ARTIFICIAL INTELLIGENCE (AI)
STATE SPACE AND SEARCH ALGORITHMS

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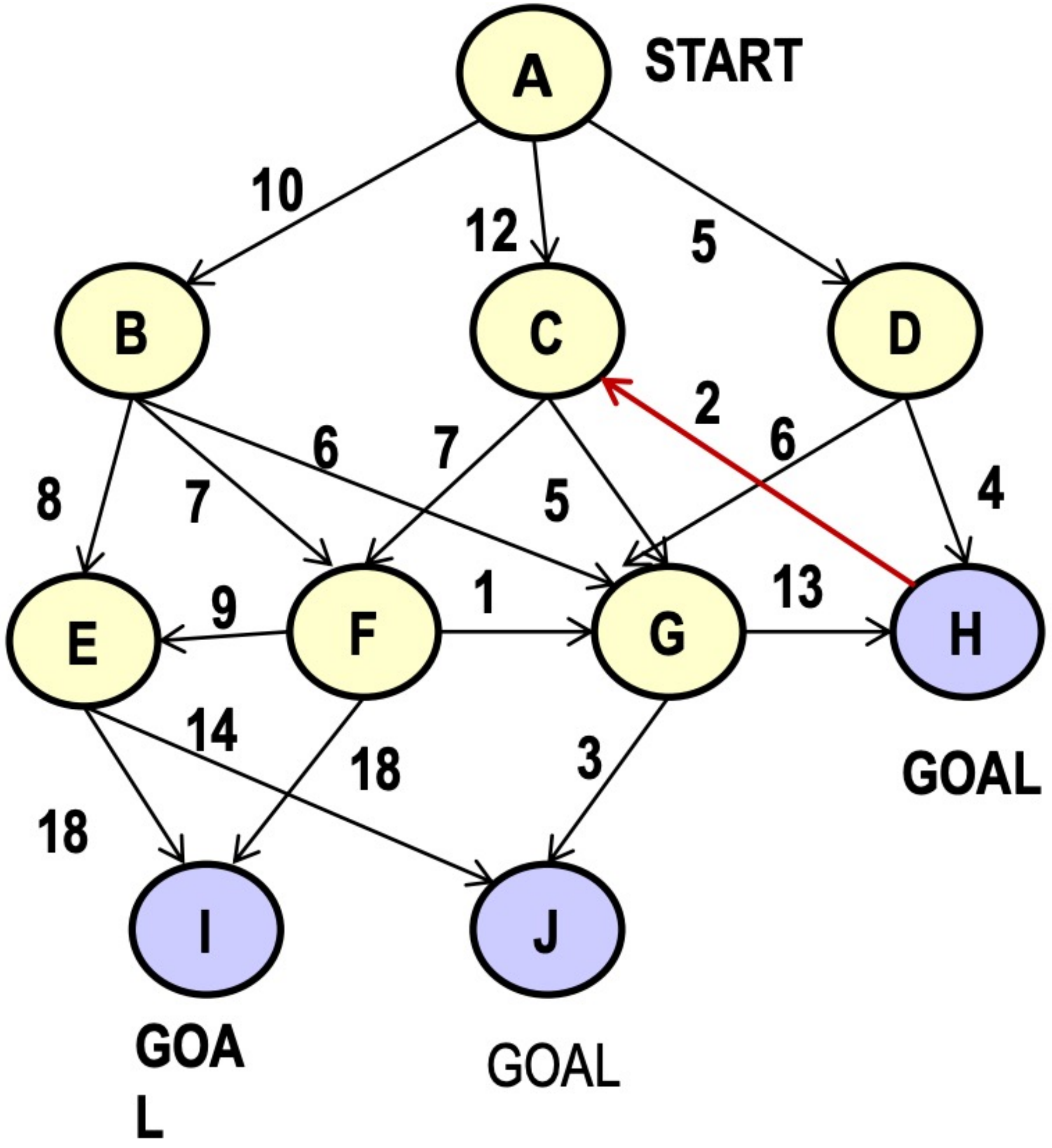
SEARCHING STATE SPACE GRAPHS WITH EDGE COSTS



