ECON 173 - Intermediate Microeconomic Analysis
Drake University, Fall 2023
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EXAMINATION #2 VERSION A
"Consumers and Demand"
September 28, 2023

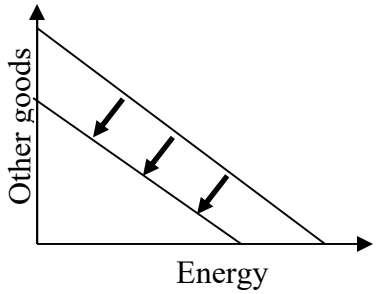
INSTRUCTIONS: This exam is closed-book, closed-notes. Calculators, mobile phones, and wireless devices are NOT permitted. Point values for each question are noted in brackets.

I. MULTIPLE CHOICE: Circle the one best answer to each question. Use margins for scratch work. [1 pt each—10 pts total]

(1) The assumption of monotonicity implies that indifference curves
a. slope up.
b. slope down.
c. get flatter as they approach the horizontal axis.
d. get steeper as they approach the horizontal axis.
e. none of the above.

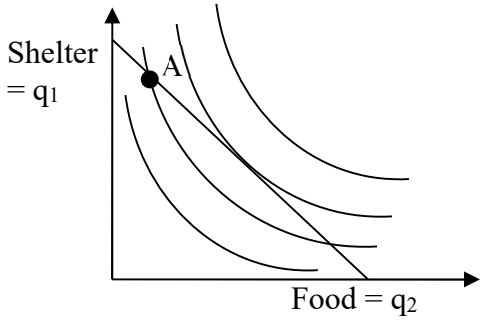
(2) Which utility function below violates the axiom of *monotonicity* or *more is better*?
a. $U(q_1,q_2) = -q_1^{-1} - q_2^{-1}$.
b. $U(q_1,q_2) = 3\, q_1^{5}\, q_2^{4}$.
c. $U(q_1,q_2) = 3\, q_1\, q_2$.
d. $U(q_1,q_2) = (5q_1) / (4q_2)$.

(3) In the graph below, the shift in the budget line could be caused by
a. an increase in income.
b. a decrease in income.
c. an increase in the price of energy.
d. a decrease in the price of energy.
e. an increase in the price of other goods.
f. a decrease in the price of other goods.



(4) If all prices and the consumer's income double, then the consumer's budget line
a. becomes steeper.
b. becomes flatter.
c. shifts outward, away from the origin in parallel fashion.
d. shifts inward, toward the origin in parallel fashion.
e. None of the above.

The next two questions refer to the following graph of a consumer's budget line and indifference curves. Suppose the consumer is currently at bundle A for some reason.



(5) This consumer could enjoy higher utility, without increasing total spending, by
a. purchasing less food and more shelter.
b. purchasing more food and less shelter.
c. purchasing less food and less shelter.
d. any of the above.
e. none of the above.

(6) Let MU_1 denote the marginal utility of shelter and MU_2 denote the marginal utility of food for this consumer. Let p_1 denote the price of shelter and p_2 denote the price of food. At bundle A,
a. $MU_2 = MU_1$ and $p_2 = p_1$.
b. $MU_2/MU_1 = p_2/p_1$.
c. $MU_2/MU_1 < p_2/p_1$.
d. $MU_2/MU_1 > p_2/p_1$.
e. cannot be determined from information given.

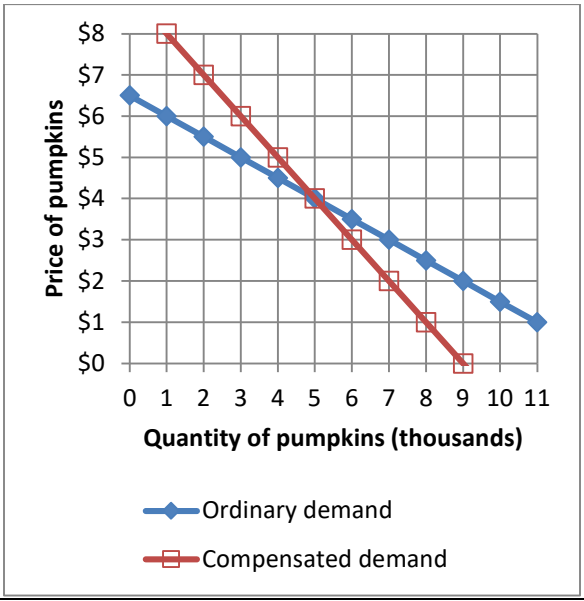
(7) What is wrong with this demand function?

