TY CSE AY-2022-23 Sem-I

Artificial Intelligence and Machine Learning Lab

Assignment No 3 **Due date- 14/09/2022**

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BATCH:T-6

1. The game Undercut consists of a sequence of moves in which two players simultaneously choose an integer between one and five, both inclusive. Each person gets the number she chooses as her score for that round, except when the opponent has chosen a number smaller than hers by one, in which case the opponent gets both the numbers for example, if A chooses 5 and B chooses 3 then A gets 5 and he gets 3. But if A chooses 5 and B chooses 4, A gets nothing and B gets 9.

Assignment-3

Q1 Ans

→ let $x \in [1,5]$, $y \in [1,5]$

Opponents ↓ / My →	x
$y < x-1$ and $y > x$	$y \mid x$
$y = x-1$	$y+x \mid 0$

→ when opponent chooses a value $y \in [1,5]$ such that $y = x-1$

then: opponent get $[y+x]$
and me myself $[0]$

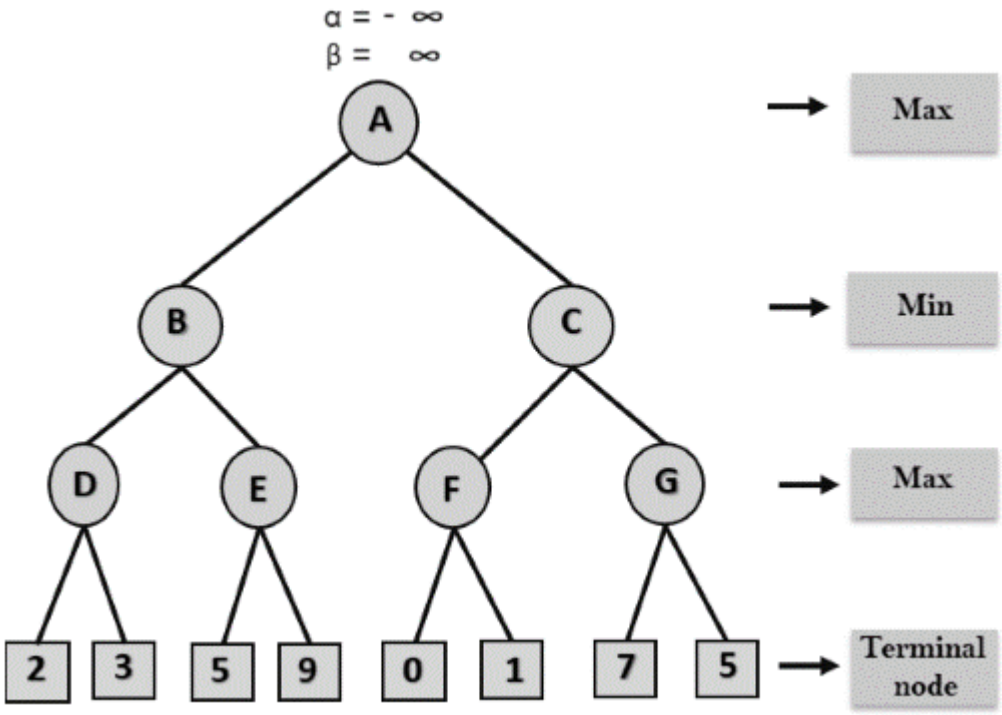
→ in other case when $y \neq x-1$ then we will get our own value

→ let player 1 ⇒ Me
and player 2 ⇒ Opponents

		Me				
		1	2	3	4	5
opponents	1	(1,1)	(3,0)	(1,3)	(1,4)	(1,5)
	2	(2,1)	(2,2)	(5,0)	(2,4)	(2,5)
	3	(3,1)	(3,2)	(3,3)	(7,0)	(3,5)
	4	(4,1)	(4,2)	(4,3)	(4,4)	(9,0)
	5	(5,1)	(5,2)	(5,3)	(5,4)	(5,5)

where (a,b) ⇒ a = opponent Reward
b = Myself Reward

2. To identify the optimal move in the game tree given below, implement



a. Min Max algorithm
b. Alpha Beta algorithm

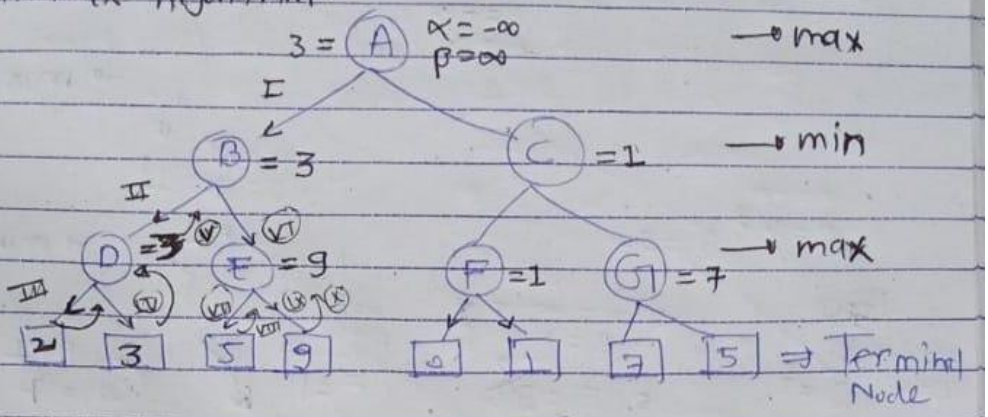
Which algorithm is efficient? Why? Justify.

(I)

Q.2 Ans

identify optimal move in given game tree by

① Min-Max Algorithm.



→ in min-max Algo:

(I) → we started from start node (A), then

(II) have traverse until the terminal has founded

(III) Backtrack the terminal node value to it's parent then traverse it's right until again terminal node has not founded

(IV) After traversing both left & Right Apply min(x,y) or max(x,y) according to min & max player to get there Node value.

Here after applying min-max Algo optimal path is.

⇒ (A) → (B) → (D) → [3]

ie (A) → max

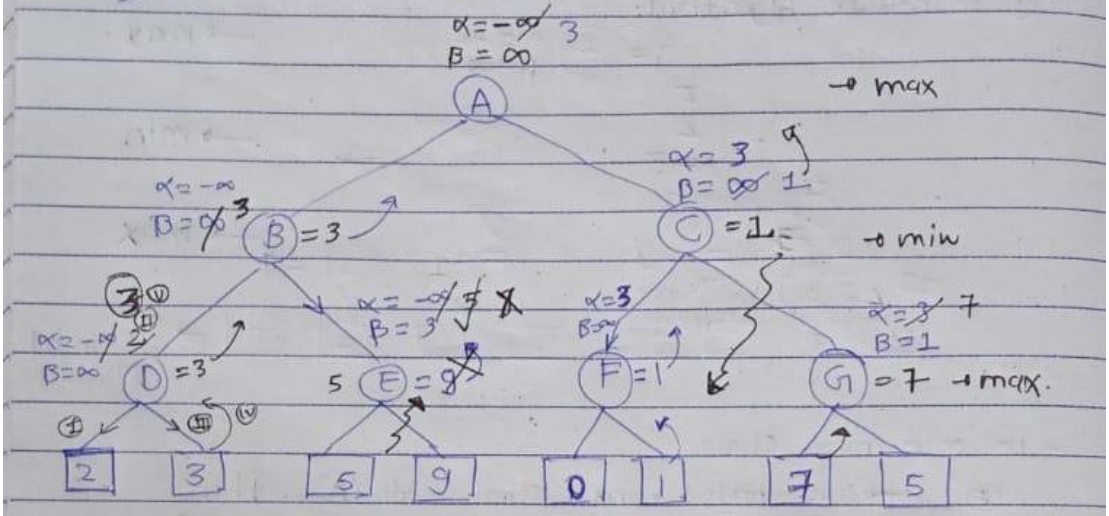
(B) → min.

(D) → max.

[3]

Q.2 (II)

(b) by Using α-β (Alpha-Beta) Algorithm.



Here α → is only update by max player
β → is only updated by min player

① After reaching to Node (D) it will
(I) first get left node = 2 then return to node D itself as it is max player then update (α) which will
$\alpha = \max(-\infty, 2) = 2$
previous.
(II) then visit to Right, which have value = 3, will Return, and again at (D) is at max player it will try to update $\alpha = \max(3, 2)$
$\therefore \alpha = 3$ previous

② After done with Node (D), it will only pass out it's value to it's parent not α-β value.
∴ (I): B will get (3) and update β as it is min play
$\therefore \beta = \min(\text{previous}, 3)$
$= \min(\infty, 3)$
$\boxed{\beta = 3}$

- this process will be continue until start Node (A) will get it's value.

Q.2 (III)

(i) → at any time when $\alpha \geq \beta$ then prune-out the Right part of that Node.

→ Here during visiting Node (E)'s left part

$\alpha = 5$

$\beta = 3$

$\therefore \alpha \geq \beta$

∴ we will prune out Right Node (9)

→ at Node (C) after visiting left part

$\alpha = 3$

$\beta = 1$

$\therefore \alpha \geq \beta$

∴ Right part will be prune out

∴ we have ~~ag~~ neglected to visiting of other 3 Right Node

Again Optimal-path: (A) → (B) → (D) → [3]

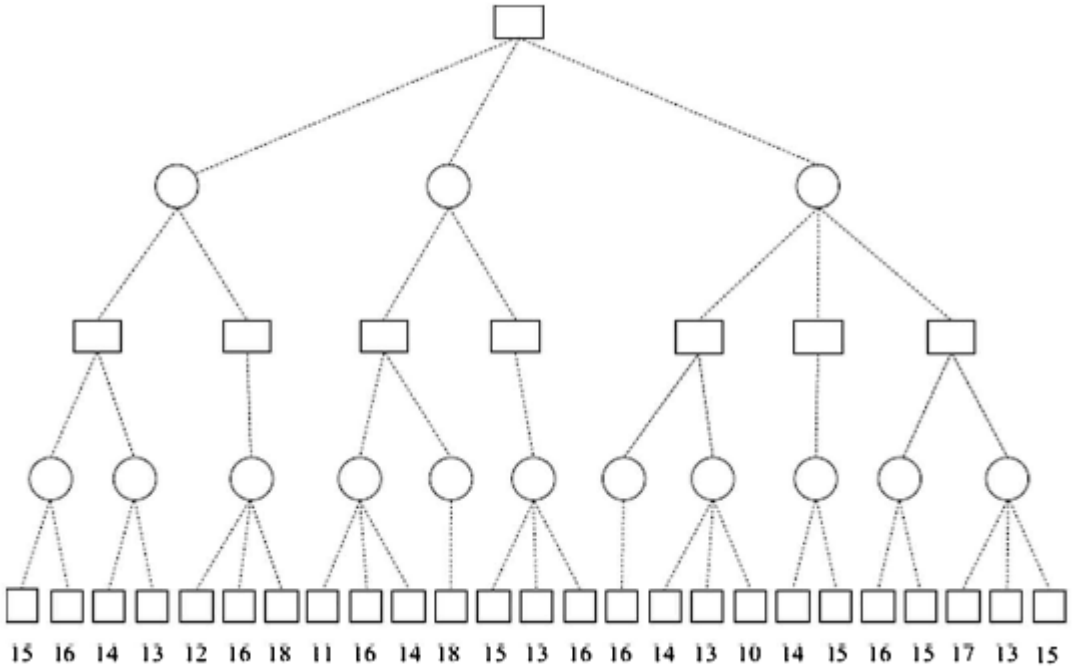
⇒ (I) On comparing bet^ min-Max Algo & α-β Algo α-β Algo will be the efficient method.

