ECON 173 - Intermediate Microeconomic Analysis
Drake University, Fall 2014
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EXAMINATION #2 ANSWER KEY
"Consumers and Demand"

Version A

I. Short answer

(1) In this question, we must try to determine where points A, B, and C lie in relation to the indifference curve that passes through points X and Y. The assumption of monotonicity implies that this indifference curve must slope down. The assumption of diminishing marginal rate of substitution implies that this indifference curve is curved (not straight) although we do not know *how* curved it is.

a. cannot be determined, because we do not know *how* curved the indifference curve is. It might pass *above or below* point A.

b. more preferred, because point B lies on the straight line connecting X and Y, but we know that the indifference curve connecting X and Y must be curved, so point B must lie *above* the indifference curve.

c. more preferred, because point C lies above the straight line connecting X and Y, so it also lies *above* the indifference curve connecting X and Y.

(2) a. elastic. b. decrease. c. 7%.
d. decrease. e. 2%.

(3) a. necessary good, because the spending share for cheese is higher for low-income consumers than for high-income consumers. Alternatively, it is a necessary good because the income elasticity, computed in part (b), is positive but less than one.
b. The general formula for an arc elasticity is $(\Delta Y/Y_{avg}) / (\Delta X/X_{avg})$
So in this case, $(\Delta Q/Q_{avg}) / (\Delta I/I_{avg}) = (20/80) / (20 \text{ thousand}/40 \text{ thousand}) = 0.5$.

(4) a. $\varepsilon^{comp} = \varepsilon + S\,\eta = -0.4 + 0.2 \times 0.5 = -0.3$.
b. decrease because ε is negative (ordinary good).
c. $10\% \times -0.4$ = decrease of 4%.
d. $10\% \times (-0.2 \times 0.5)$ = decrease of 1%.
e. $10\% \times \varepsilon^{comp}$ = decrease of 3%.

(5) 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. 10 units. c. \$12.
d. 3 units. e. -4 units. f. -3 units.

(6) a. Laspeyres = 140. b. Paasche = 120. c. $\sqrt{140 \times 120} \approx 130$.

(7) a. worse off from price increase.
b. change in consumer surplus = area between horizontal lines at \$5 and \$7, vertical axis, and ordinary demand curve = \$8.
c. compensating variation in income = area between horizontal lines at \$5 and \$7, vertical axis, and compensated demand curve = \$10.

II. Problems

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

b. $MRS = MU_2/MU_1 = (2q_1)/(3q_2)$.

c. Solve $MRS = p_2/p_1 = 5/4$ jointly with equation for budget line to get $q1^* = 15$, $q_2^* = 8$.

(2) a. Check homogeneity of the demand function:

$54\,(a\,I)^{0.8}\,(a\,p_1)^{-0.7}\,(a\,p_2)^{0.1} = a^{0.8-0.7+0.1}\;54\,I^{0.8}\,p_1^{-0.7}\,p_2^{0.1} = a^{0.2}\;54\,I^{0.8}\,p_1^{-0.7}\,p_2^{0.1}$.

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

b. $\frac{\partial q_1^*}{\partial p_1} = -0.7\,(54\,I^{0.8}p_1^{-1.7}p_2^{0.1}) < 0$, so price and quantity demanded are negatively related and this is an <u>ordinary good</u>.

c. The income elasticity of demand is $\frac{\partial q_1^*}{\partial I}\,\frac{I}{q_1} = 0.8$. Since the income elasticity is positive but less than one, this is a <u>necessary good</u>.

d. $\frac{\partial q_1^*}{\partial p_2} = 0.1\,(54\,I^{0.8}p_1^{-0.7}p_2^{-0.9}) > 0$, so the price of the other good and the quantity demanded are positively related and the two goods are <u>substitutes</u>.

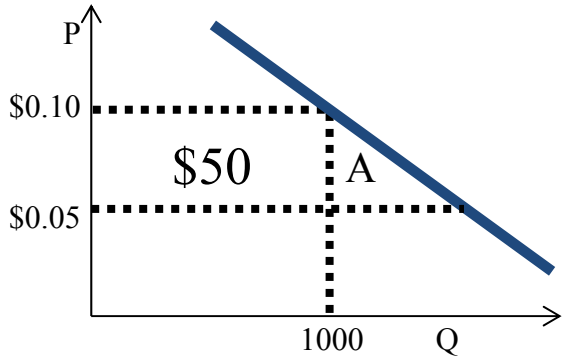
(3) a. $MRS = MU_2/MU_1 = 2\,(q_1\text{-}3)\,/\,q_2$.

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

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

III. Critical thinking

(1) The gain in consumer surplus from the decrease in price equals $0.05\times1000 = \$50$ plus the area of triangle A. Thus the gain in consumer surplus is greater than \$50. Therefore the decrease in the price of electricity would benefit the consumer more than a \$50 increase in income.



