SOLUTIONS

CSC 384 Winter 2023 Test 2 Version B

February 13 and 14, 2023

Last Name: ______________________________

First Name: ______________________________

Email: ______________________________

Q1 (4 marks)

Q1.1 (1 mark) Which is a **multiplayer** game? Circle the best answer.

A. 8-puzzle
B. Rubik’s cube
[✓ C. Chess]

Q1.2 (1 mark) Which is a **stochastic** game? Circle the best answer.

[✓ A. Monopoly]
B. Checkers
C. Tic Tac Toe

Q1.3 (1 mark) Which is an **imperfect-information** game? Circle the best answer.

A. Checkers
B. Go
[✓ C. Poker]

Q1.4 (1 mark) Consider the game below. Player A has two actions: Up and Down. Player B has two actions: Left and Right. In each cell, the two numbers specify player A’s and B’s utility, respectively. For example, if player A chooses Up and player B chooses Right, player A gets a utility of 5, and player B gets a utility of 4.

		Player B	
		Left	Right
Player A	Up	6, 6	5, 4
	Down	4, 5	6, 6

Is this a **constant-sum** game? YES OR [✓ NO]

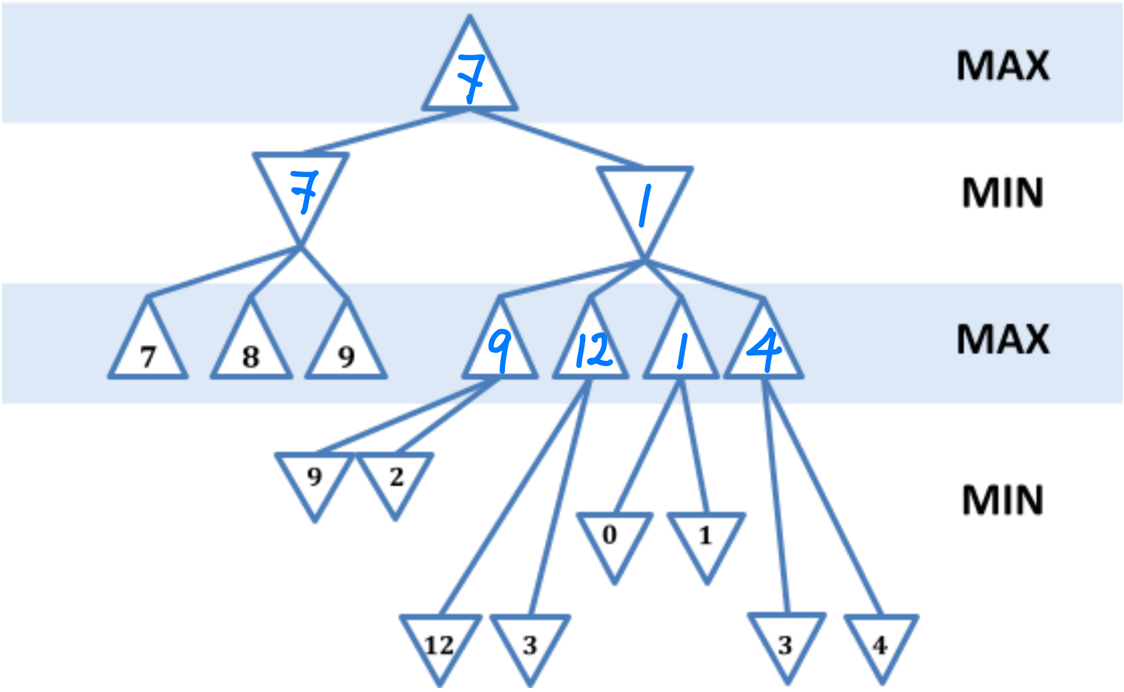
Justify your answer in at most two sentences:

The total utility of the two players is NOT constant.

(up, left) $6+6=12$ (up, right) $5+4=9$

$12 \neq 9$

Game Tree 1 Below



Q2 (4 marks)

Perform **Minimax search** with **NO Alpha-Beta Pruning** on **Game Tree 1** above.

Q2.1 (2 marks) Fill in the minimax value of every node.

Q2.2 (1 mark) How will the **results** differ if we used **Depth-First Minimax** instead of regular **Minimax** for Game Tree 1? Explain in one sentence.

The results will NOT differ.

Q2.3 (1 mark) How will the **performance** differ if we used **Depth-First Minimax** instead of regular **Minimax** for Game Tree 1? Explain in one sentence.