ALGORITHM IDA*

ITERATIVE DEEPENING A* (IDA*)

1. Set Cut-off Bound to f(s)
2. Perform DFBB with Cut-off Bound. Backtrack from any node whose f(n) > Cut-off Bound.
3. If Solution is Found, at the end of one Iteration, Terminate with Solution
4. If Solution is not found in any iteration, then update Cut-off Bound to the lowest f(n) among all nodes from which the algorithm Backtracked.
5. Go to Step 2
6. PROPERTIES OF DFBB AND IDA*: Solution Cost, Memory, Node expansions, Heuristic Accuracy, Performance on Trees / Graphs

GAMES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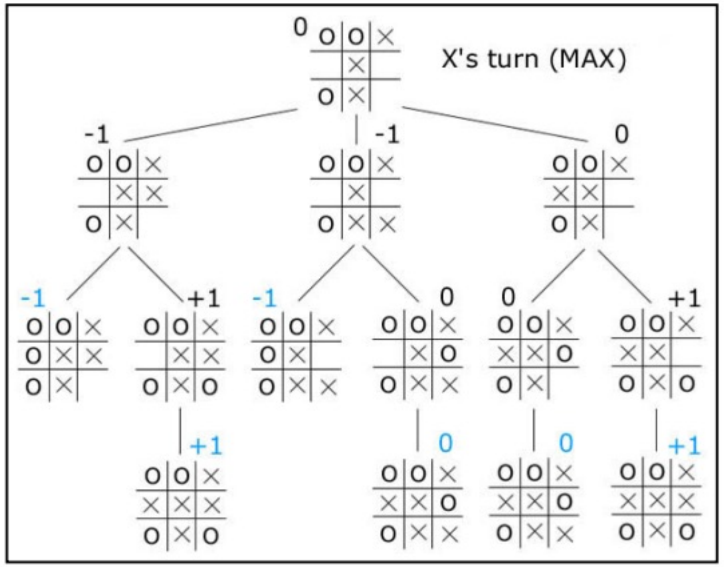

X's turn (MAX)

