Homework 4 (70 pts)

An answer that shows understanding with some mistakes will be given partial credit, decided by the grader. A well-written response should receive more than 25%. Show all your work. Answers without work are not guaranteed credit.

Formatting (6 pts)

Single file, in pdf format, etc.

Problem #1: Definitions (5 pts)

a. Define future discounting
b. Why, for every value of p, is the Nash bargaining solution a Nash equilibrium?

Problem #2: Principal-Agent Problem (20 pts)

Assume the role of the head of the Human resources department at a large corporation. You must design a contract for the next CEO. Your sources have given you the following quantitative data to help you decide. A typical CEO has a reservation wage of $150,000. Their cost of putting out a high effort is equivalent to $50,000, while the cost of low effort is 0. They are aggressive and think only of the expected outcome; in other words, they are risk neutral: U(wage, effort) = wage - c(e). The revenue of a successful project is $1,000,000, and the revenue from an unsuccessful project is zero. The probability of success with high effort is 0.7. With low effort, the probability of success is 0.3

1. What contract should be offered so that the CEO will put in a high level of effort if you assume the low-level effort contract is a base salary equal to the reservation wage?

Now take on the role of the chief investor in the company.

2. What level of effort will give the highest expected profit?

Problem #3 Adverse Selection (15 pts)

Find the competitive equilibrium if types are not observable for the following labor market.

Types: $\theta_1 = 3, \theta_2 = 6, \theta_3 = 9$

Lottery: $p(\theta = \theta_1) = 1/3$, $p(\theta = \theta_2) = 1/3$, $p(\theta = \theta_3) = 1/3$

Reservation wages: $r(\theta_1) = 3, r(\theta_2) = 9, r(\theta_3) = 6$

Problem #4 Discount Rate (6 pts)

Using the following interest rates find the implied future discount rate, rounded to 2 decimal places.

a. 7.67% APR (current mortgage rate)
b. 3.2% APR (mortgage rate during Covid-19)
c. 24.24% APR (interest rate if I fail to pay the credit card on time)

Problem #5 Utility Function (24 pts)

Assume the role of a college student looking for a job. To rate each job, you use 5 characteristics: location, pay, independence, culture, and impact. Pay is measured in thousands of dollars; the other characteristics are measured from 0 to 100. To make things easier, use a utility function in which these are perfect substitutes: $U = aL + b\$ + dI + eC + fI$. Where the capital letters stand for the ranking given to each characteristic, and the lowercase letters are the importance you assign to each characteristic.

a. Design a utility function that represents your preferences. The preference letters should add up to 10: a+b+e+d+f = 10
b. Find 5 jobs that interest you and describe the characteristics of each job using the capital letters. For example:
   Janitor = {L= 100, $ = 25 (average pay around 25,000), I = 100, C= 50, I = 10}
c. Calculate your utility for each job.