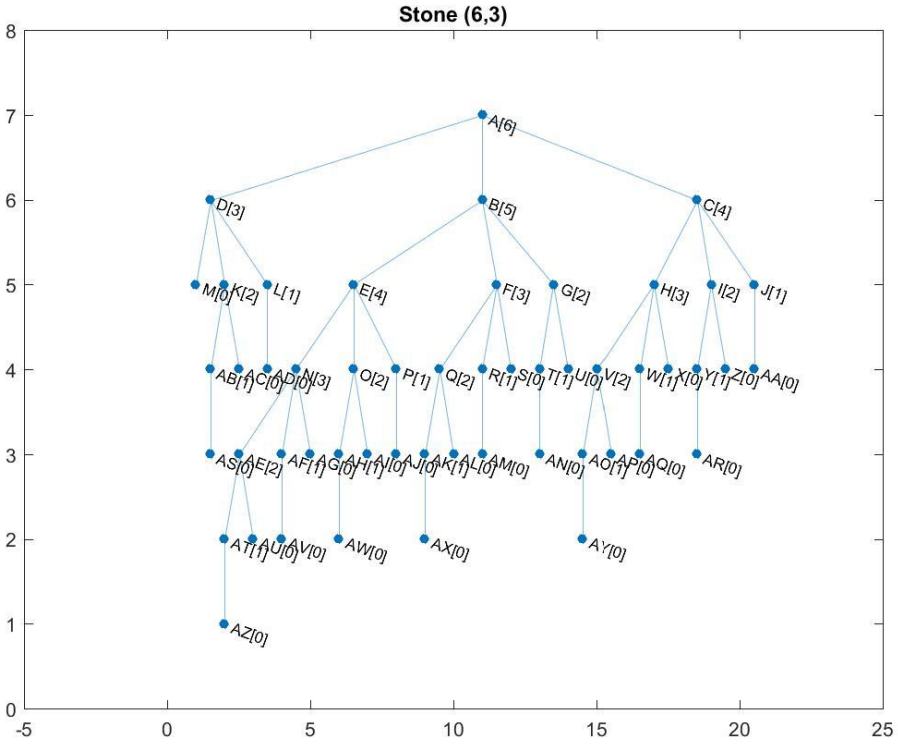
# Question 1

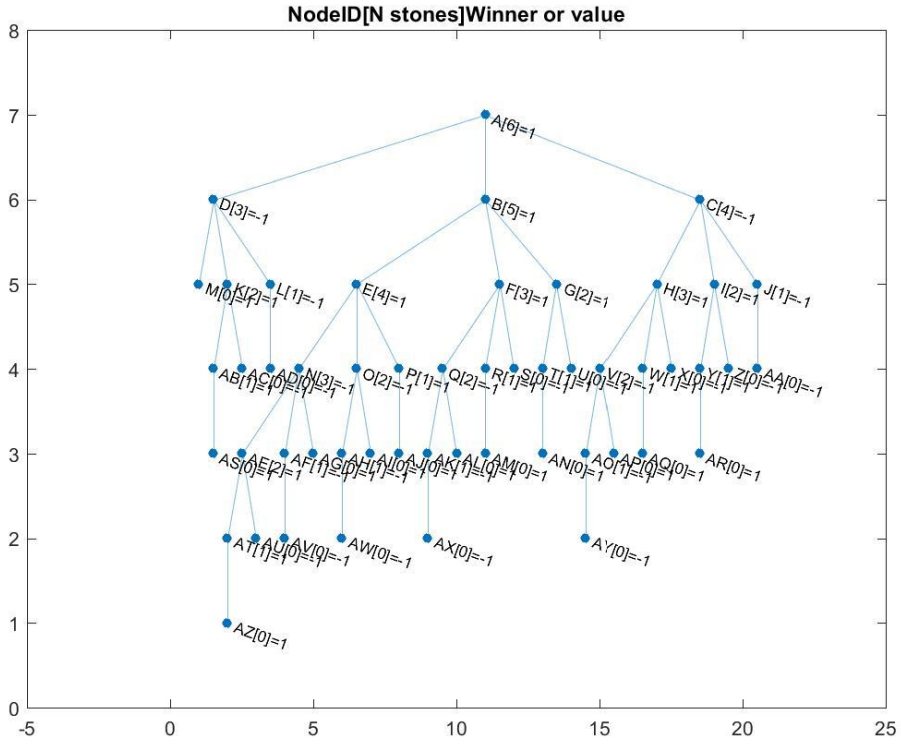
Generate the search tree for *the stone game(6,3)*and use minimax algorithm to calculate the value of each node hence decide the winner for that game assuming rational steps

