Due Wednesday, Feb. 10th, in class or by noon to the box in the basement of Robinson Hall.

1 Drawing indifference curves (20 points)

For each of the following utility functions, sketch two indifference curves: one for the utility level \( u = 1 \) and one for the utility level \( u = 2 \). Remember to label the axes and the indifference curves on your diagram.

a) \( u(x_1, x_2) = x_2 \)

b) \( u(x_1, x_2) = \min\{x_1, x_2\} \)

c) \( u(x_1, x_2) = x_1 + x_2 \)

2 Marginal utility and marginal rate of substitution (20 points)

Jim likes both watching baseball (\( x_1 \), measured in ‘hours per day’) and teaching microeconomics (\( x_2 \), measured in ‘hours per day’). He has decided that his utility function for these two goods is

\[ u(x_1, x_2) = x_1^3 x_2. \]

a) Find \( MU_1 \), the marginal utility of an hour per day of watching baseball.

b) Find \( MU_2 \), the marginal utility of an hour per day of teaching microeconomics.

c) Find Jim’s \( MRS \), his marginal rate of substitution of hours of teaching for watching baseball.

d) Jim currently watches 8 hours of baseball per day and teaches microeconomics for 2 hours per day. Find the value of his \( MRS \) at this point, and describe in words what this value means.

e) Jim thinks he might have made a mistake. He thinks his utility function might actually be

\[ u(x_1, x_2) = 6 \ln x_1 + 2 \ln x_2. \]

How does the \( MRS \) for this utility function compare to the \( MRS \) for the original one? Why?

3 More MRS (20 points)

Find the marginal rate of substitution of good 2 for good 1 for each of the following utility functions:

a) \( u(x_1, x_2) = 4 \ln x_1 + 2 \ln x_2 \)

b) \( u(x_1, x_2) = \sqrt{x_1} + 2x_2 \)

4 Drawing budget sets (20 points)

For each of the following situations, write down an equation for the consumer’s budget constraint, and sketch the budget set (with \( x_1 \) on the horizontal axis and \( x_2 \) on the vertical axis). Label your axes, and write the slope of the budget line and the intercepts on your diagram.

a) \( p_1 = 4, p_2 = 2, m = 60 \)

b) \( p_1 = 1, p_2 = 5, m = 30 \)

For this situation, just sketch the consumer’s budget constraint.

c) \( p_1 = 5 \) and \( m = 30 \). The price of good 2 depends on the number of units the consumer buys. The first 5 units of good 2 cost 3 per unit, but each unit after that costs 5.
5 The shape of preferences (20 points)

Using two or three non-technical sentences:

a) Give an example of a situation in which a consumer’s preferences are nonconvex. Sketch a couple of indifference curves that match your example.

c) Explain the preferences of a consumer with upward-sloping indifference curves in a two-good world.