

Econ 409 – Game Theory
Problem Set 1
Due: September 26, 2018 at midnight

September 19, 2018

Submit your answers on Canvas by Wednesday, September 26, 2018, at midnight. Please submit your answers electronically, in the form of a PDF file, Word file, or set of JPEG files. (On iOS, the built-in Notes app has a terrific scanning feature, and can export to PDF. Find instructions at the URL <https://9to5mac.com/2017/07/11/ios-11-how-to-scan-documents-notes-app/>.)

Prove your answers (where applicable). You are encouraged to work together, but you must write and submit your own answers. You are also welcome to consult reference sources of your choosing, as long as those sources do not directly give you the answers to the questions here.

Your submission will not be graded in detail for correctness. Instead, grading will holistically assess whether you engaged with the questions and exerted effective effort. To establish correctness, you should compare your answers to the answer key that will be distributed. You will not be rewarded for excessive effort.

This homework assignment is worth 20 points in total. The expectation is that most students who submit the homework on time will score 20 points. Though due at midnight, there will be an 8.5 hour grace period, so you may submit your work without penalty until 8:30 AM on the next day. Late submissions are allowed up to 1 week later, but are worth at most 5 points.

Question 1

Consider the following extensive form game:

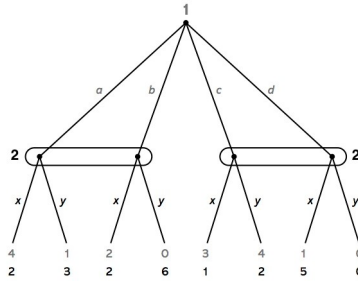


Figure 1:

- Identify the strategy sets for each of the players.
- Give an example of a strategy profile. In your example, what is s_{-1} ?
- Identify the set of strategy profiles in this game (write down the full set).
- Write down the normal form of this game

Question 2

A board of directors has to decide on a proposal to approve the payment of a dividend to shareholders. Suppose Mr. Greedy is the chair and the other two board members are Ms. X and Mr. Y. The voting procedure works as follows: excluding the chair, Ms. X and Mr. Y simultaneously vote for or against the approval of the dividend. Suppose that both write down their vote on a slip of paper (either “approve” or “reject”), fold it and hand it to the secretary of the board. The secretary opens the slips of paper and announces the vote tally. If the secretary reports that both members voted “approve”, then the dividend is approved; if both “reject” no dividend is paid in this quarter. However, if there is one approval and one rejection vote, then Mr. Greedy has to vote. If he votes for the dividend payment, then the dividend is approved; if he votes against, then it is rejected. That is to say, Mr. Greedy casts a vote only to break ties.

If the dividend is approved, then Ms. X has a payoff of 6 and Mr. Y a payoff of 2. If the dividend payment is rejected then both, Ms. X and Mr. Y each receive

a payoff of 3. As for Mr. Greedy, he prefers to reject the dividend, but would prefer not to be on record as the one voting against the dividend payment to shareholders. Mr. Greedy's payoff if the dividend payment is rejected when his vote is not required is 7. His payoff if the dividend is rejected only as a result of his vote is 4. His payoff from approval of the dividend is zero (regardless of whether or not he voted).

- a) Identify the set of players involved in the game.
- b) Identify the set of actions for each of the players. That is, identify the set of actions each of the players can choose amongst when they moves in the game.
- c) Write down the extensive form of this game as a game tree. Indicate the information sets for each of the players clearly.
- d) Identify the set of strategies for each of the players.
- e) Write down the normal form of this game

Question 3

Which of the examples in Figure 2 are valid game trees? For examples that are not valid game trees explain why – include **all** features that are not in line with the required properties of a game tree.

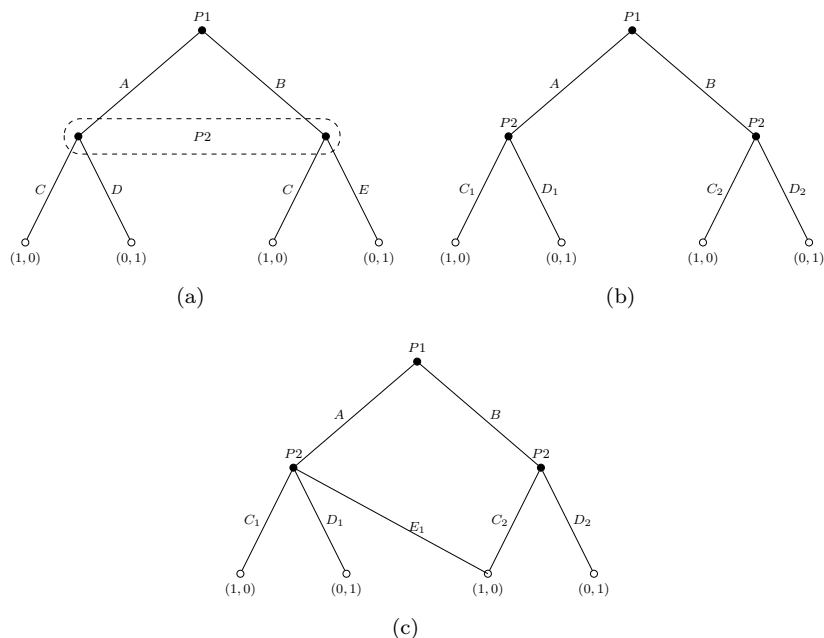


Figure 2: Extensive form III

Question 4

Consider the following setting:

- Player 1 moves first. He can choose among three actions: l, m, and r (left, middle, right).
- After observing the choice of player 1, player 2 chooses between two actions: u and d (up and down).

Consider the following three scenarios regarding what player 3 can do and what she knows when she moves. For each of the cases, write down a game tree that captures the structure described (ignore payoffs).

- a) If player 1 chose m, then player 3 selects among two actions: H and L (high and low). Player 3 knows player 2's choice when she moves.
- b) If player 1 chose l, then player 3 selects among two actions: H and L (high and low). Player 3 does not know player 2's choice when she moves.
- c) If player 1 chose either m or r, then player 3 selects among two actions: H and L (high and low). Player 3 observes the choice of player 2, but not that of player 1.