---

The game tree is:




The game tree after evaluation is:



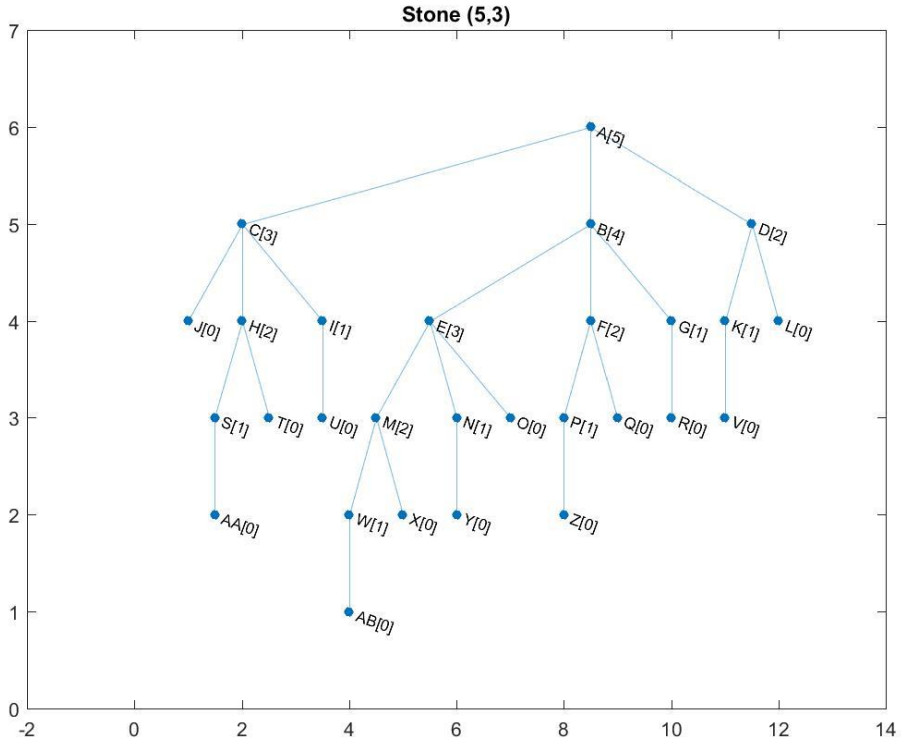

Based on the above graph Max player will win

# Question 2

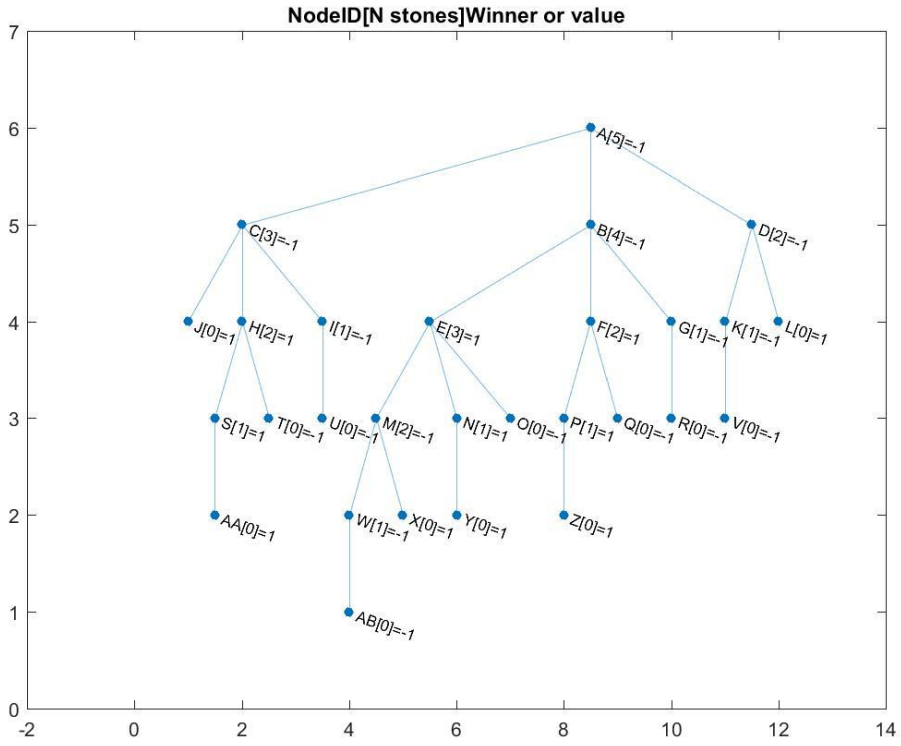
Generate the search tree for *the stone game(5,3)*and use minimax algorithm to calculate the value of each node hence decide the winner for that game assuming rational steps

