ECON 3070 Problem Set 4

Chapter 4

Optimal Consumptions

Consumers will consume until the tangency condition is satisfied:

$$\frac{\frac{\partial}{\partial x}U(x,y)}{\frac{\partial}{\partial y}U(x,y)} = \frac{MU_x}{p_x} = \frac{MU_y}{p_y} \quad \text{(Tangency Condition)}$$

If the two are not equal, you can shift consumption and increase happiness. For a simple example, assume $p_x = p_y = 1$ and at a given consumption bundle:

$$MU_x = 5 > 3 = MU_y$$

Giving up 1 unit of good y will lose 3 utility but it allows you to buy 1 unit of good x and gain 5 utility, making you happier without spending extra money.

1. Suppose that Sam can buy only two goods with her income, bread (B) and eggs (E). Sam wants to buy the combination of bread and eggs that maximizes her utility, which is given by the following function:

$$U(B, E) = 20B - \frac{1}{2}B^2 + 40E - \frac{1}{2}E^2$$

(a) Find Sam's marginal utility functions for both bread and eggs. Is Sam's marginal utility for eggs increasing, decreasing, or constant?

(b) Given her marginal utility functions, write the optimality condition that Sam's consumption of bread and eggs must satisfy. Explain why this condition must be satisfied in order for Sam's utility to be maximized

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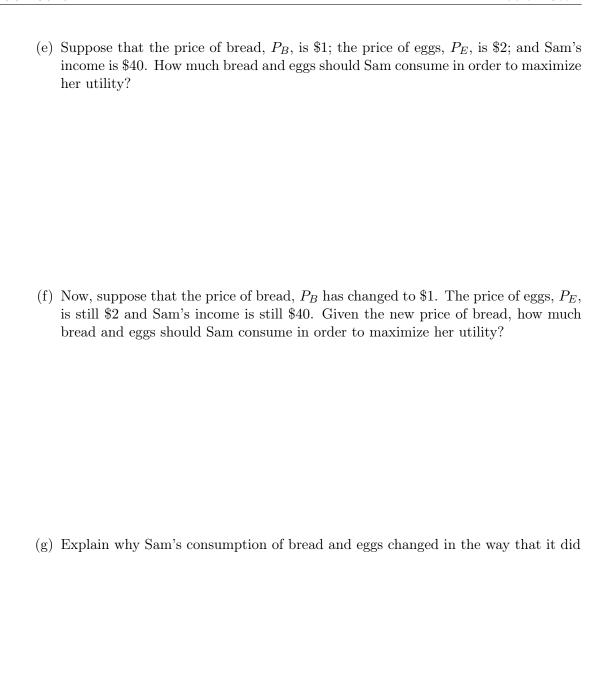
Budget Constraints

When consumers are purchasing, they face the constraint of their wallet. They can't spend more than they have in money. Budget constraints are of the form:

$$p_x x + p_y y \le I$$

which means the amount I spend on x plus the amount I spend on y is less than or equal to budget. Note the most you can spend is when the equation is equal.

- (c) Let the price of bread be P_B , the price of eggs be P_E , and Sam's income be I. Write Sam's budget constraint
- (d) Using Sam's budget constraint, and her optimality condition, solve for Sam's demand curves for bread and eggs, in terms of P_B , P_E , and I. You should finnd that your answer matches the demand curves below. (Note: In this question you will be graded on the steps you took to finnd the answer, so show all steps.)



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3. Solve the following problems for demand

(a)
$$U(x,y) = \min(x,2y)$$
 and $P_x = 2, P_y = 2, I = 24$

(b)
$$U(x,y) = 2x + 4y$$
 and $P_x = 1, P_y = 3, I = 18$

(c)
$$U(x,y) = x^{\frac{1}{2}}y^{\frac{1}{2}}$$
 and $P_x = 4, P_y = 4, I = 24$