EC 320 Game Theory
Fall 2025
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Problem Set 1

Warm-up

[1] Suppose two players, John and Paul, take part in a sequential-move game. John moves first, Paul moves second, and each player moves only once.

[a] Draw an extensive-form game in which John has two possible actions (Up or Down) at each node and Paul has three possible actions (Top, Middle, or Bottom) at each node.
[b] Identify each node type in [a]'s tree.
[c] Draw an extensive-form game in which John and Paul each have three possible actions (Sit, Stand, or Jump) at each node.

[2] Consider the rivalry between Airbus and Boeing to develop a new commercial jet aircraft. Suppose Boeing is ahead in the development process and Airbus is considering whether to enter the competition. If Airbus stays out, it earns 0 profit, whereas Boeing enjoys a monopoly and earns a profit of $1 billion. If Airbus decides to enter and develop the rival airplane, then Boeing has to decide whether to accommodate Airbus peaceably or to wage a price war. In the event of peaceful competition, each firm will make a profit of $300 million. If there is a price war, each will lose $100 million because the prices of airplanes will fall so low that neither firm will be able to recoup its development costs.

Represent this game in extensive form.

[3] There are two movie theaters in your neighborhood: The Brattle, which is located one mile from your home, and Newton Cinema, located three miles from your home. Each is showing three films. The Brattle is showing Casablanca, Gone with the Wind, and Dr. Strangelove, while Newton Cinema is showing The Matrix, Blade Runner, and Aliens. Your problem is to decide which movie to go to.

[a] Draw a game tree representing this problem without assigning payoff values.
[b] Imagine that you don't care about distance and that your preferences for movies

are alphabetic (i.e., you like Aliens the most and The Matrix the least). Using payoff values 1 through 6 complete the decision tree you drew in part [a]. Which option would you choose?
[c] Now imagine that your car is in the shop and that the cost of walking each mile is equal to one unit of payoff. Update the payoffs in the decision tree. Would your choice change?

Group problems

[**1**] A manager is negotiating salaries with the union representative. The manager puts a piece of paper on the table, saying that the next year's salary can either remain frozen or be adjusted for inflation. The representative reads the options and can choose either to propose a strike to his union workers or accept the adjustment offer. If salaries remain frozen, workers lose \$20 in purchasing power, while the manager gets \$20. In case workers decide to go on a strike, their gain is 0, while the manager loses \$10. On the other hand, the adjustment offer gives workers \$0 in net gains, while going on a strike may give them \$30 in the following weeks. If the first occurs, the manager loses \$10; while with the second, it loses \$100.

Represent this game in extensive form.

[**2**] Consider the following strategic situation concerning the owner of a firm (O), the manager of the firm (M), and a potential worker (W). The owner first decides whether to hire the worker, to refuse to hire the worker, or to let the manager make the decision. If the owner lets the manager make the decision, then the manager must choose between hiring the worker or not hiring the worker. If the worker is hired, then they between working diligently and shirking. Assume that the worker does not know whether they were hired by the manager or the owner when they make this decision. If the worker is not hired, then all three players get a payoff of 0. If the worker is hired and shirks, then the owner and manager each get a payoff of -1, whereas the worker gets 1. If the worker is hired by the owner and works diligently, then the owner gets a payoff of 1, the manager gets 0, and the worker gets 0. If the worker is hired by the manager and works diligently, then the owner gets 0, the manager gets 1, and the worker gets 1.

Represent this game in extensive form.

[**3**] You probably know this game. Two players simultaneously throw their right arms up and down to the count of "one, two, three." (Nothing strategic happens

as they do this.) On the count of three, each player quickly form their hand into the shape of either a rock, a piece of paper, or a pair of scissors. Abbreviate these shapes as R, P, and S, respectively. The players make this choice at the same time. If the players pick the same shape, then the game ends in a tie. Otherwise, one of the players wins and the other loses. The winner is determined by the following rule: rock beats scissors, scissors beats paper, and paper beats rock. Each player obtains a payoff of 1 if they win, − 1 if they lose, and 0 if they tie.

[a] Represent this game in extensive form.
[b] Does the order of play matter in this game? Explain.