---

The game tree is:




The game tree after evaluation is:



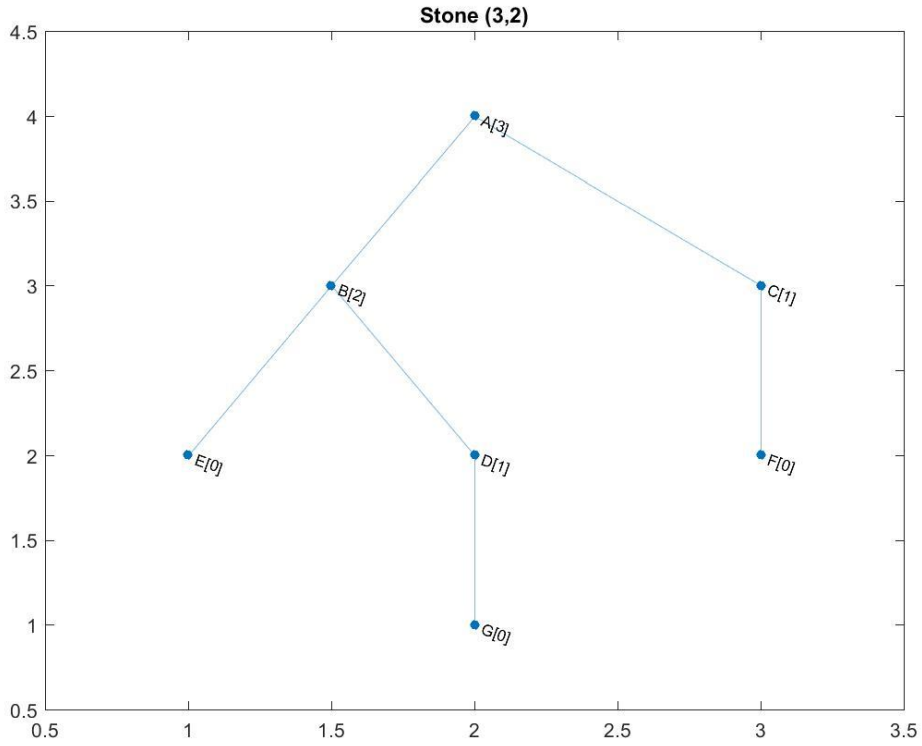

Based on the above graph Min player will win

# Question 3

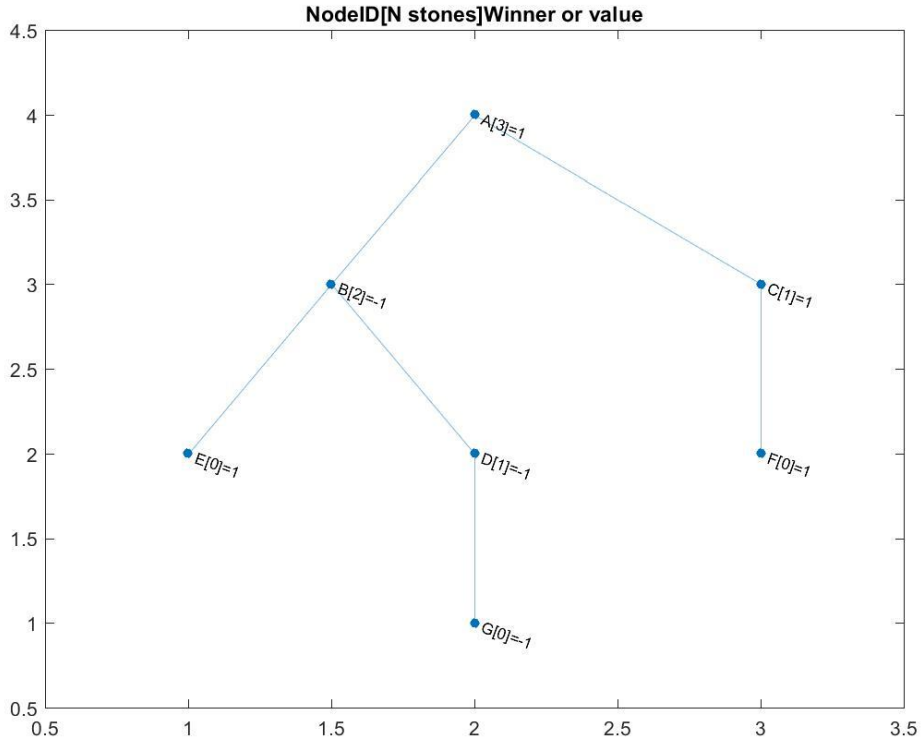
Generate the search tree for *the stone game(3,2)*and use minimax algorithm to calculate the value of each node hence decide the winner for that game assuming rational steps

