# Game Theory

ECON 3208

## MIDTERM EXAMINATION

This exam has four questions of which you need to answer three, worth 20 points each (60 points total). There is also an extra credit section. Note that, if you have time, you may attempt all of the questions. All of them will be graded and the best three will be counted.

Please identify any assumptions you are using in your analysis and show all work for partial credit.

You may use the back of a page if necessary, but clearly indicate if you do so that I will know to look there. Work quickly if you wish to answer every question, but carefully.

QUESTION 1.

Consider the following strategic-form simultaneous game. Player 1's payoffs are listed first, in bold.

| | | Player 2 | | |
|---|---|---|---|---|
| | | X | Y | Z |
| **Player 1** | **A** | **5** , 5 | **3** , 4 | **80** , 4 |
| | **B** | **2** , 5 | **5** , 5 | **70** , 5 |
| | **C** | **2** , 20 | **1** , 10 | **5** , 5 |

a. [3 pts] List all *strictly* ***dominant*** strategies for both players. Briefly explain your answer.

b. [4 pts] List all *strictly* ***dominated*** strategies for both players. Briefly explain your answer.

c. [3 pts] List all *weakly* ***dominated*** strategies for both players. Briefly explain your answer.

d. [6 pts] List all pure-strategy Nash equilibria of the above game.

e. [2 pts] Can a Nash equilibrium involve a player playing a strictly dominated strategy? If yes, provide an example. If no, briefly explain why not.

f. [2 pts] The United States senate is currently playing a game with respect to the United States budget. The game might look like the one pictured below.

| | | Democrats | |
|---|---|---|---|
| | | Compromise | Don't compromise |
| **Republicans** | **Compromise** | **5** , 5 | **0** , 30 |
| | **Don't compromise** | **30** , 0 | **−50** , −50 |

How would you classify this game (i.e., prisoner's dilemma, game of assurance, etc.)? Explain.

QUESTION 2.

Consider the following game:

| | | P 2 | |
|---|---|---|---|
| | | X | Y |
| P 1 | A | **5** , 20 | **10** , 0 |
| | B | **20** , 20 | **0** , 200 |

a. [9 pts] In the game above, what is Player 1's Nash equilibrium strategy?

b. [3 pts] In equilibrium, what s Player 2's expected payoff from strategy Y?

c. [2 pts] If the "10" in the top right box increased slightly (but everything else stayed the same), how would Player 1's equilibrium strategy change (Would Player 1 play A more often, less often, or just as often?) Explain. [Calculations are not necessary but count as an explanation]

d. [3 pts] Find **all** values of X and Y for which the game below has at least one Nash equilibrium.

| | | P 2 | |
|---|---|---|---|
| | | C | D |
| P 1 | A | **5** , 6 | **8** , 4 |
| | B | **10** , 2 | **X** , Y |

e. [3 pts] An online reading discussed data from penalty kicks in professional soccer. Soccer players tend to kick to the left side of the goal about 40% of the time and to the right side of the goal about 60% of the time. When kicking to the left, soccer players score a goal 80% of the time. How often do they score a goal when kicking to the right? Briefly explain.

QUESTION 3.

Consider the following game. Player 1's payoffs are listed first, in bold:

| | | Player 2 | |
|---|---|---|---|
| | | X | Y |
| **Player 1** | **A** | **10** , 6 | **20** , 2 |
| | **B** | **5** , 8 | **30** , 8 |

a. [2 pts] Write down all pure-strategy Nash equilibrium/equilibria of the above game.

b. [10 pts] Imagine that Player 1 makes a decision first and Player 2 makes a decision after observing Player 1's choice. Write down every subgame-perfect Nash equilibrium of this game.

c. [3 pts] Imagine that Player 2 makes a decision first and Player 1 makes a decision after observing Player 2's choice. Write down every subgame-perfect Nash equilibrium of this game.

d. [2 pts] Of the above three ways of playing this game, how would the players prefer to play it? Briefly explain.

e. [3 pts] Imagine that player 1 decides on A or B in March and Player 2 decides on X or Y in April. Discuss whether this game should be characterized as simultaneous or sequential.

QUESTION 4

a. [5 pts] What does it mean for payoffs in a game to be “common knowledge”?

b. [5 pts] Discuss how a game theory student should approach very long sequential games (with many rounds or decision points) when playing against those who perhaps haven’t studied game theory.

c. [10 pts] The nine-person International Olympic Committee is deciding between three possible host cities for the 2036 Summer Games: Barcelona (B), Copenhagen (C), and Doha (D). The rules of voting are as follows: (1) in the first round, each of the nine members votes for a city, B, C, or D; (2) the city with the fewest votes is eliminated and, in the second round, each of the nine members votes for one of the two remaining cities, with the larger vote-getter winning.

Two committee members prefer C to B to A, and will be voting for C in the first round

Three committee members prefer B to A to C, and will be voting for B in the first round

Four committee members prefer A to C to B

How should the four committee members vote? Carefully explain.