Exercise session 1

Course: Mathematical methods in Economics

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Problem 1

Describe the individual preference relation. Explain the representativity theorem, according to which, if individual's preferences are complete, transitive, continuous, and strictly monotonic, there exists a continuous utility function that represents them.

Problem 2

Suppose there is a continuous utility function, $U(x) = f(x)$.

A. Explain the concept of total utility and marginal utility.

B. For $U_1(x) = 2x - x^2$ and $U_2(x) = x^2 - 2x$ draw graphs of the total and marginal utilities.

C. Find x^* that maximizes $U_1(x)$ and $U_2(x)$. Interpret your findings.

Problem 3 (application of the utility maximization framework)

Suppose the utility is linear in wage, $U = w$, and there are N individuals. Each of them decides whether to study. Without education she gets w_L and if she studies, she gets w_H.

A. In the simplest case suppose it costs c to study one year. Draw individual's decision tree.

B. Derive conditions under which individuals decide to study.

C. Suppose now the choice is to study 0 year or 4. The life expectancy is M. Derive conditions for when the individual decides to study.

Problem 4

In the above problem answer the following questions:

A. How many individuals will choose to study?

B. How many individuals will have wage w_L?

C. How do you interpret c?

Problem 5

Solve Problem 3C when individuals are heterogeneous with respect to costs, $c_i \sim U[0, \bar{c}]$.

Problem 6 Suppose, an individual derives utility from two goods, x_1 and x_2, $U(x_1, x_2) = f(x_1, x_2)$.

1. Explain the assumptions imposed on $U(x_1, x_2)$.

2. Derive the marginal rate of substitution of x_1 for x_1. Draw the indifference curves.