---

The game tree is:




The game tree after evaluation is:



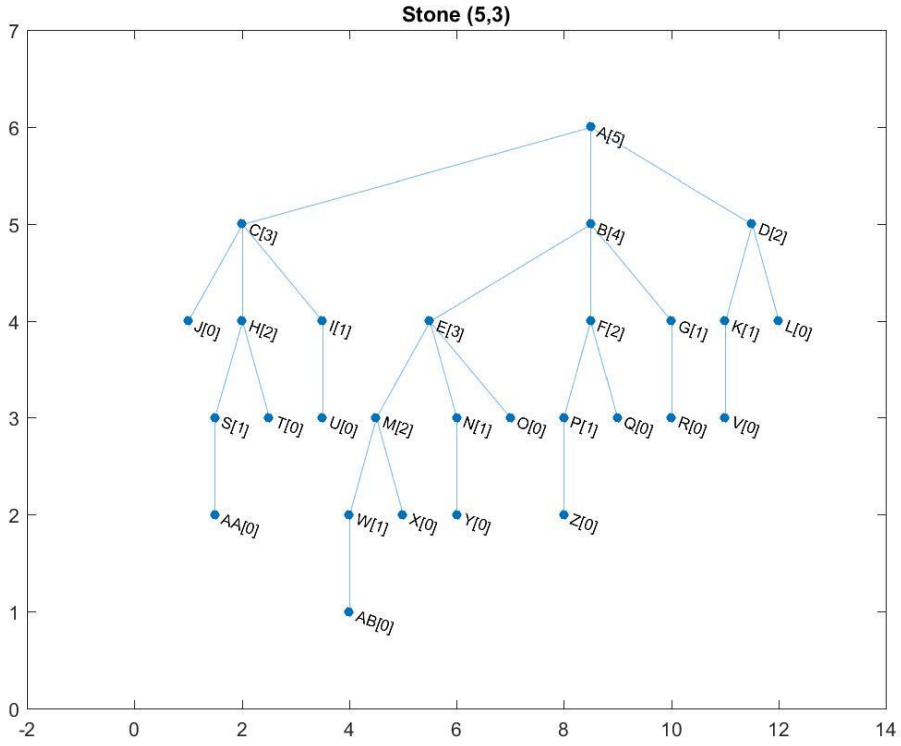

Based on the above graph Max player will win

# Question 4

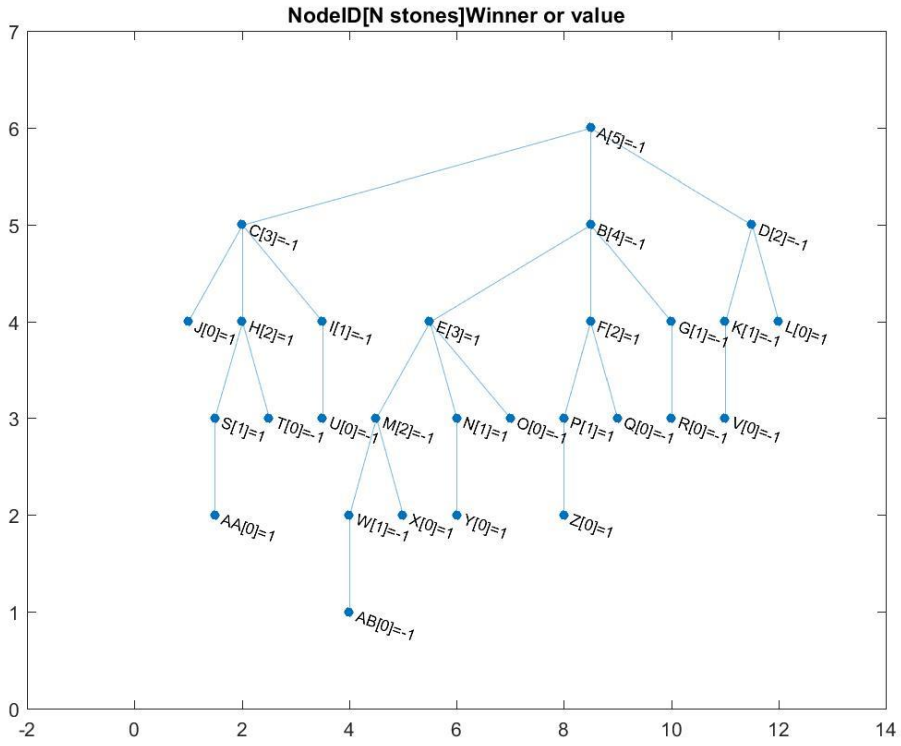
Generate the search tree for *the stone game(5,3)*and use minimax algorithm to calculate the value of each node hence decide the winner for that game assuming rational steps