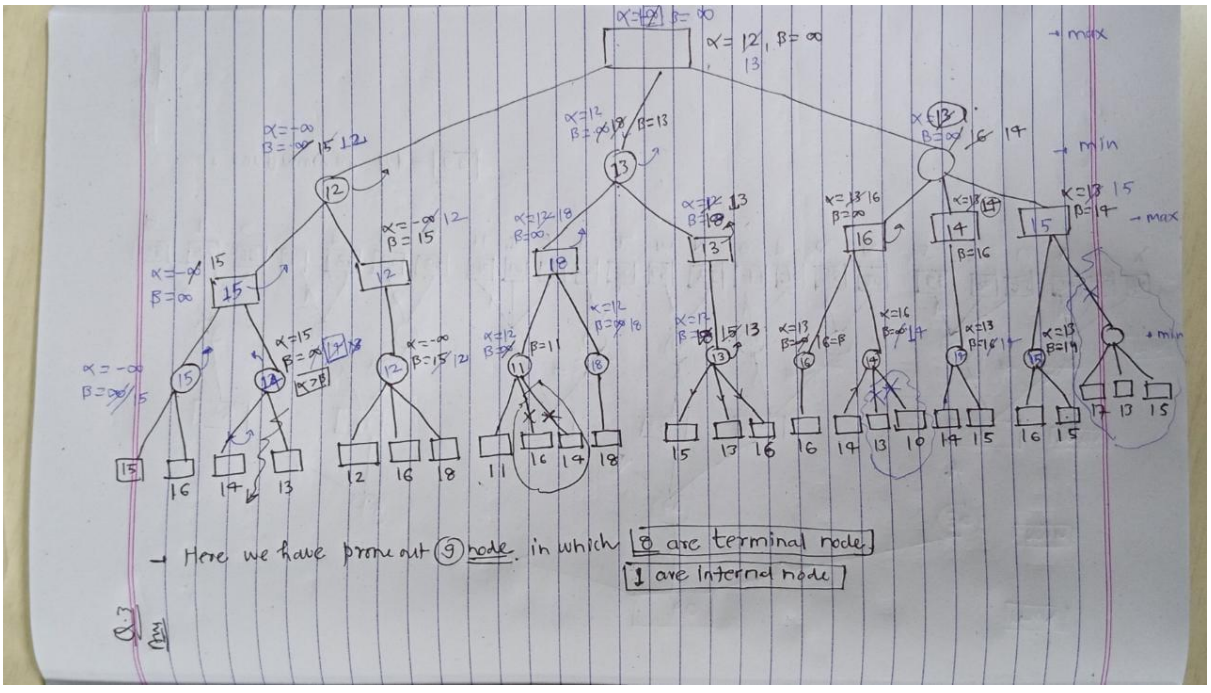
(II) as in case of α-β Algo, at any stage of traversing whenever $\alpha \geq \beta$ then automatically we will have prune out (neglected) the Right part to traverse ∴ hence save time &

But in case of min-max we have traversed all node

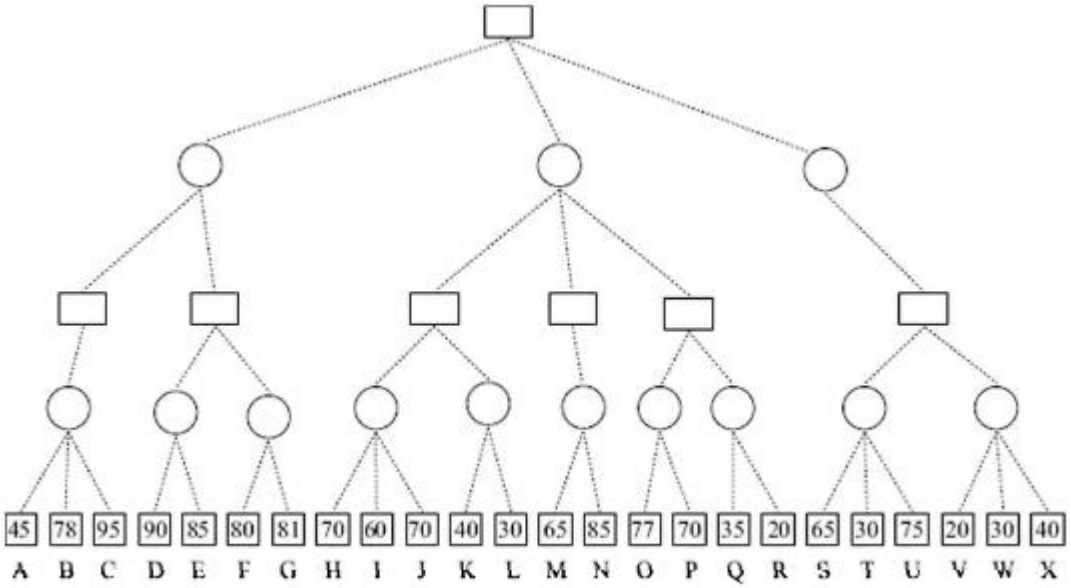
∴ α-β will have efficient Algo than min-max Algo.

