4511W, Fall-2018
ASSIGNMENT 3 :
Assigned: 10/19/18 Due: 10/24/18 at 11:00 PM (submit via moodle, you may scan or take a picture of your paper answers in a zip if you have multiple files)

Problem 1. (15 points)
Assume you have a tree with a branching factor of 2. Run Monte-Carlo tree search assuming the "random plays/rollouts" happen in the order as follows: win, win, loss, loss, win, win, win, loss, loss, win, loss.

If there is a tie between the branches/children, select the left branch. Show the current Monte-Carlo tree and corresponding UCB values for every node after seeing a "loss" in the random play/rollout (i.e. after the 3rd, 4th, 8th, 9th, and 11th iteration).

Problem 2. (25 points)
Consider the following game:

	Player 2, Action 1	Player 2, Action 2	Player 2, Action 3
Player 1, Action 1	(1,2)	(3,4)	(5,6)
Player 1, Action 2	(0,2)	(4,6)	(8, 0)
Player 1, Action 3	(5,2)	(3,3)	(4,1)

Answer the following questions:
(1) What are the pure Nash equilibrium for the game above.
(2) What are the mixed Nash equilibrium for the game above.
(3) What are the pure Pareto optimum for the game above.
(4) What are the mixed Pareto optimum for the game above.

Problem 3. (20 points)
(1) Give an example of a payoff matrix that has 4 different Nash equilibrium with a pure strategy. All values in the payoff matrix must be unique (i.e. no duplicate numbers).

(2) Give an example of a payoff matrix that has 4 different Nash equilibrium with a mixed strategy. All values in the payoff matrix must be unique (i.e. no duplicate numbers).

Problem 4. (20 points)
Suppose you have a full tree (all leaves at same depth) with a branching factor of 3. Assume the game is zero-sum, the top node is a maximizer and turns always alternate. Assume the tree is always searched from left to right.

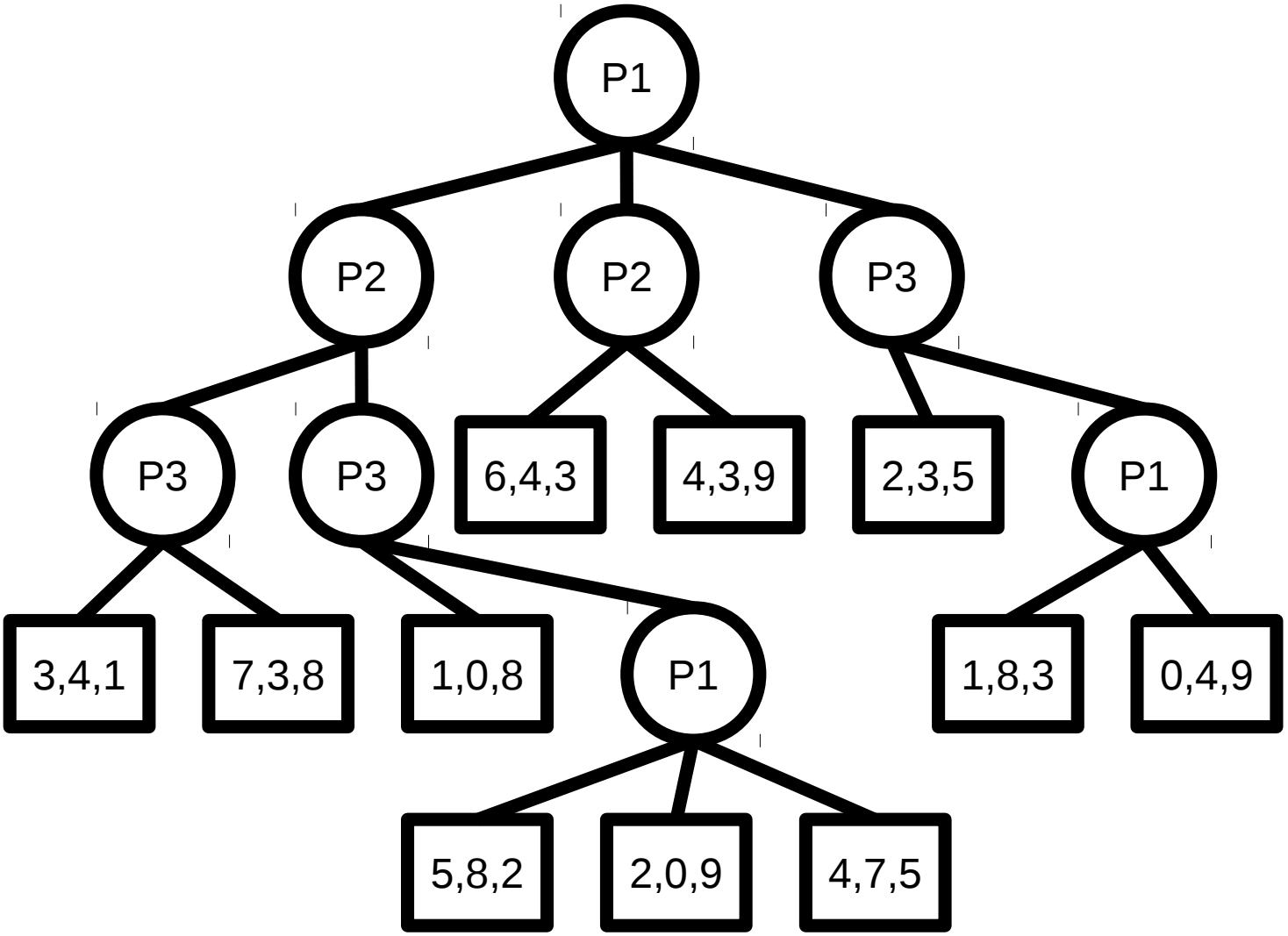
(1) Give an example of a tree where over 50% of the leaves can be pruned.

(2) What is the minimum depth for which 75% of the leaves can be pruned? Describe the values of the

leaves from left to right.

Problem 5. (10 points)
Use a “mini-max”-like technique to figure out how player 1 should play on the following tree. Circle indicate which player’s turn it is (assume they will greedily maximize their own options without any coordination/cooperation). Rectangles are terminal states with the points for each player (player 1’s points first, player 3’s points on the right).

Also answer this question: In what ways is it inappropriate to call what you are doing “mini-max” on the following tree?



Problem 6. (10 points)
For this problem, we will use this webpage:
http://ncase.me/trust/

(1) Go to part “2. Repeated games”. What is the payoff matrix? In a pure strategy, indicate which strategies are Nash equilibrium or Pareto optima?

(2) For each of the 5 games in “2. Repeated games”, what is the maximum amount of points you can

get for that game? In addition to the amount, indicate how you should play. (You cay say “Cheat/Cooperate” or L/R (L=Cheat, R=Cooperate)).

(3) Go to part “7. Sandbox”. Use the default “rules” except the chance of mistake.
(3.1) Set the mistake chance to 0% and 12 “Random” agents. Make 13 of each of the other 7 types of agents one at a time. Report who ends up “winning” long term.
(3.2) Repeat (3.1), except with a 25% chance of making a mistake in the “rules”. Report who wins when faced against the other 7 types (12 random agents vs. 13 other agents).