$$q_1^* = 5\, I^{0.5}\, p_1^{0.2}\, p_2^{-0.7}$$

a. This demand function implies that the quantity demanded can be negative even if income and prices are positive.
b. This demand function implies that good 1 is a Giffen good.
c. This demand function is not homogeneous of degree zero.
d. This demand function implies that the price of another good influences the demand for good 1, which is impossible.

(8) Which price index tends to *overestimate* the rate of inflation, due to substitution bias?
a. Laspeyres price index.
b. Paasche price index.
c. Fisher price index.
d. All of the above.
e. None of the above.

The next two questions refer to the following graph of ordinary and compensated demand curves for pumpkins.



(9) Suppose the price of pumpkins rose from \$4 to \$6. The compensating variation in income that would leave consumers just as well off as before the price change equals
a. \$2.
b. \$6 thousand.
c. \$8 thousand.
d. \$10 thousand.

(10) Again, suppose the price of pumpkins rose from \$4 to \$6. The decrease in consumer surplus equals
a. \$2.
b. \$6 thousand.
c. \$8 thousand.
d. \$10 thousand.

II. SHORT ANSWER: Please write your answers in the boxes on this question sheet. Use margins for scratch work.

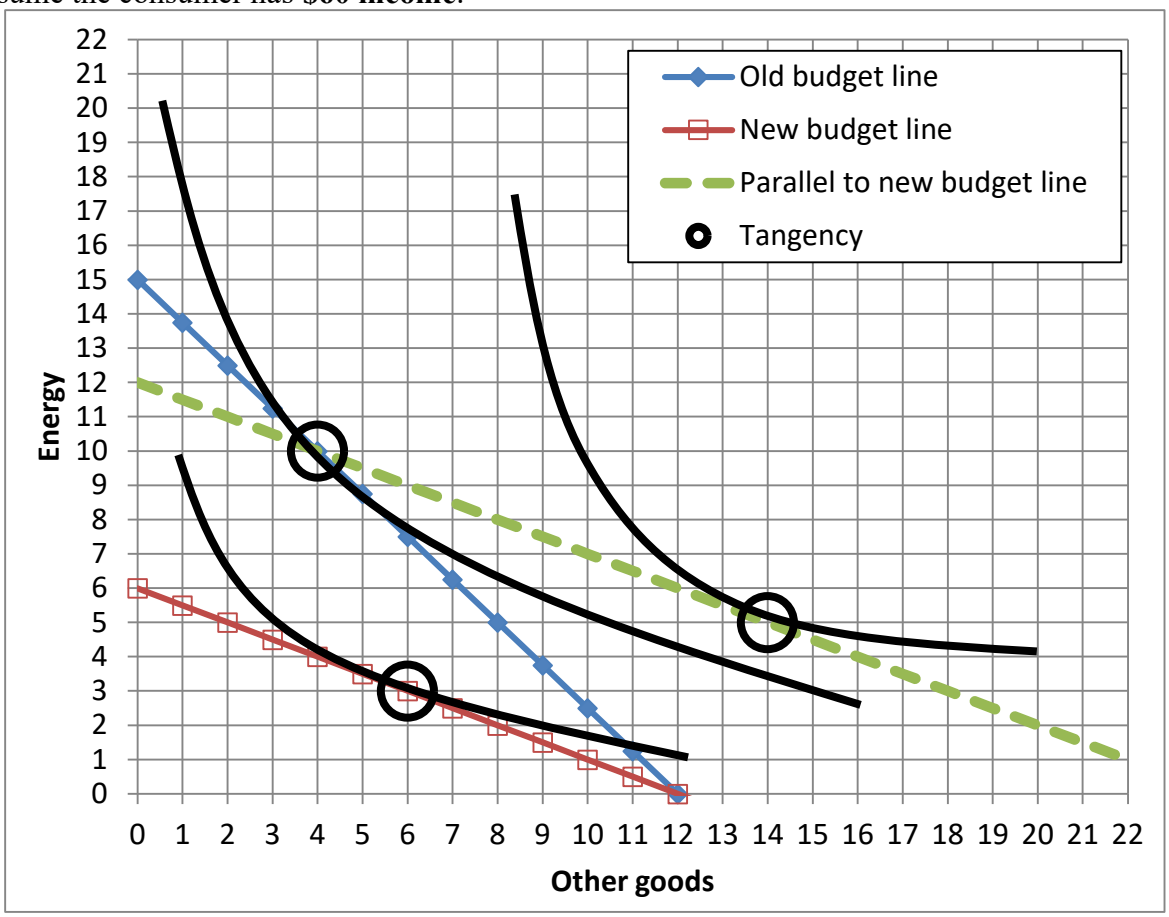
(1) [Price elasticity of demand: 10 pts] Suppose the price elasticity of demand for hummus is –1.5, and the price of hummus rises by 4 %.