MULTI-PLAYER GAMES

South Deals
N-S Vul

North:
♠ K J 8 5
♥ J 10 2
♦ J 8
♣ A J 10 4

West:
♠ 10 6
♥ A 6 4 3
♦ A K 10 5 2
♣ Q 2

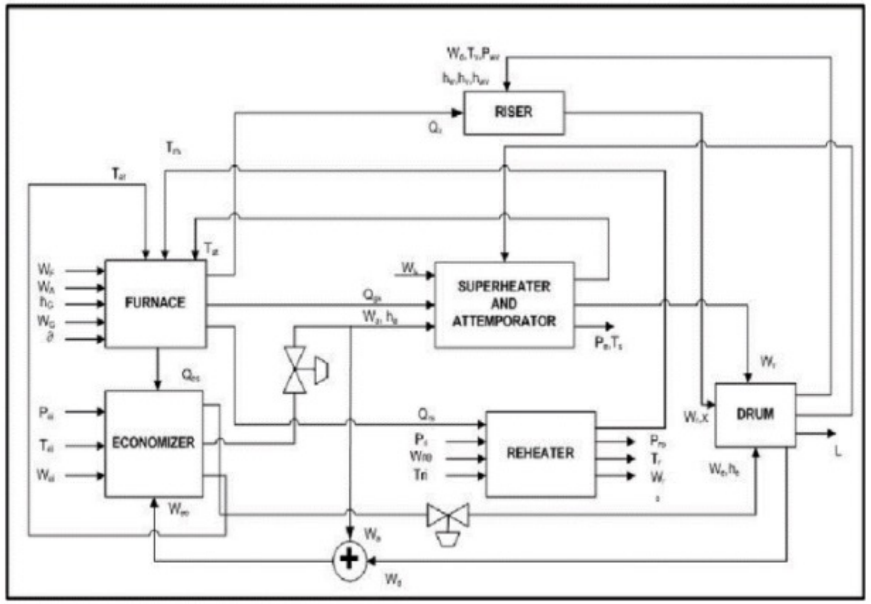
East:
♠ Q 9 2
♥ 8 7 5
♦ Q 9 6 3
♣ K 8 6

South:
♠ A 7 4 3
♥ K Q 9
♦ 7 4
♣ 9 7 5 3

West	*North*	*East*	*South*
			Pass
1 ♦	Dbl	2 ♦	2 ♠
3 ♦	3 ♠	All pass	

PROBABILISTIC GAMES

BLOCK DIAGRAM OF A BOILER SYSTEM



ROBOT GAMES

PRISONER'S DILEMMA

- Two members of a criminal gang are arrested and imprisoned. Each prisoner is in solitary confinement with no means of communicating with the other.
- The prosecutors lack sufficient evidence to convict the pair on the principal charge, but they have enough to convict both on a lesser charge.
- Simultaneously, the prosecutors offer each prisoner a bargain

PRISONER'S DILEMMA

		PRISONER B	
		Prisoner B stays silent (cooperates)	Prisoner B betrays (defects)
PRISONER A	Prisoner A stays silent (cooperates)	Each serves 1 year	Prisoner A: 3 yrs Prisoner B: goes free
	Prisoner A betrays (defects)	Prisoner A: goes free Prisoner B: 3 yrs	Each serves 2 yrs

