BRAC UNIVERSITY
CSE422 : Artificial Intelligence
Fall 2025

Duration: 30 minutes | **Quiz 3** | **Total: 15 marks**

Name: | **ID:** | 0.5 Points

Section: | 0.5 Points

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1. Consider the current state of a game of Tic-Tac-Toe as follows:

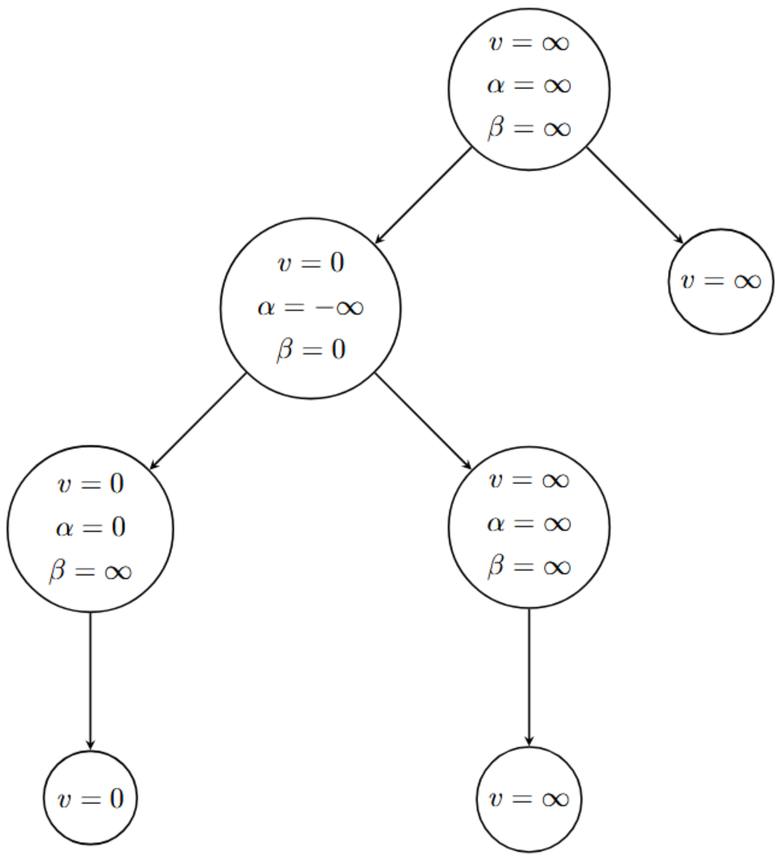
O	X	O
X	O	
		X

Fig: Current State

Use the **Minimax algorithm with Alpha-Beta Pruning** to determine the next move. (7 Points)

- Assume you are playing as **'O'**.
- For each internal node, show its **minimax value,** along with its **alpha and beta values**.
- Generate child nodes **in row-major order** (i.e., fill cells from top-left to bottom-right).
- A win earns ∞ **utility points**, a draw earns **0 utility points**, and a loss earns **-∞ utility points**.
- Only **expand nodes that are necessary** for the Minimax search.

Solution:



2. Consider the following objective function:

$$E(\theta) = |sin^2(\theta) * cos(\theta)|$$

Using the Hill-Climbing algorithm, if the initial value of θ is 0.5 and the value of θ can be changed by 0.1 at each step, what will be the **next value of** θ? [Note: You must show all necessary calculations] (4 Points)

Answer:

$E(0.4) = 0.14$

$E(0.6) = 0.26$

$\theta = 0.6$

3. Write two techniques that we can use to **overcome the local maxima problem** of the Hill-Climbing algorithm. (2 Points)

Answer: 1. Random restart, 2. Simulated annealing.

4. Does random restart guarantee **global maxima** for the Hill-Climbing algorithm? (1 Points)

Answer: No.

Bonus

Prove that Simulated Annealing Reduces to Hill Climbing as T→0. (1.5 Points)

Solution: