

A7 Assignment -1

Question 1) Part A

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for A* algorithm:

Start node = S

Goal node = G

Initial frontier = (S, 8, 0.)

\downarrow \downarrow \downarrow
 node f-score path cost

Nodes explored	F-Score	Path cost	Frontier nodes (node, f-score, path cost)
S	8	0	A - 5, 3. B - 2, 1 C - 13, 5.
B	2	1	A - 5, 3 C - 13, 5 D - 9, 5 F - 6, 3 G ₂ - 13, 13
A	5	3	C - 13, 5 D - 9, 5 F - 6, 3 G ₂ - 13, 13 G ₁ - 13, 13
F	6	3	C - 13, 5 D - 8, 4 G ₂ - 13, 13 G ₁ - 13, 13 D - 9, 5

nodes explored	F Score	Path Lost	Frontier nodes
D	8	4	C - 13, 5 D - 9, 5 G ₃ - 13, 13 G ₁ - 13, 13 G ₂ - 9, 9 E - 7, 6
E	7	6	C - 13, 5 G ₃ - 13, 13 G ₁ - 8, 8 G ₂ - 9, 9 D - 9, 5
G ₁	8	8	C - 13, 5 G ₃ - 13, 13 G ₂ - 9, 9 D - 9, 5

Path found $\Rightarrow S \rightarrow B \rightarrow F \rightarrow D \rightarrow E \rightarrow G_1$

Path cost $\Rightarrow 8$

Part b) Taking uniform cost search.

Start node = S

Goal node = G

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Initial frontier = (S, 0)

↓
node ↳ path cost.

Nodes explored	Path cost	Frontier nodes (Node → Path cost)
S	0	A → 3 B → 1 C → 5
B → 1	1	A → 3 C → 5 D → 5 F → 3 G ₃ → 13
A → 1	3	C → 5 D → 5 F → 3 G ₃ → 13 G ₁ → 13
F	3	C → 5 D → 5 E → 4 D → 4 G ₃ → 13 G ₁ → 13
D	4	C → 5 G ₃ → 13 G ₁ → 13 E → 6 G ₂ → 9 D → 5

Nodes explored	Path cost	Frontier nodes
C	5	$G_3 \rightarrow 13$ $G_1 \rightarrow 13$ $E \rightarrow 6$ $G_2 \rightarrow 9$ $D \rightarrow 5$
D	5	$G_3 \rightarrow 13$ $G_1 \rightarrow 13$ $E \rightarrow 6$ $G_2 \rightarrow 9$
E	6	$G_3 \rightarrow 13$ $G_1 \rightarrow 8$ $G_2 \rightarrow 9$ $G_1 \rightarrow 13$
G_1	8	$G_1 \rightarrow 13$ $G_3 \rightarrow 13$ $G_2 \rightarrow 9$

Path found (Shortest path) $\Rightarrow S \rightarrow B \rightarrow F \rightarrow D \rightarrow E \rightarrow G_1$
 Path cost $\Rightarrow 8$

Part c) Iterative Deepening A*

Initial node - S

Goal node - G₁

Initial threshold - 8.8

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Threshold Nodes explored Path cost Frontier node

Threshold	Node	Path cost	Fscore	Frontier (Node, {score, path cost})
8	S	0	8	A - 5, 3 B - 2, 1 C - 13, 5
8.8	A	3	5	B - 2, 1 G ₁ - 13, 13 D - 11, 7 B - 2, 1 C - 13, 5
8.8	G ₁	13	13	Threshold limit exceeded, D - 11, 7 B - 2, 1 C - 13, 5
8.8	D	7	11	Threshold limit exceeded B - 2, 1 C - 13, 5
8.8	B	1	2	D - 9.5, 5 F - 6, 3 G ₃ - 13, 13 C - 13, 5

Threshold	Node	Path Cost	F Score	Frontier
8	D	5	9	Threshold limit exceed
				F - 6,3
				G ₃ - 13,13
				C - 13,5
8	F	3	6	D - 8,4
				G₃ - 13,13
				G ₃ - 13,13
				C - 13,5
8	D	4	8	E - 7,6
				G ₂ - 9,9
				G ₃ - 13,13
				C - 13,5
8	E	6	7	G ₁ - 8,8
				G ₂ - 9,9
				G ₃ - 13,13
				C - 13,5
8	G ₁	8	8	G ₂ - 9,9
				G ₃ - 13,13
				C - 13,5