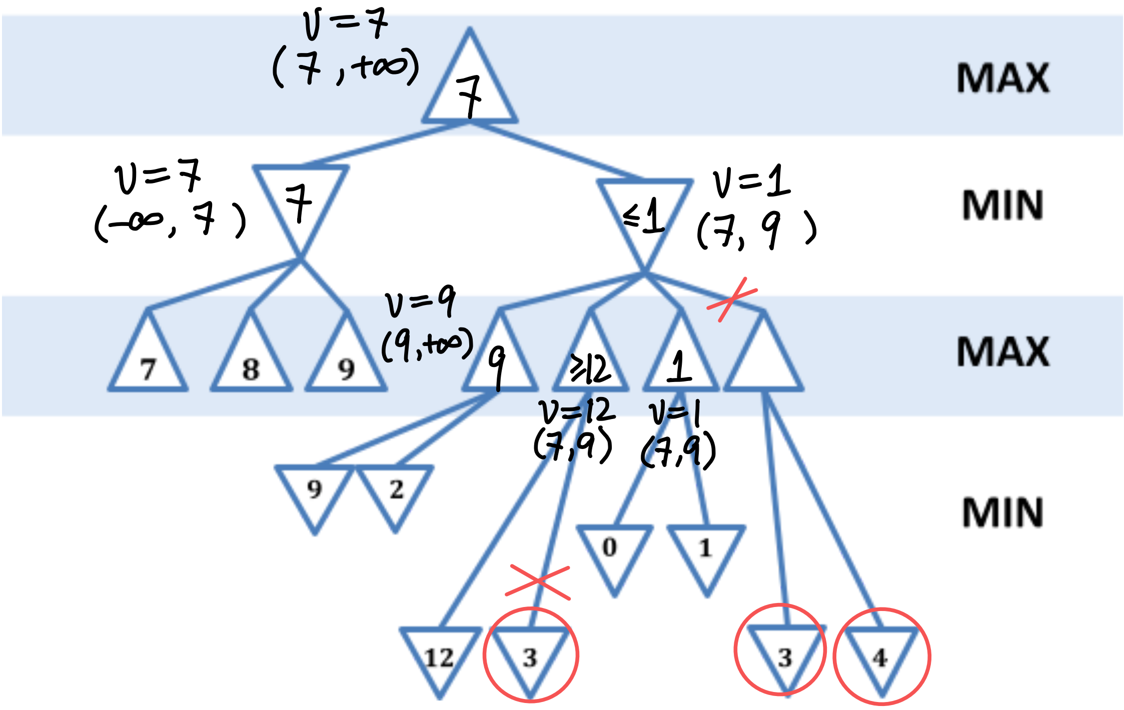
Depth-First Minimax will use less memory.

Q3 (6 marks)

Consider Game Tree 1 below. Perform **Alpha-Beta Pruning from left to right**.

Circle all the **terminal** nodes that are **pruned** (**NOT visited**).