---

The game tree is:




The game tree after evaluation is:



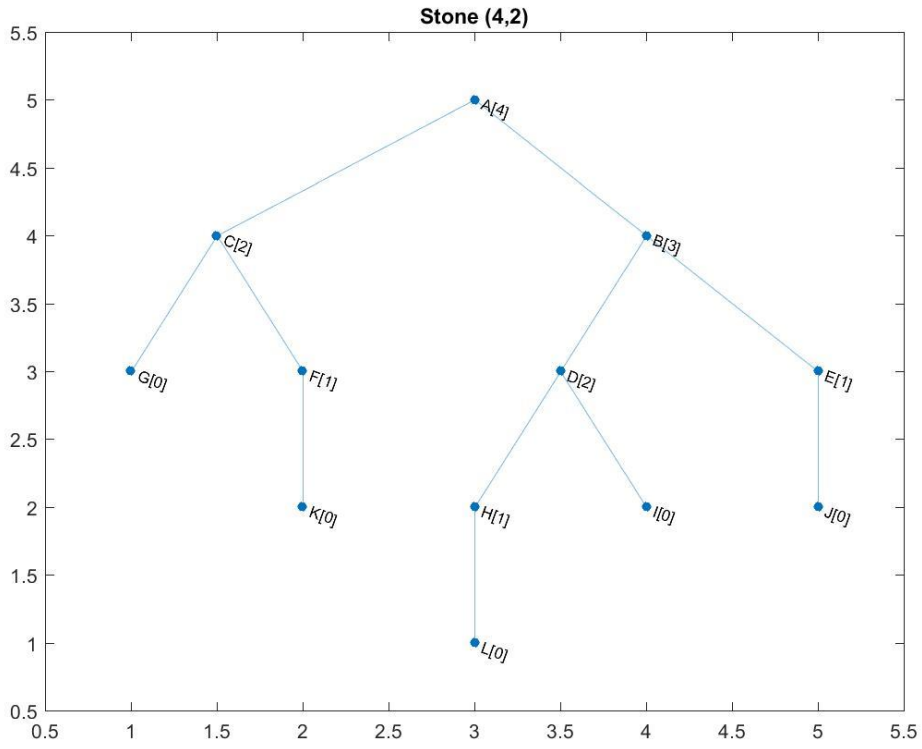

Based on the above graph Min player will win

# Question 5

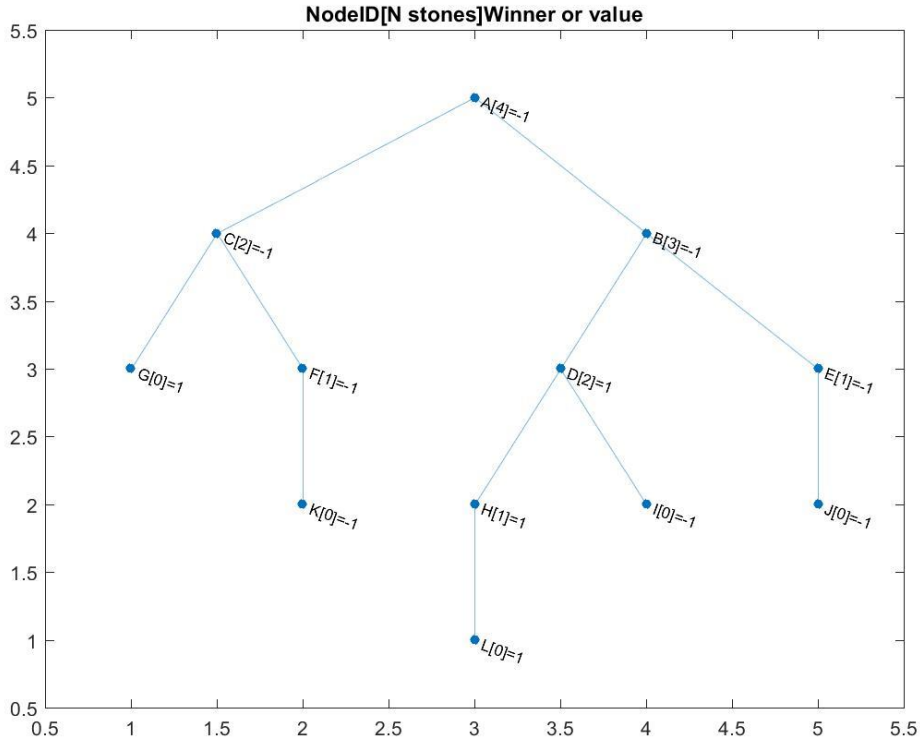
Generate the search tree for *the stone game(4,2)*and use minimax algorithm to calculate the value of each node hence decide the winner for that game assuming rational steps

