MIDTERM EXAM

SUBJECT	: INTRODUCTION TO GAME THEORY
Date	: 1 April 2019
Time	: 150 Minutes
Exam Status	: Closed Books, No calculator or any counting tools
Note	: Process is as important as the result!
Lecturer	: Chaikal Nuryakin, PhD and Teguh Dartanto, PhD

Please, write your answer neatly. Any irrelevant handwriting would not be counted.

1. Consider the following games **(20 points)**
   For the static games whose payoff matrices are given below, answer the following questions:

a. Can the game be solved by iterated elimination of strictly dominated strategies? If yes, describe the elimination process. If not, explain why. (6 point)

b. Using the best response, find all pure strategy Nash equilibria if it exist. If it exist, then is the outcome pareto optimal? (7 point)

c. Explain the concept of beliefs, best response and rationalizability in game theory! Why are beliefs and rationalizability very important in deriving the solution of games? (7 point)

Player 2 Player 1	L	C	R
U	2 , 0	5 , 2	0 , 2
M	1 , -1	3 , 1	0 , 0
D	0 , 2	4 , - 1	2 , 0

2. The penalty kick game (25 point)

The 2019 UEFA Champion League will have a last final game in Madrid, Spain. Teguh and Chaikal as football commentators predict that Juventus will beat Barcelona in the final game, and after 90 minutes + Extra time, the result is draw. The game will be continued in the penalty game. In the last chance, Ronaldo will face the goalkeeper of ter Stegen. Below is the payoff matrix of the penalty game. As you are an expert of game theory, what is the best strategy for Ronaldo to win the 2019 UCL. Answer the following questions!

a. Find all pure strategies Nash Equilibria if exist. If it is not exist, explain why! (5 point)
b. Find the best response function for each player! (10 point)
c. What is the Nash Equilibrium of the penalty game! (5 point)
d. Give your comments on the results of Nash Equilibrium! Who will win the 2019 UCL? (5 point)

ter-Stegen (Barca's goalkeeper)

|		Left	Right
Ronaldo (Juve's striker)	Left	50, 100	200, 0
	Right	200, 0	50, 100

Note: If Juventus fails, it does not matter since becoming a finalist is a good achievement, while for Barcelona, if it cannot be a winner, it is embarrassing.

3. **Cournot Model (30 points)**
   Suppose two firms produce an identical good. The (inverse) demand function for the good is given as $P = 130 - Q$, where Q is the total quantity produced by the two firms. Each firm has a constant marginal cost 10 of producing the good.
   a. Suppose that firms compete as quantity setting duopolists. Find the best response function for both firms. Find Cournot Nash equilibrium of this game. (12)
   b. What quantities will they produce, what is the market price and how much profit does each firm earn? (8)
   c. Suppose the firms form a cartel: each firm produced the same output and maximizes their joint profit. What quantity would each firm produce? What would be the profit of each firm? (6)

4. **Dynamic Games (25)**
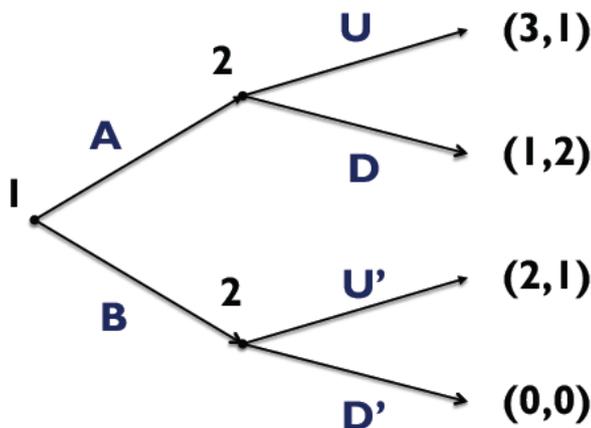
   a. Translate this game into normal-form by drawing the payoff bi-matrix. (6) Hint: remind yourself that a strategy especially for player 2 is a complete plan of actions.
   b. In (a), find all pure-strategy Nash equilibria. How many are there? (6)
   c. Solve this game by backward induction, and derive the subgame perfect Nash equilibrium. (7)
   d. Explain and compare the result you have in (b) and (c)! (6)

   ~~~~~~~~~ Life is a game, so play it wisely. (anonymous) ~~~~~~~~