Copy of Game Tree 1 Below



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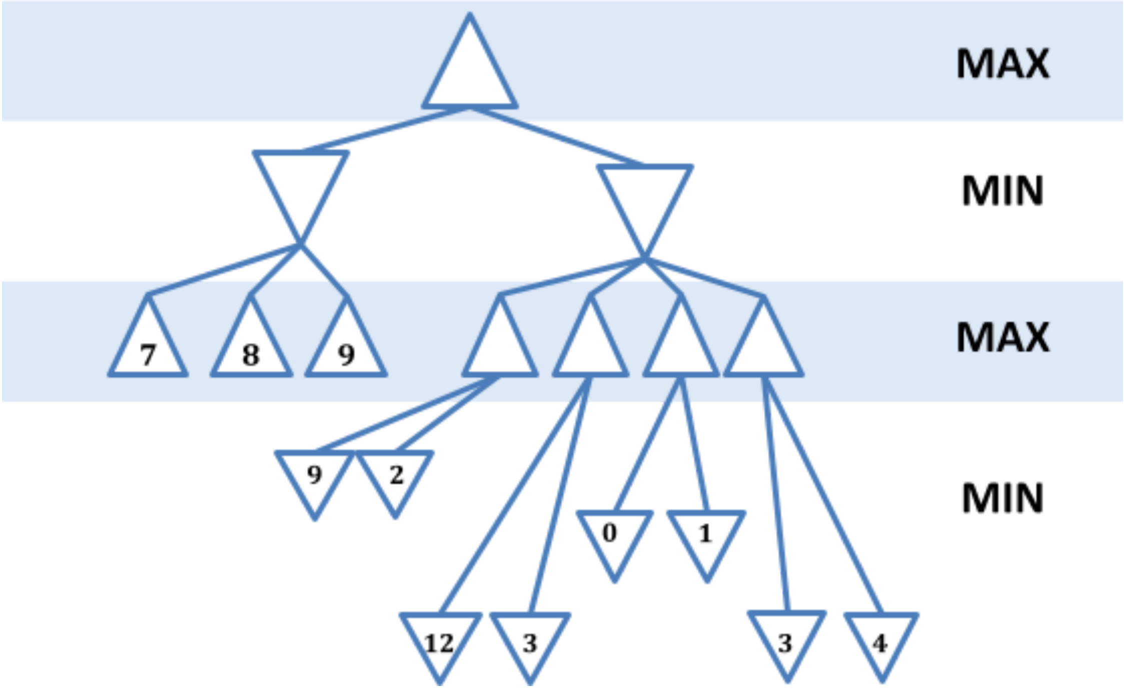
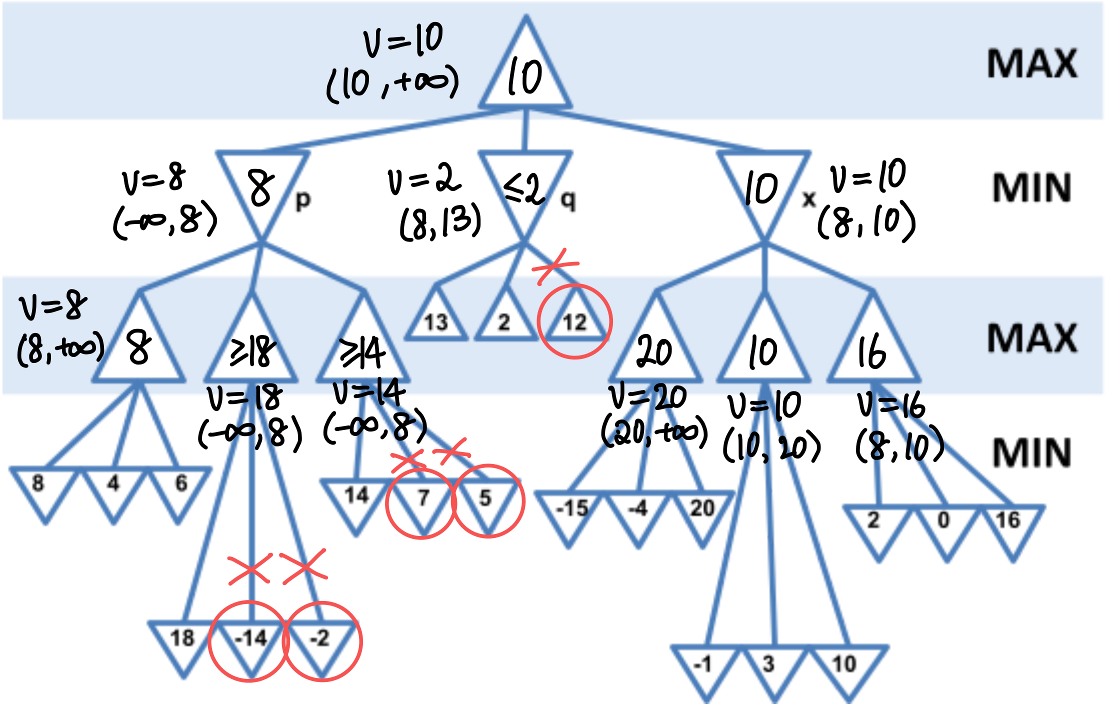
Copy of Game Tree 1 Below



Game Tree 2 Below



Q4 (8 marks)

Consider **Game Tree 2** above.

Q4.1 (6 marks) Execute **Alpha-Beta Pruning** from **left** to **right**. Circle all the **terminal** nodes that are **pruned (not visited)**. (5 terminal nodes pruned.)