---

The game tree is:




The game tree after evaluation is:



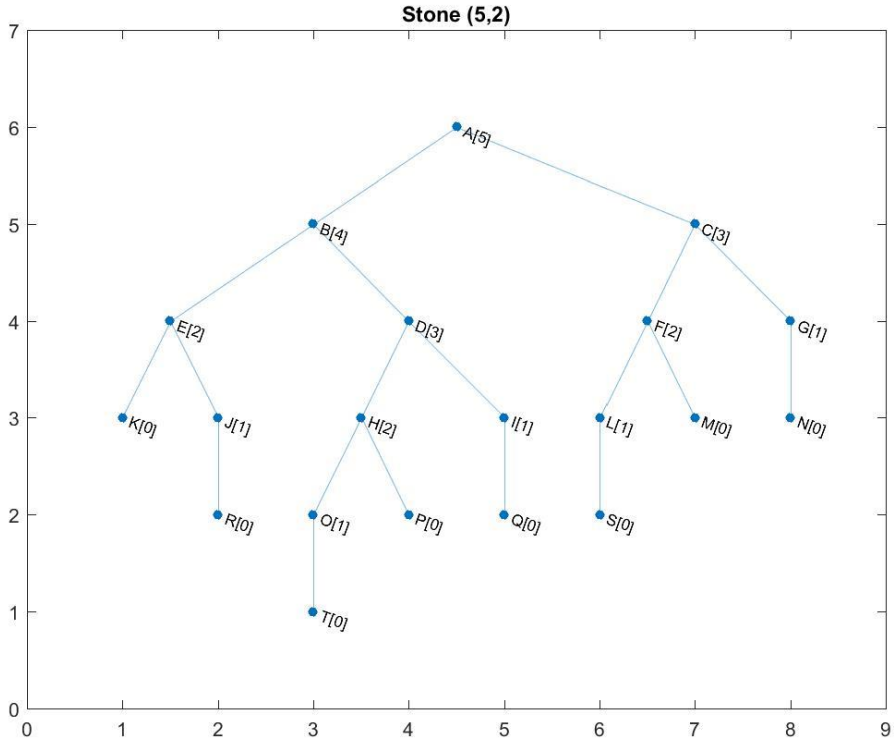

Based on the above graph Min player will win

# Question 1

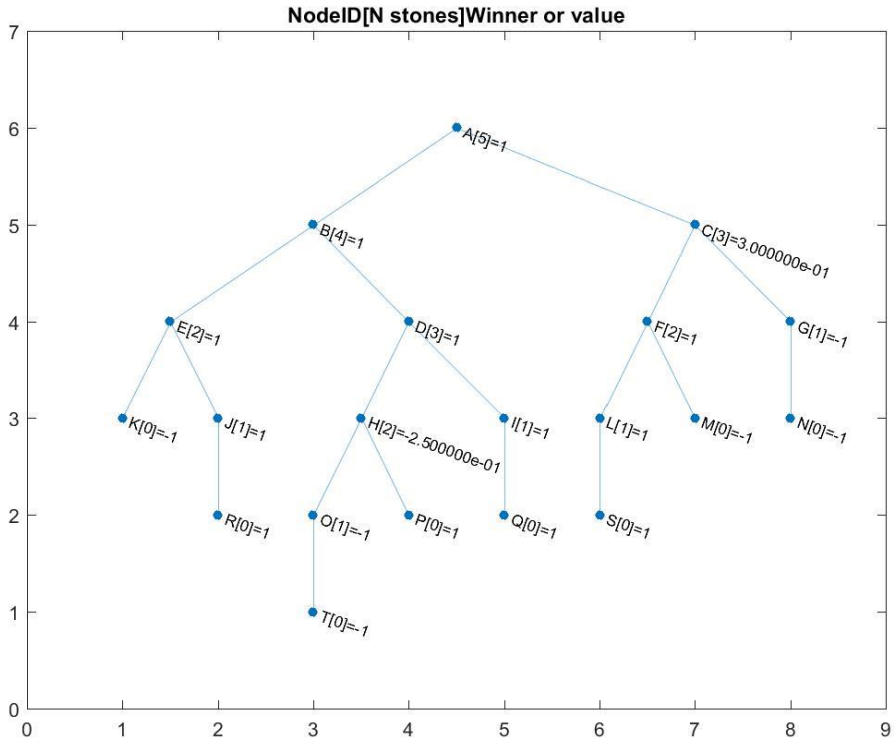
Given the following search tree for *the stone game(5,2)*, use expectiminimax algorithm to calculate the value of each node hence decide the winner for that game.
Assume the following switching probabilities for min player:

| Action | p |
|---|---|
| O[1] | 0.63 |