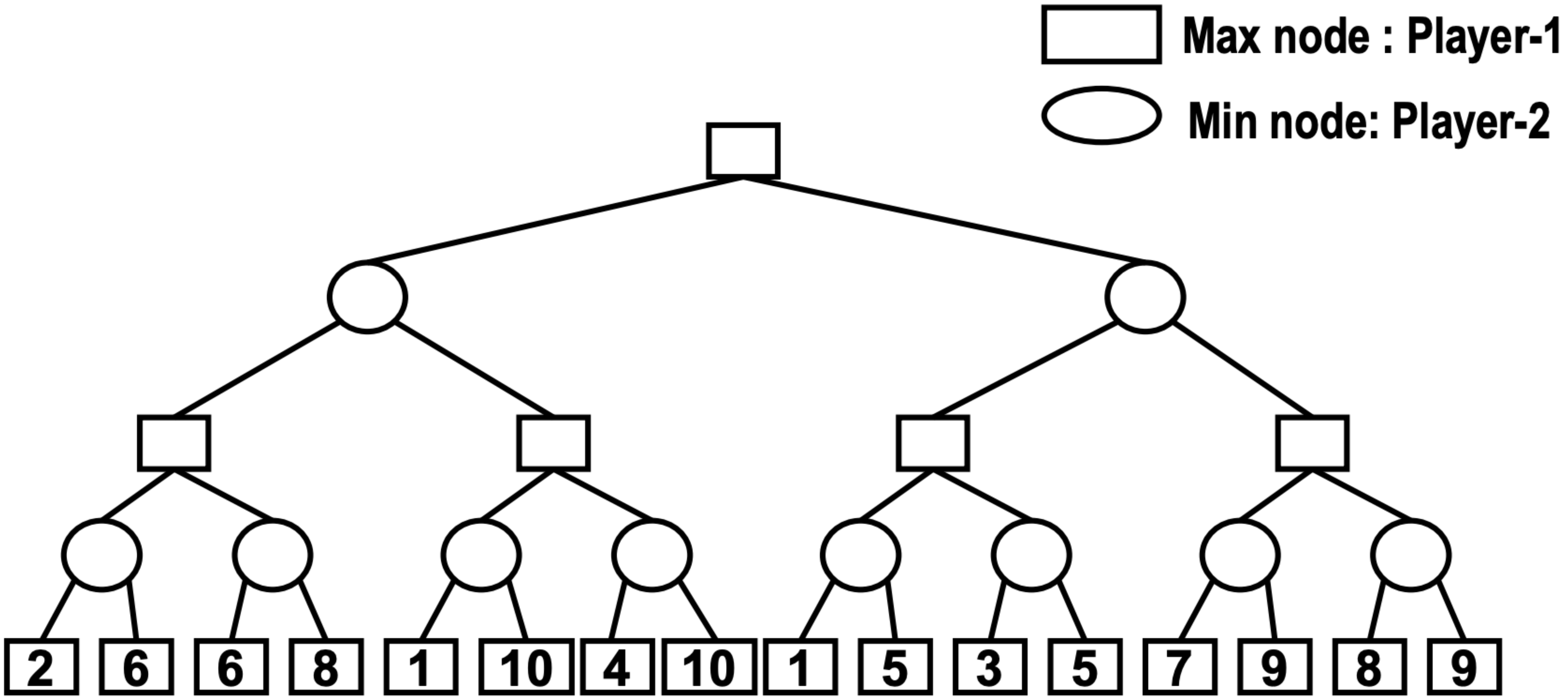
GAME TREE

- A tree with three types of nodes, namely Terminal nodes, Min nodes and Max nodes.
- Terminal nodes have no children. The tree has alternating levels of Max and Min nodes, representing the turns of Player-1 and Player-2 in making moves
- All nodes represent some state of the game
- Terminal nodes are labeled with the payoff for Player-1. It could be Boolean (such as WON or LOST). In large games, where looking ahead up to the WON / LOST states is not feasible, the payoff at a terminal node may represent a heuristic cost representing the quality of the state of the game from Player-1's perspective

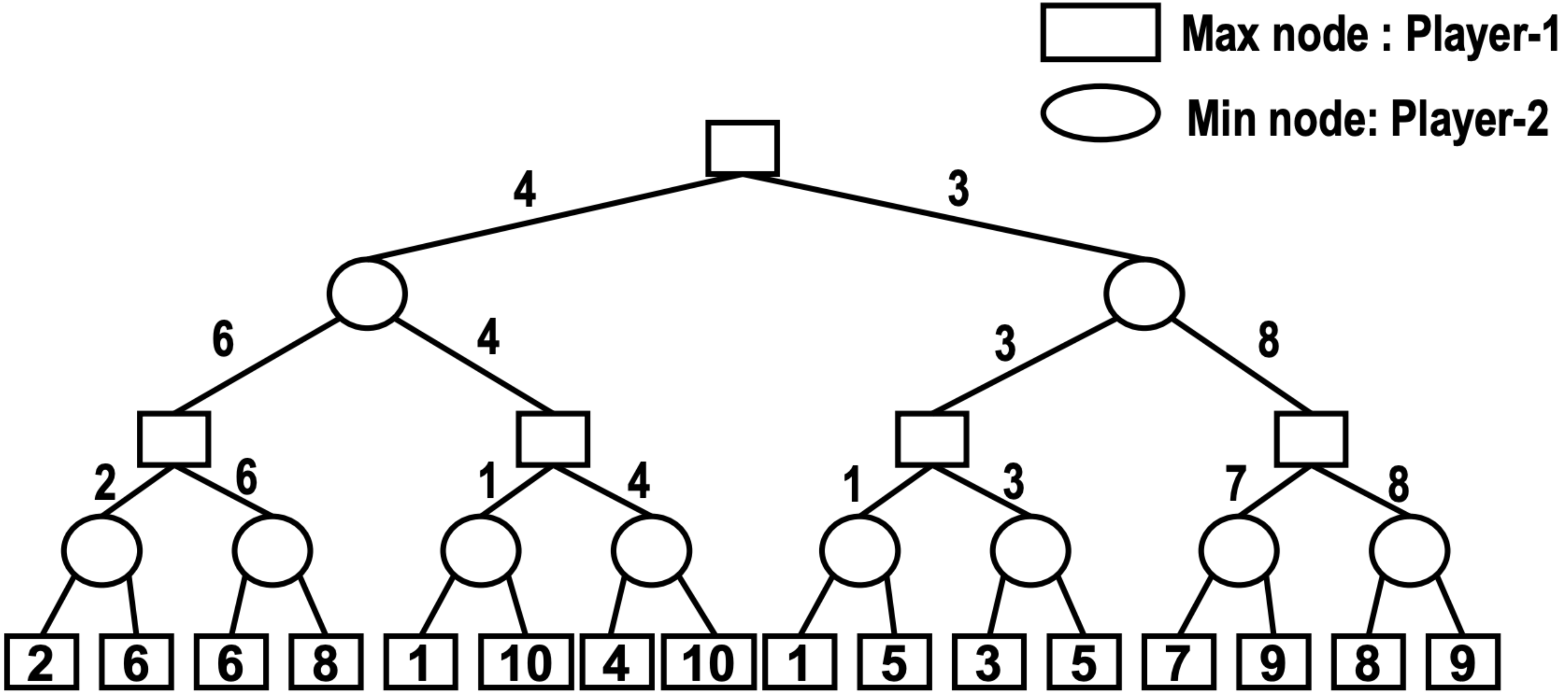
- The payoff at a Min node is the minimum among the payoffs of its successors
- The payoff at a Max node is the maximum among the payoffs of its successors