Q4.2 (2 marks)

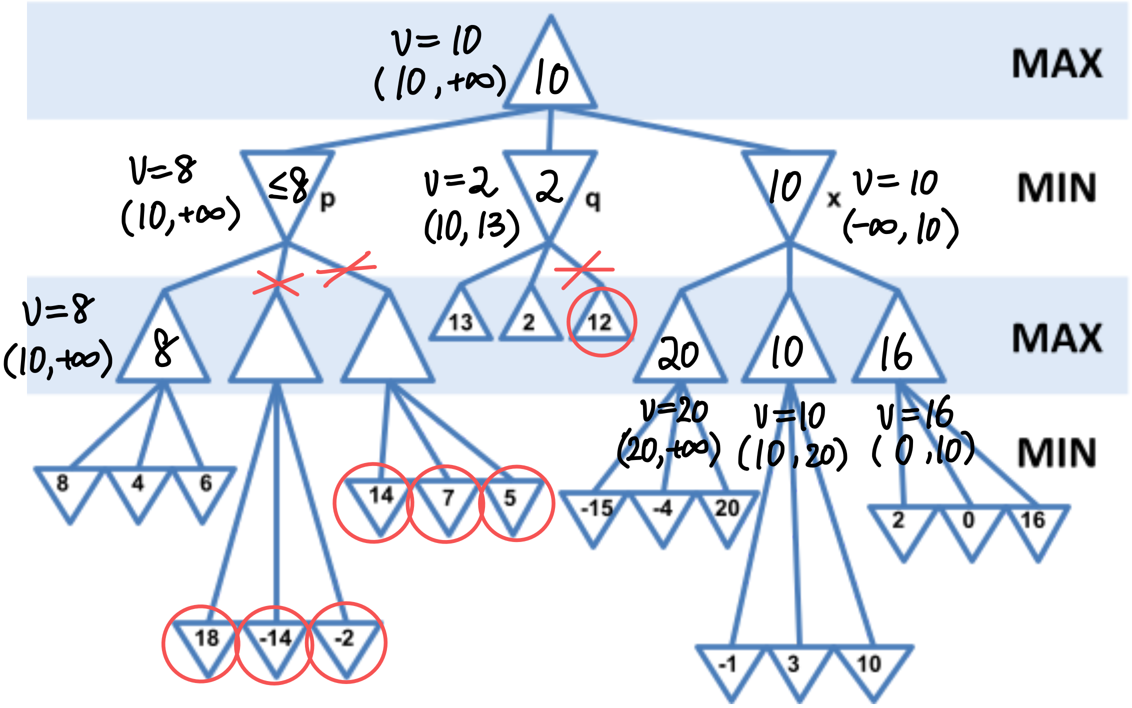
How can we re-order **p, q, and x** to **maximize** the number of terminal nodes pruned by Alpha-Beta Pruning? Write down the new order below. When reordering p, q, and x, the order of their descendants remains the same.

x, p, q. (8 terminal nodes pruned.)

There is no question on this page. Feel free to use this page for your rough work.

After re-ordering to x, p, q.

Copy of Game Tree 2 Below



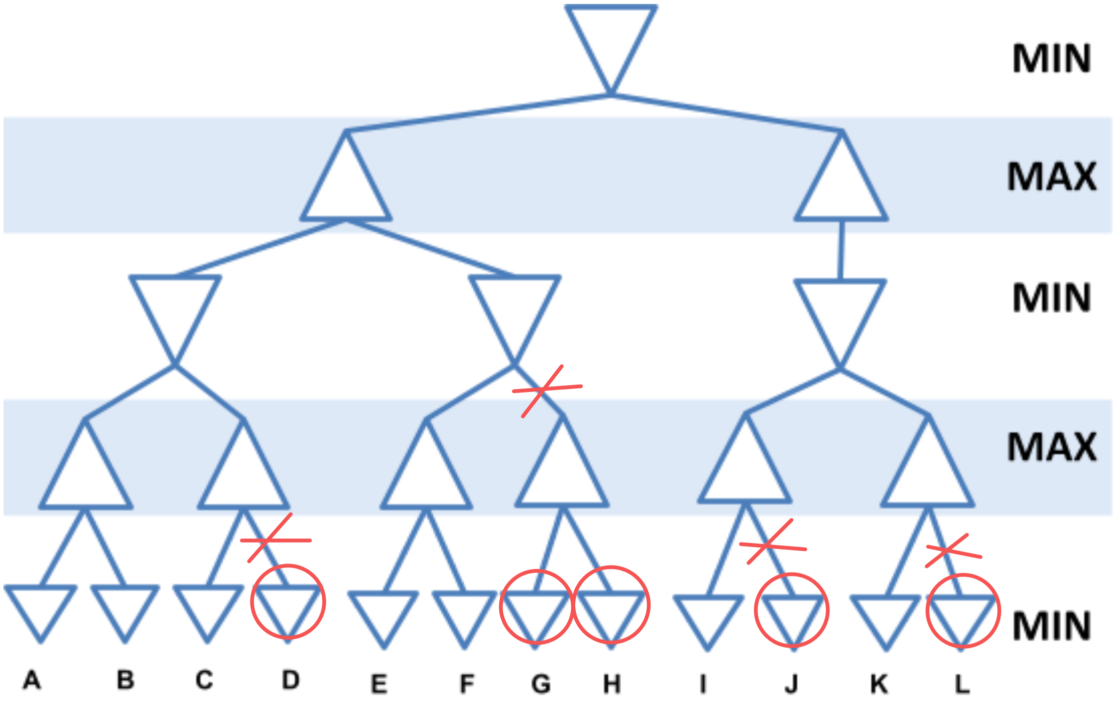
Q5 (4 marks)

