partial p_1} = -\frac{I}{5} p_1^{-2} - 2p_2 p_1^{-2}$. This expression is negative, so good #1 is an ordinary good, not a Giffen good.

c. $\frac{\partial q_1^*}{\partial I} = \frac{1}{5p_1}$. This expression is positive, so good #1 is a normal good, not an inferior good.

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

(3) [Finding individual demand functions]
a. MRS = $MU_2/MU_1 = (3q_1) / (2q_2)$.
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

(1) The minimum amount of income that Amanda must have to attain a target level of utility of $\bar{U}$= 500 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 Amanda's utility function is given as $U= q_1\, q_2$, the equation for the target indifference curve is

(a) $500 = q_1q_2$.

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 = \$5/\$4. So the tangency condition is

(b) $q_1/q_2 = 5/4$.

Solving (a) and (b) jointly gives $q_1^* = 25$ and $q_2^* = 20$. This bundle will cost 25×\$4 + 20×\$5 = $\boxed{\textbf{\$200}}$, answer.

(2) Demand is given by $q_1^* = 5\, p_1^{\varepsilon} p_2^{\alpha} I^{\eta}$. Homogeneity of degree zero means that if income and prices are all multiplied by some factor (a) then that factor cancels out, leaving the original demand function. (In other words, quantity demanded is unaffected by perfectly balanced inflation.) So we check homogeneity of the demand function by replacing I by (aI), replacing p_1 by (ap_1), and replacing p_2 by (ap_2):

$$q_1^* = 5\,(ap_1)^{\varepsilon}(ap_2)^{\alpha}(aI)^{\eta}$$
$$q_1^* = a^{\varepsilon}a^{\alpha}a^{\eta}\;\; 5p_1^{\varepsilon}p_2^{\alpha}I^{\eta}$$
$$q_1^* = a^{\varepsilon+\alpha+\eta}\;\; 5p_1^{\varepsilon}p_2^{\alpha}I^{\eta}$$

Now the factor (a) cancels out if and only if $a^{\varepsilon+\alpha+\eta} = 1$, which is true if and only if the exponent equals zero: $\boxed{\boldsymbol{\varepsilon + \alpha + \eta = 0},}$ answer.

Version B

I. Multiple choice

(1)c . (2)b. (3)e. (4)e. (5)b. (6)b. (7)c.

II. Short answer

(1) a. cannot be determined, because an indifference curve passing through bundles X and Y might pass either above bundle A or below bundle A.
b. more preferred, because an indifference curve passing through bundles X and Y must pass below bundle B due to diminishing MRS.
c. less preferred, because bundle C is directly to the left of bundle Y. Monotonicity implies that a bundle that has less of one good and the same of another good must be less preferred.

(2) a. elastic. b. decrease. c. 6 %.
d. decrease. e. 3 %.

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

(4) 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.

(5) a. $\varepsilon^{comp} = -1.16$. b. increase. c. 12.0 %.
d. 0.4 %. e. 11.6 %.

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

III. Problems

(1) [Budgets and choice]
a. Equation for budget line (income=spending): $100 = 5\ q_1 + 6\ q_2$.
b. MRSC = $MU_2/MU_1 = \frac{(q_1+10)}{(q_2+5)}$.
c. Solve the tangency condition (MRSC = $p_2/p_1 = 6/5$) jointly with equation for budget line (see part a) to get $q_1^* = 8$, $q_2^* = 10$.

(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):

$$\begin{aligned}&10\ (a\ p_1)^{-0.6}\ (a\ I)^{0.6}\ (a\ p_2)^{-0.1}\\ &= a^{-0.6}\ a^{0.6}\ a^{-0.1}\ (10\ p_1^{-0.6}\ I^{0.6}\ p_2^{-0.1})\\ &= a^{-0.1}\ (10\ p_1^{-0.6}\ I^{0.6}\ p_2^{-0.1})\end{aligned}$$

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. $\frac{\partial q_1^*}{\partial p_1} = -0.6\ (10\ p_1^{-1.6}\ I^{0.6}\ p_2^{-0.1})$. This expression is negative, so good #1 is an <u>ordinary good</u>, not a Giffen good.
c. $\frac{\partial q_1^*}{\partial I} = 0.6\ (10\ p_1^{-0.6}\ I^{-0.4}\ p_2^{-0.1})$. This expression is positive, so good #1 is a <u>normal good</u>, not an inferior good.
d. $\frac{\partial q_1^*}{\partial p_2} = -0.1\ (10\ p_1^{-0.6}\ I^{0.6}\ p_2^{-1.1})$. This expression is negative, so goods #1 and #2 are <u>complements</u>, not substitutes.

(3) [Finding individual demand functions]
a. MRS = MU_2/MU_1 = $(4\ q_1) / (q_2)$.
Solve MRS = p_2/p_1 jointly with $I = p_1q_1 + p_2q_2$ to get
b. $q_1^* = \frac{I}{5\ p_1}$, and c. $q_2^* = \frac{4\ I}{5\ p_2}$.

III. Critical thinking
Same as Version A.

[end of answer key]