Version B

I. Short answer

(1) In this question, we must try to determine where points A, B, and C lie in relation to the indifference curve that passes through points X and Y. The assumption of monotonicity implies that this indifference curve must slope down. The assumption of diminishing marginal rate of substitution implies that this indifference curve is curved (not straight) although we do not know *how* curved it is.

a. more preferred, because point A lies above the straight line connecting X and Y, so it also lies *above* the indifference curve connecting X and Y.

b. more preferred, because point B lies on the straight line connecting X and Y, but we know that the indifference curve connecting X and Y must be curved, so point B must lie *above* the indifference curve.

c. cannot be determined, because we do not know *how* curved the indifference curve is. It might pass *above or below* point C.

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

(3) a. luxury (or superior) good, because the spending share for cheese is higher for high-income consumers than for low-income consumers. Alternatively, it is a necessary good because the income elasticity, computed in part (b), is greater than one.
b. The general formula for an arc elasticity is $(\Delta Y/Y_{avg}) / (\Delta X/X_{avg})$
So in this case, $(\Delta Q/Q_{avg}) / (\Delta I/I_{avg}) = (200/300) / (20 \text{ thousand}/40 \text{ thousand}) = 4/3$.

(4) a. $\varepsilon^{comp} = \varepsilon + S\,\eta = -0.9 + 0.2 \times 1.5 = -0.6$.
b. decrease because ε is negative (ordinary good).
c. $10\% \times -0.9$ = decrease of 9%.
d. $10\% \times (-0.2 \times 1.5)$ = decrease of 3%.
e. $10\% \times \varepsilon^{comp}$ = decrease of 6%.

(5) 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. 9 units. c. \$6.
d. 5 units. e. -3 units. f. -1 units.

(6) a. Laspeyres = 120. b. Paasche = 110. c. $\sqrt{120 \times 110} \approx 115$.

(7) a. better off from price decrease.
b. change in consumer surplus = area between horizontal lines at \$5 and \$1, vertical axis, and ordinary demand curve = \$40.
c. compensating variation in income = area between horizontal lines at \$5 and \$1, vertical axis, and compensated demand curve = \$32.

II. Problems

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

b. $MRS = MU_2/MU_1 = (4q_1)/\,q_2$.

c. Solve $MRS = p_2/p_1 = 5/4$ jointly with equation for budget line to get $q1^* = 5$, $q_2^* = 16$.

(2) a. Check homogeneity of the demand function:
$54\,(a\,I)^{1.1}\,(a\,p_1)^{-0.9}\,(a\,p_2)^{-0.2} = a^{1.1-0.9-0.2}\;54\,I^{1.1}\,p_1^{-0.9}\,p_2^{-0.2} = a^0\;54\,I^{1.1}\,p_1^{-0.9}\,p_2^{-0.2}$.
Note that the "a" factor disappears because $a^0 = 1$. So multiplying income and prices by some factor *does not* change the quantity demanded. The function <u>is homogeneous of degree</u> zero in income and prices.

b. $\frac{\partial q_1^*}{\partial p_1} = -0.9\,(54\,I^{1.1}p_1^{-1.9}p_2^{-0.2}) < 0$, so price and quantity demanded are negatively related and this is an <u>ordinary good</u>.

c. The income elasticity of demand is $\frac{\partial q_1^*}{\partial I}\,\frac{I}{q_1} = 1.1$. Since the income elasticity is greater than one, this is a <u>luxury (or superior) good</u>.

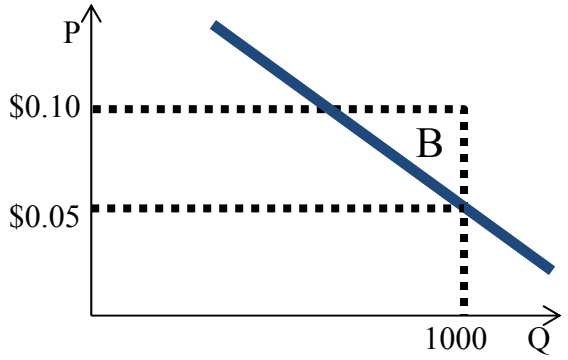
d. $\frac{\partial q_1^*}{\partial p_2} = -0.2\,(54\,I^{1.1}p_1^{-0.9}p_2^{-1.2}) > 0$, so the price of the other good and the quantity demanded are negatively related and the two goods are <u>complements</u>.

(3) a. $MRS = MU_2/MU_1 = 2\,q_1/(q_2+5)$.
Solve $MRS = p_2/p_1$ jointly with $I = p_1q_1 + p_2q_2$ to get

b. $q_1^* = \frac{I}{3p_1} + \frac{5p_2}{3p_1}$, and c. $q_2^* = \frac{2I}{3p_2} - \frac{5}{3}$.

III. Critical thinking

(1) The loss of consumer surplus from the increase in price equals $0.05\times1000 = \$50$ minus the area of triangle B. Thus the loss of consumer surplus is less than \$50. Therefore the increase in the price of electricity would harm the consumer less than a \$50 decrease in income.



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