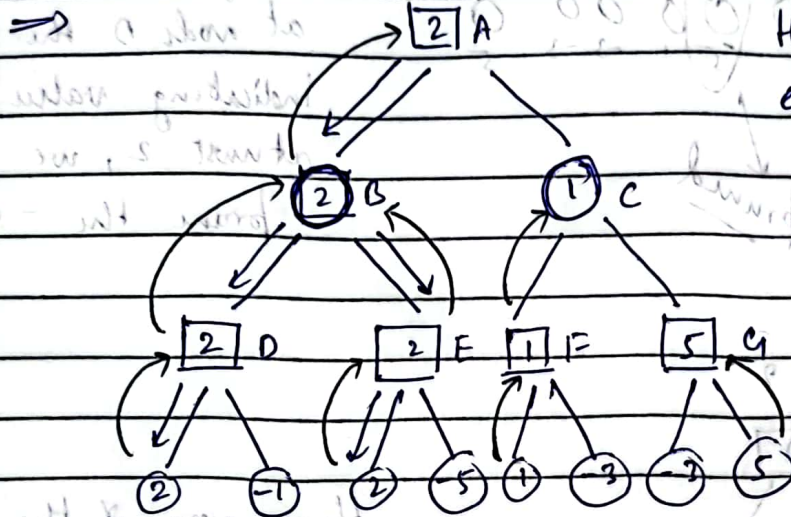
Path found $\rightarrow S \rightarrow B \rightarrow F \rightarrow D \rightarrow E \rightarrow G$

Path cost $\rightarrow 8$

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Question 2

Part a)



The arrow symbolize the optimal action at each state.

Arrow indicates min max algorithm

Arrow indicates optimal moves.

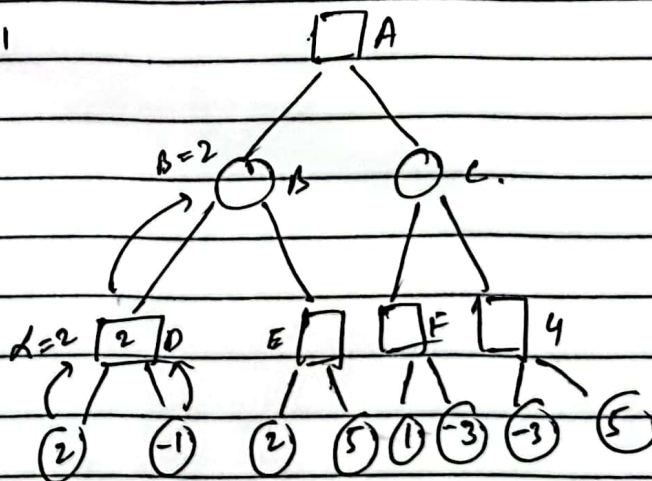
Path 1 $\Rightarrow A \rightarrow B \rightarrow D$

Path 2 $\Rightarrow A \rightarrow B \rightarrow E$

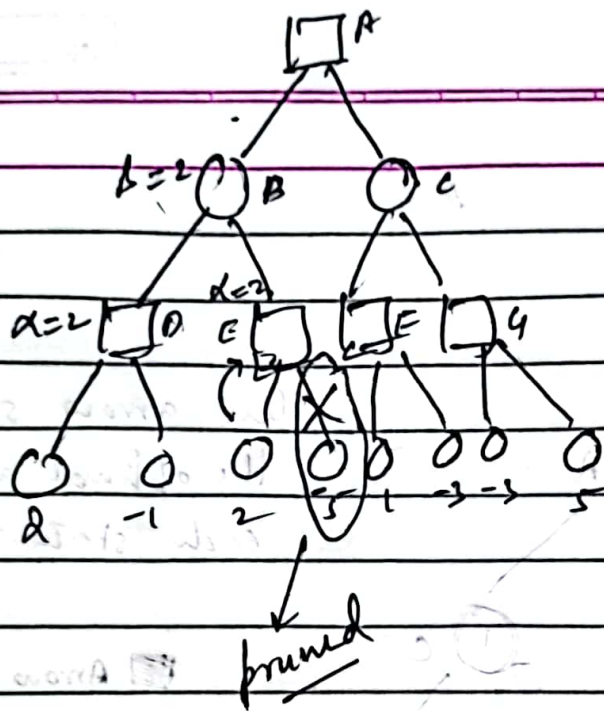
} both are optimal paths.

\Rightarrow For alpha beta pruning, the steps will be as follows.

Step 1



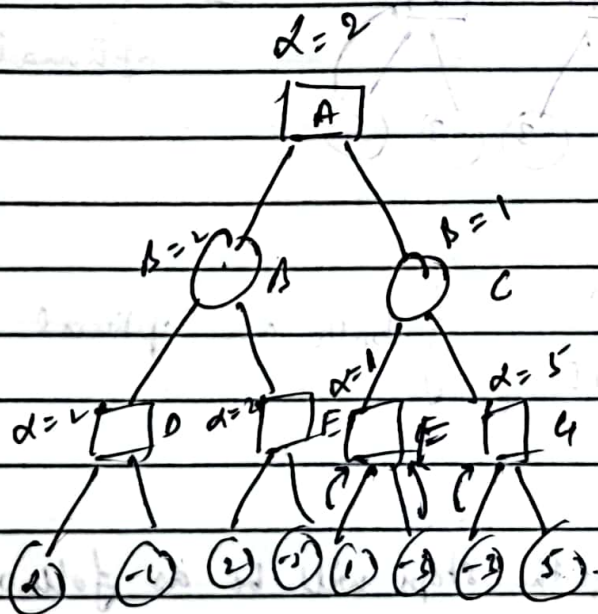
Step 2



At node E

we know that the value will be at least greater equal to 2, and at node D the $\alpha=2$ indicating value is at most 2, we can prune the -5

Step 3



Here none of the value will be pruned and the rest of the tree is explored