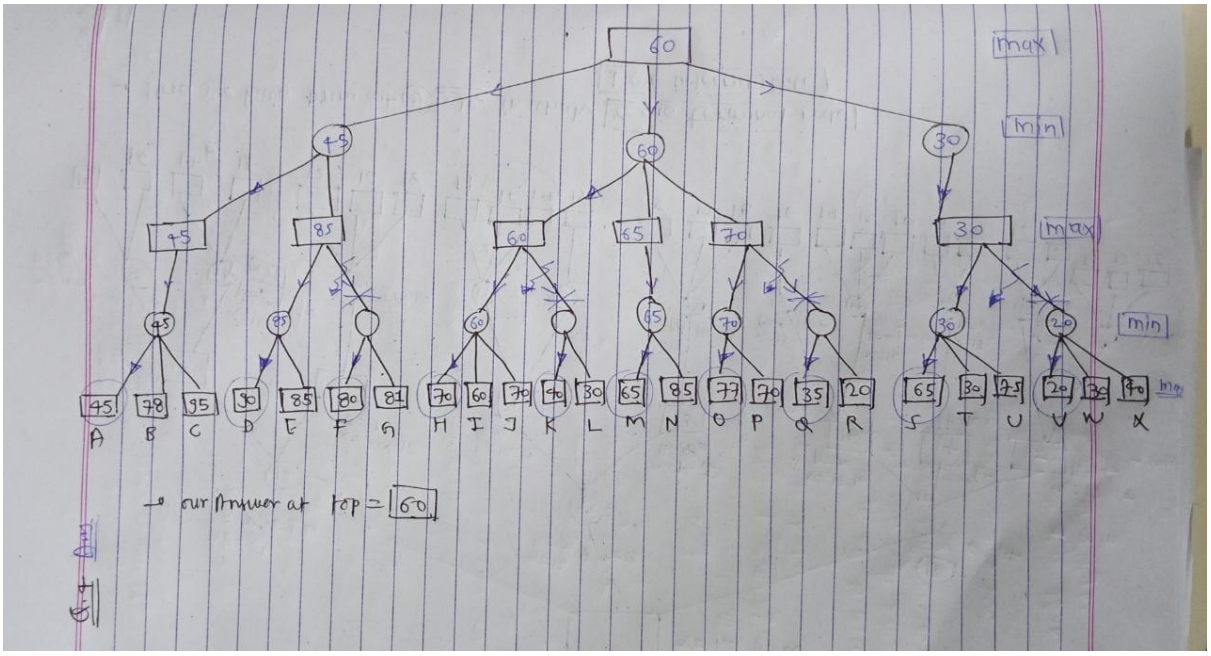
3. Show how the algorithm AlphaBeta explores the game tree, searching from left to right.
   (a) Fill in the leaves that are inspected by AlphaBeta.
   (b) Show the cutoffs and label them with their type.
   (c) Mark the move that AlphaBeta will choose for MAX at the root.





4. In the game tree on the following page, the leaves are labelled with the values from the evaluation function. The letter labels [A ... X] below the leaves are names of the leaves. Show the order in which algorithm SSS* will inspect the nodes, explaining all the decisions made, along with diagrams where appropriate. What is the minimax value of the game?





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