Consider **Game Tree 3** below. The values of the terminal states are unknown. You can make the following assumptions:

- All the nodes have been ordered such that **Alpha-Beta Pruning from left to right** will prune the **maximum** number of terminal nodes.
- The utility values of all the terminal nodes are all different.

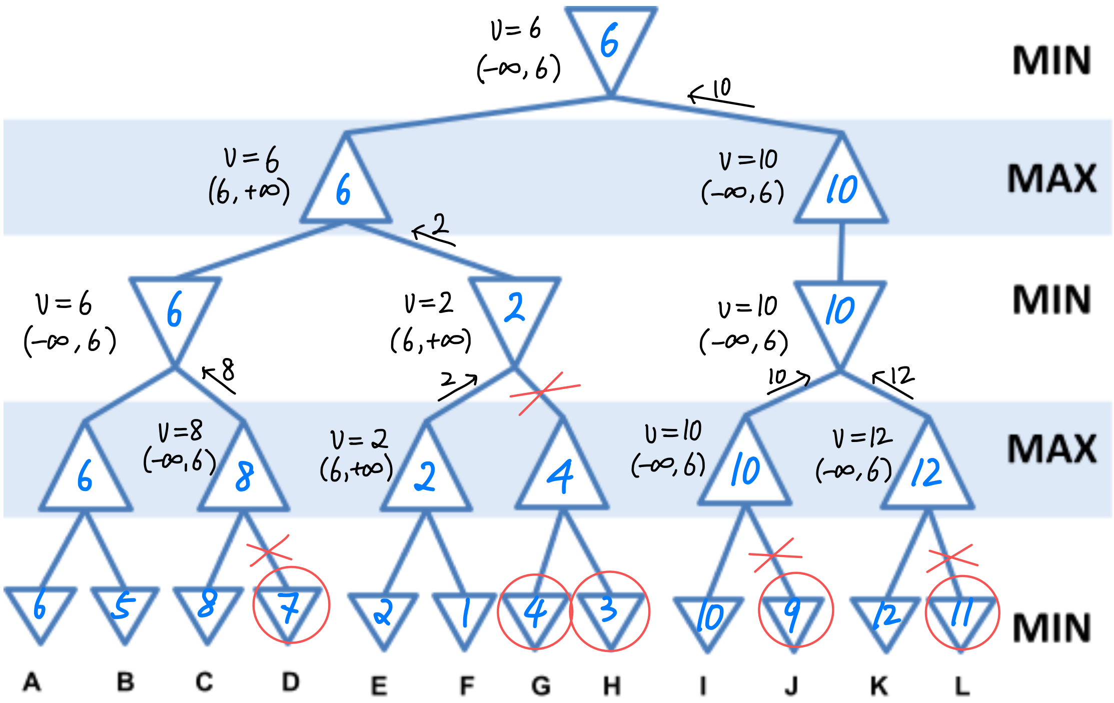
Circle all the **terminal** nodes that will be **pruned** (**NOT visited**).

Game Tree 3 Below



There is no question on this page. Feel free to use this page for your rough work.

Copy of Game Tree 3 Below



You can solve this question by trying an example.
Assume that the terminal nodes have utilities
1 to 12. Start by assigning the utilities to
the terminal nodes arbitrarily. Then, re-order
the utility values to maximize pruning.
We get the tree above.

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