a. Is the demand for hummus *elastic* or *inelastic* ?	
b. Will the quantity demanded of hummus *increase* or *decrease*?	
c. By about how much?	%
d. Will consumers' total spending on hummus *increase* or *decrease*?	
e. By about how much?	%

(2) [Income elasticity of demand: 10 pts] Suppose that a consumer's income rises by 5%, and the income elasticity of demand for baseball tickets is 1.4 .

a. Does the income elasticity indicate that baseball tickets are an *inferior* good, a *necessary* good, or a *luxury or superior* good?	
b. Will the quantity demanded of baseball tickets *increase* or *decrease*?	
c. By about how much?	%
d. Will the share of the consumer's budget devoted to baseball tickets *increase* or *decrease*?	
e. By about how much?	%

(3) [Substitution and income effects: 12 pts] Consider the indifference-curve diagram below. Assume the consumer has **$60 income**.



a. What was the price of energy on the old budget line?

b. Given the old budget line, how much energy does the consumer demand?

c. What is the price of energy on the new budget line?

d. Given the new budget line, how much energy does the consumer demand?

e. Compute the change in quantity of energy demanded due to the substitution effect: Δq^{sub} .

f. Compute the change in quantity of energy demanded due to the income effect: Δq^{inc} .

$
units
$
units
units
units

(4) [Slutsky equation: 10 pts] The Slutsky equation in elasticity form is given by

$$\varepsilon = -S\,\eta + \varepsilon^{comp}$$

where, as usual, ε denotes the own-price elasticity of demand, S denotes the share of total consumer spending devoted to the good (a fraction), η denotes the income elasticity of demand, and ε^{comp} denotes the compensated demand elasticity. Suppose that for food, $\varepsilon = -0.4$, $S = 0.2$, and $\eta = 0.3$.

a. Compute the compensated elasticity of demand for food (ε^{comp}).

Suppose the price of food rises by 10%, but the consumer's income does *not* change.

b. Does the quantity demanded of food *increase* or *decrease*?

c. By about how much? %

Continue to assume that the price of food rises by 10%, but now suppose the government helps the consumer by giving them a cash transfer equal to 10% of last year's spending on food.

d. Does the quantity demanded of food *increase* or *decrease*?

e. By about how much? %

(5) [Cost-of-living indexes: 6 pts] Suppose we are given the following data on prices and quantities consumed of food and clothing.

	Food		Clothing	
	Price	Quantity	Price	Quantity
Old period	\$4	20 units	\$5	4 units
New period	\$6	15 units	\$5	8 units

Assume that all cost-of-living indexes equal 100 in the old period.

a. Compute the *value* of the Laspeyres cost-of-living index in the new period.

b. Compute the *value* of the Paasche cost-of-living index in the new period.

c. Give a *formula* for the Fisher cost-of-living index in the new period. The formula should include numbers but no variables.