- If Player-1 aims to maximize its payoff, then it represents Max nodes, else it represents Min nodes

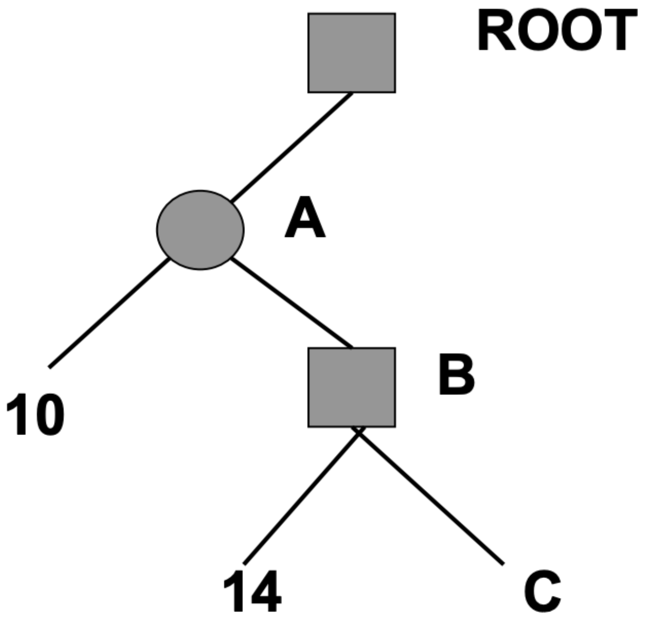
SAMPLE GAME TREE

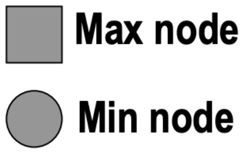


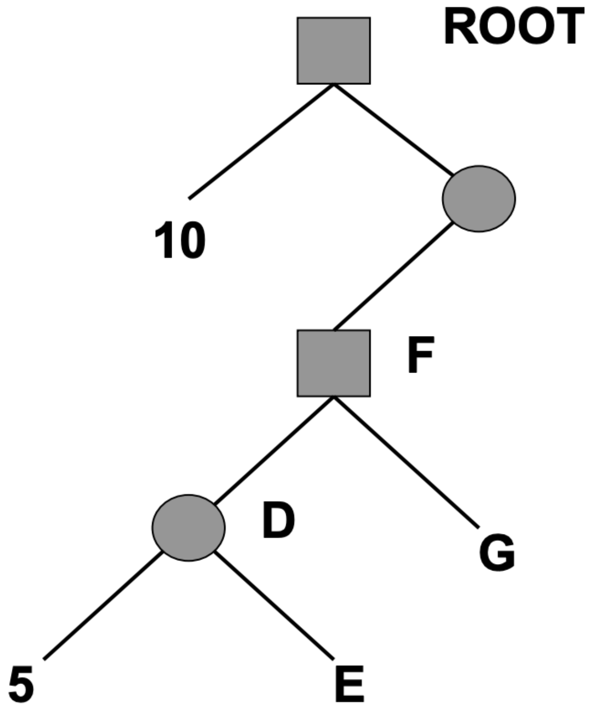
GAME TREE: MINMAX VALUE



Shallow and Deep Pruning







Pruning explained