Problem Set 6 – Wrap Up

Econ 4310

Due: 11:59pm, 12/11/2025

Please turn in a single copy of the problem set on Canvas. Each of you must independently write your own solutions to the homework. You should feel free to discuss the questions with each other, with me, or with our graduate AIs. However, the work you produce must, in the end, represent your own thoughts and understanding of the problems. In particular, it would not be appropriate to study someone else's answer to a problem and reproduce it as your own.
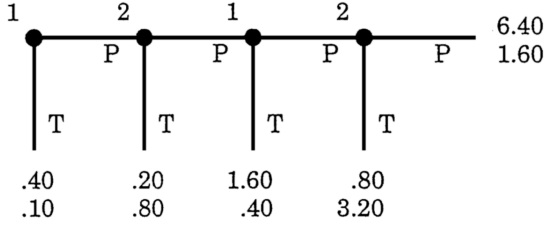
1. **Incentives in experiments.**

   Suppose you are designing an experiment and wish to understand a participant's valuation a 50/50 lottery on the outcomes $10 and $100. Describe a set of incentivized questions that you could ask in order to elicit the participant's valuation. What will the instructions to the participant be? How many questions will you ask? How will you pay them?

   Hint: As you've seen in lab, the easiest way to elicit the valuation is to present a set of binary choices to make, where one item in each choice is the alternative in question, and you vary the other item. For example, if you offer a choice between (i) the alternative, and (ii) a certain dollar amount of $50, and the participant chooses the $50, you can infer that they value the alternative less than $50.

2. **Class lottery.** As you know, the points you accumulated in the lab sessions during the semester will be used to run a lottery for a $100 gift card. Suppose that at the end of the semester, the total accumulated points by the entire class, including you, is 25,000. Suppose your total is 600, and suppose I were to offer you a bonus of 70 points at the end of the semester. How much, in dollar terms, is the bonus worth?

3. **QRE.** Consider the 4-move centipede game given in the figure below.

Assume play is according to logit QRE with lambda $= 1.5$. In this problem, we are going to calculate the take probabilities at each of the four decision nodes. Notice that, in this particular game, the quantal response functions can be computed recursively, and do not require any sophisticated techniques. Recall in logit QRE, the probability that a player chooses action x_j can be written as:

$$p(x_j) = \frac{\exp(\lambda u(x_j))}{\sum_{x_k \in A} \exp(\lambda u(x_k))} \tag{*}$$

(a) Starting with the last node, we will work backwards through the game. For notation, let p_i^t denote the probability that player i chooses *Take* at the tth decision node and $u_i^4(a_i)$ denote player i's expected utility by choosing action $a_i \in \{T, P\}$. So, at node 4 for example, the last decision node where player 2 moves, she gets utility $u_2^4(T) = 3.2$ by choosing take and utility $u_2^4(P) = 1.6$ by choosing pass. Thus, what is the probability that she chooses T?

(b) Iterating this process, what is the probability that player 1 chooses T at node 3? Note that to calculate the expected $u_1^3(P)$, you will use the value that you calculated for p_2^4.

(c) Iterating this process again, what is the probability that player 2 chooses T at node 2?

(d) Iterating this process for the final time, what is the probability that player 1 chooses T at node 1?

4. **k-level thinking.** Use the same centipede game as above. Assume play is according to the level-k model (in which level k=0 plays uniformly randomly and every type k ≥ 1 believes her opponent is precisely type k-1, and best responds to that belief). Let $p^t(k)$ denote the level k players' take probability at the tth decision node.

(a) For level 0, compute the take probability at each decision node.

(b) For level 1, compute the take probability at each decision node. [Hint: here you will have to calculate expected utilities based on the assumed level of other players.]

(c) For level 2, compute the take probability at each decision node.