III. PROBLEMS: Please write your answers in the boxes on this question sheet. Show your work and circle your final answers.

(1) [Budgets and choice: 14 pts] A consumer has the following utility function: $U(q_1,q_2) = q_1 (q_2 +5)$, where q_1 denotes quantity of food and q_2 denotes the quantity of other goods. The price of food is \$5 and the price of other goods is \$4. The consumer has \$100 in income to spend on these items.

a. [4 pts] Give an equation for the consumer's budget line. The variables q_1 and q_2 should be the only unknowns.

b. [4 pts] Find a formula for the consumer's marginal rate of substitution in consumption of other goods for food—that is, the |slope| of the consumer's indifference curve with food on the vertical axis and other goods on the horizontal axis. The variables q_1 and q_2 should be the only unknowns. Circle your final answer.

c. [6 pts] Solve for the quantities of food (q_1*) and other goods (q_2*) that this consumer will choose. Circle your final answers.

(2) [Properties of individual demand functions: 12 pts] Suppose an alleged demand function is $q_1^* = 10\, I^{0.9}\, p_1^{-0.3}\, p_2^{0.1}$, where I denotes the consumer's income, p_1 denotes the price of good #1, and p_2 denotes the price of good #2.

a. Is this function homogeneous of degree zero in income and prices? Justify your answer.

b. Find the partial derivative $\partial q_1^*/\partial p_1$. Is good #1 an ordinary good or a Giffen good? Justify your answer.

c. Find the partial derivative $\partial q_1^*/\partial I$. Is good #1 an inferior good or a normal good? Justify your answer.

d. Find the partial derivative $\partial q_1^*/\partial p_2$. Are goods #1 and #2 substitutes, complements, or unrelated in demand? Justify your answer.

(3) [Finding individual demand functions: 12 pts] A consumer has the following utility function: $U(q_1, q_2) = q_1^2 q_2^5$, where q_1 denotes the quantity of entertainment and q_2 denotes the quantity of other goods.

a. Find a formula for the consumer's marginal rate of substitution in consumption of other goods for entertainment—that is, the |slope| of the consumer's indifference curve with entertainment on the vertical axis and other goods on the horizontal axis. The variables q_1 and q_2 should be the only unknowns. Circle your final answer.

Let p_1 denote the price of entertainment and let p_2 denote the price of other goods. Let I denote the consumer's income.

b. Solve for the consumer's demand function for entertainment—that is, the formula showing q_1^* as a function of p_1, p_2, and I (but not q_2). Show your work and circle your final answer. [Hint: check that your answer is homogeneous of degree zero.]

c. Solve for the consumer's demand function for other goods—that is, the formula showing q_2^* as a function of p_1, p_2, and I (but not q_1). Show your work and circle your final answer. [Hint: check that your answer is homogeneous of degree zero.]

IV. CRITICAL THINKING: Answer just *one* of the questions below (your choice). [4 pts]

(1) Alex's utility function is $U = q_1 q_2$, where q_1 denotes the quantity of food and q_2 denotes the quantity of other goods. If the price of food is $p_1 = \$3$ and the price of other goods is $p_2 = \$2$, compute the *minimum* amount of income that Alex must have to attain a target level of utility of $U = 600$ utils.

a. Give the equation for Alex's target indifference curve.
b. Give an equation for the tangency condition, where the slope of Alex's indifference curve equals the slope of Alex's budget line.
c. Solve for Alex's optimal quantities of food q_1^* and other goods q_2^*.
d. Find the amount of income Alex would need to purchase the optimal quantities.

(2) Suppose the demand function for good 1 takes the following form:

$$q_1 * = 15\ p_1^{\varepsilon}\ p_2^{\alpha}\ I^{\eta},$$

where p_1 is the good's own price, p_2 is the price of another good, and I is the consumer's income. If the demand for good 1 is homogeneous of degree zero in all prices and income, then what must be the value of the *sum* of the exponents: $\boldsymbol{(\varepsilon + \alpha + \eta)}$? Justify your answer with algebra.

Circle the question you are answering and write your answer below. Full credit requires good grammar, legible writing, accurate spelling, and correct reasoning.

[end of exam]