

Due September 6th, 2023, 10PM Eastern

Instructions:

- Submit your assignments on Gradescope as a PDF. You may either handwrite your answers and scan them into a PDF, or type your answers and convert them to PDF. If you are handwriting your answers, please make sure your handwriting is legible.
- Clearly label any intercepts, slopes, jumps, or kinks on your graphs. If you do not label these, you will not receive full credit. Don't worry about making graphs exactly to scale; just make them reasonable.
- You only need to submit answers for graded questions. The ungraded questions are for your own edification.

1. (5 points) **Caveat Emptor**

For each of the following statements, determine the circumstances under which it is true. Explain your reasoning.

- (a) (2 points) A consumer's optimal choice of goods is where the slope of the budget line equals the marginal rate of substitution.
- (b) (3 points) Many utility functions can represent the same set of preference relations.

2. (5 points) **Recovering Utility from Choices**

Consider the following scenarios. For each scenario, write down a utility function that rationalizes the consumer's choice between the two goods provided. Explain your reasoning.

- (a) (1 point) Samantha always purchases the cheaper of flax seeds and chia seeds for her smoothies.
- (b) (2 points) Moonju always purchases yogurt and granola in a ratio of 3:2, **regardless of prices or income.**
- (c) (2 points) Alex spends $\frac{4}{5}$ of his income on pizza and $\frac{1}{5}$ of his income on beer, **regardless of prices or income.**

3. (10 points) **Concerts and Corners**

Max has preferences over live music and vinyl records. Specifically, his utility function is $U(m, r) = 10m - 0.5m^2 + r$, where m is the number of live music events Max attends, and r is the number of vinyl records Max buys. Max has income I and the prices of live music and vinyl records are p_m and 1 respectively.

- (a) (3 points) Graph Max's indifference curves with m on the horizontal axis and r on the vertical axis.
- (b) (3 points) Suppose Max has income $I = 40$ and $p_m = 5$. What is Max's optimal bundle of goods?
- (c) (4 points) Now suppose Max's income is $I = 20$ and $p_m = 5$. What is Max's new optimal bundle of goods?
- (d) (0 points (bonus)) Write Max's demand equations for both live music and vinyl records as a function of I and p_m . Draw his demand curve for live music on a graph. On a separate graph, draw his Engle curve for live music.

4. (10 points) **Doctors, Dollars, and Distance**

Eric is choosing the number of times to visit doctor A, and doctor B. His utility over each visit is given by $u(q_A, q_B) = q_a(10 - d_a) + q_b(10 - d_b)$, where d_A and d_B are the distance (in miles) to the respective doctor. Each doctor offers the same level of service, so all Eric cares about is price and distance. Suppose Eric lives 2 miles away from doctor A and 5 miles away from doctor B. The cost of visiting doctor A is \$200, and the cost of visiting doctor B is \$100. Eric has \$2000 to spend on doctor visits.

- (a) (4 points) Find Eric's optimal choice of visits.
- (b) (2 points) Suppose Eric's insurer removes doctor B from his network, leaving only doctor A in the market. How does this affect Eric's optimal choice of visits?
- (c) (4 points) Suppose that doctor C enters the market, positioning themselves 3 miles away from Eric and charging 150 per visit. How does this affect Eric's optimal choice of visits? (Hint: rewrite the utility function and budget constraint to include this new doctor)
- (d) (0 points (bonus)) Derive the demand equations for doctor A and doctor B as a function of their prices (p_a, p_b) and income I . Graph these demand curves. (Hint: the equations will be piecewise functions)

5. Ungraded Questions

- (a) Consider a consumer with preferences over books and records. The consumer's utility function is given by $U(B, R) = B^{\frac{1}{3}}R^{\frac{2}{3}}$, where B is the number of books consumed and R is the number of records consumed. The consumer has an income of \$100 to spend on books and records. Books cost \$10 each and records cost \$20 each.
- Solve for the consumer's optimal consumption bundle of books and records.
 - What is the marginal rate of substitution between books and records at the optimal consumption bundle?
 - Suppose the price of books increases to \$20 each. What is the consumer's new optimal consumption bundle of books and records?
 - What is the marginal rate of substitution between books and records at the new optimal consumption bundle?
- (b) Joe likes spending his time exercising (e) and reading (r) as long as each is done in moderation. He prefers more exercise to less as long as he has been exercising for less than 3 hours. After 3 hours he prefers less exercise to more. Similarly, he prefers more reading time to less so long he reads fewer than 4 hours. Beyond 4 hours he prefers less to more. With reading on the horizontal axis and exercising on the vertical axis, sketch Joe's indifference map. Be sure to label your graphs in detail. Hint: Look for the point where Joe gets the most utility possible from his consumption of these two activities.
- (c) Sketch an indifference map for the following utility functions:
- $U(x, y) = x + y$
 - $U(x, y) = x - y$
 - $U(x, y) = x$
 - $U(x, y) = y - 100$
 - $U(x, y) = x^2 + y^2$
 - $U(x, y) = \min\{2x + y, y + 2x\}$
 - $U(x, y) = \max\{2x + y, y + 2x\}$