| P[0] | 0.37 |
| F[2] | 0.65 |
| G[1] | 0.35 |
| D[3] | 0.82 |
| E[2] | 0.18 |

The game tree is:




The game tree after evaluation is:




Based on the above graph Max player will win

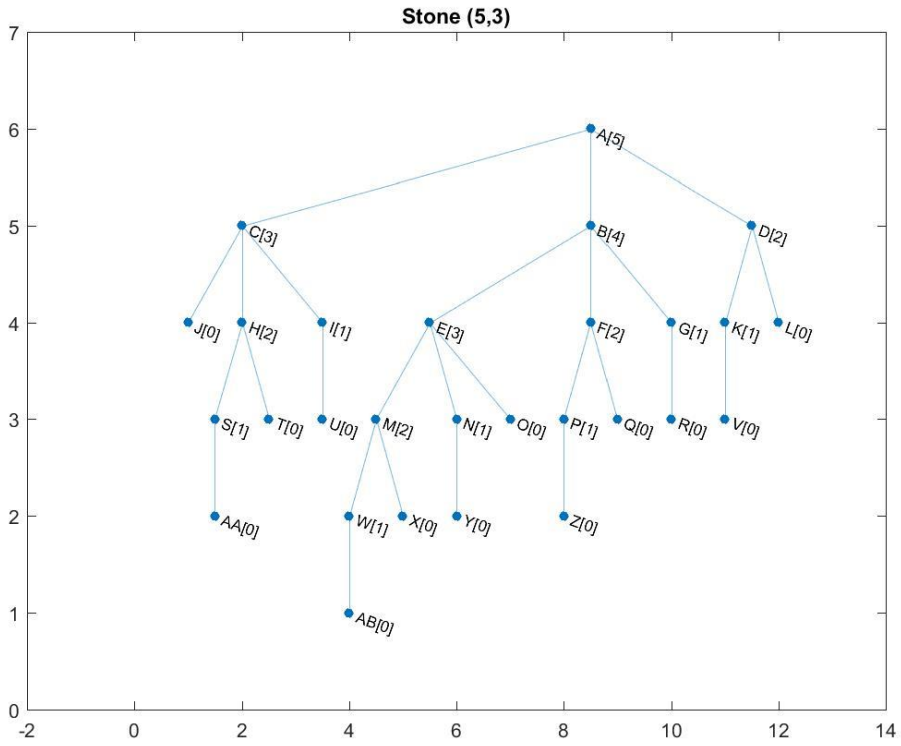
# Question 2

Given the following search tree for *the stone game(5,3)*, use expectiminimax algorithm to calculate the value of each node hence decide the winner for that game.
Assume the following switching probabilities for min player:

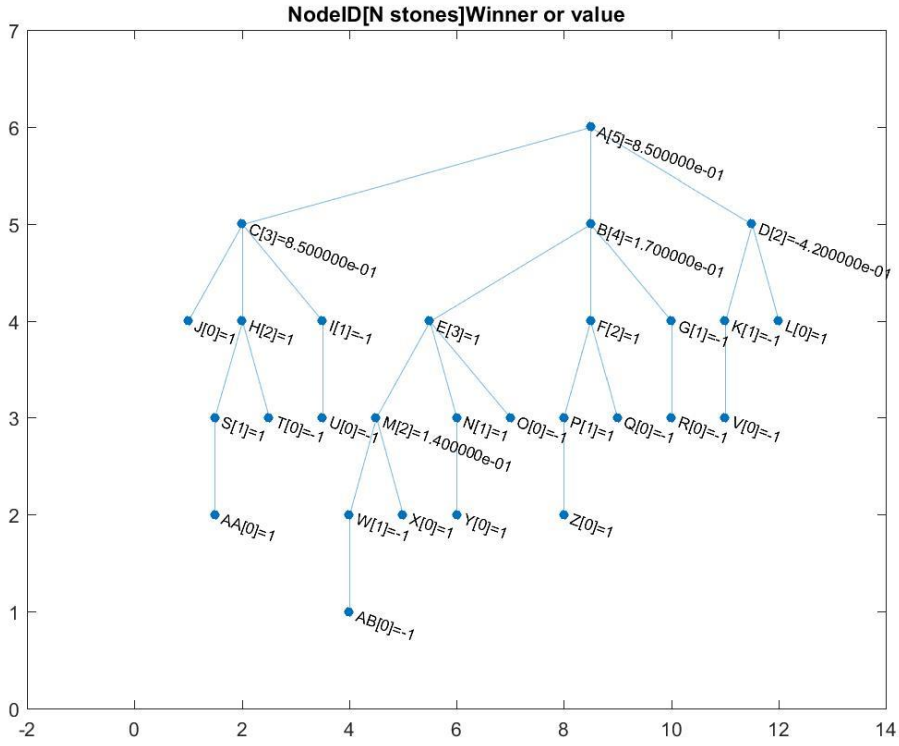
| Action | p |
|---|---|
| K[1] | 0.71 |
| L[0] | 0.29 |
| W[1] | 0.43 |
| X[0] | 0.57 |
| H[2] | 0.42 |
| I[1] | 0.07 |
| J[0] | 0.50 |
| E[3] | 0.22 |
| F[2] | 0.37 |
| G[1] | 0.41 |

---

The game tree is:



The game tree after evaluation is:



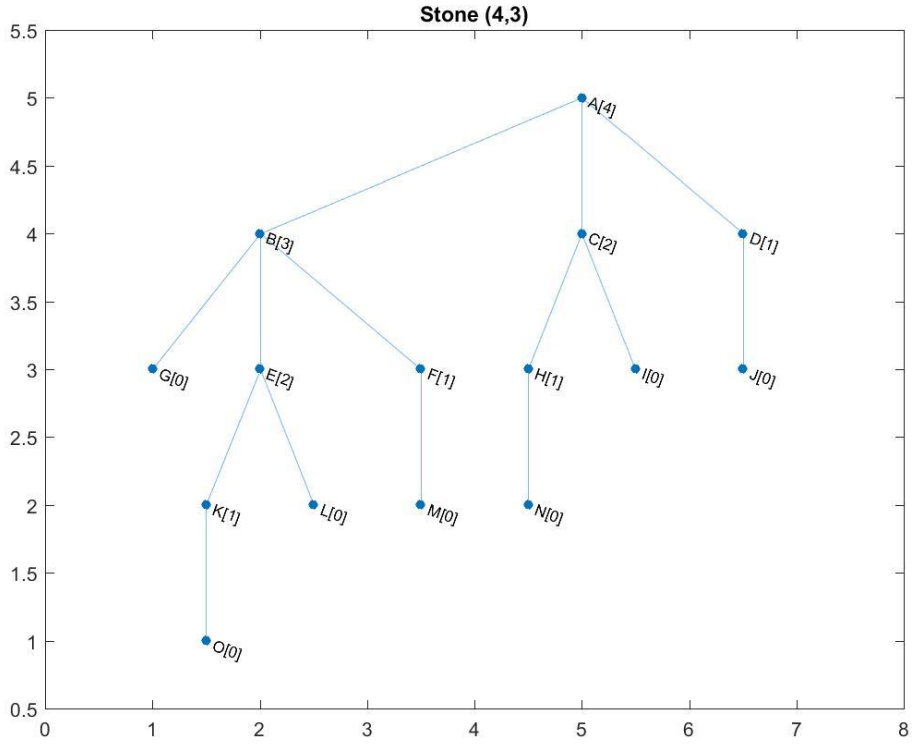

Based on the above graph Max player will win

# Question 3

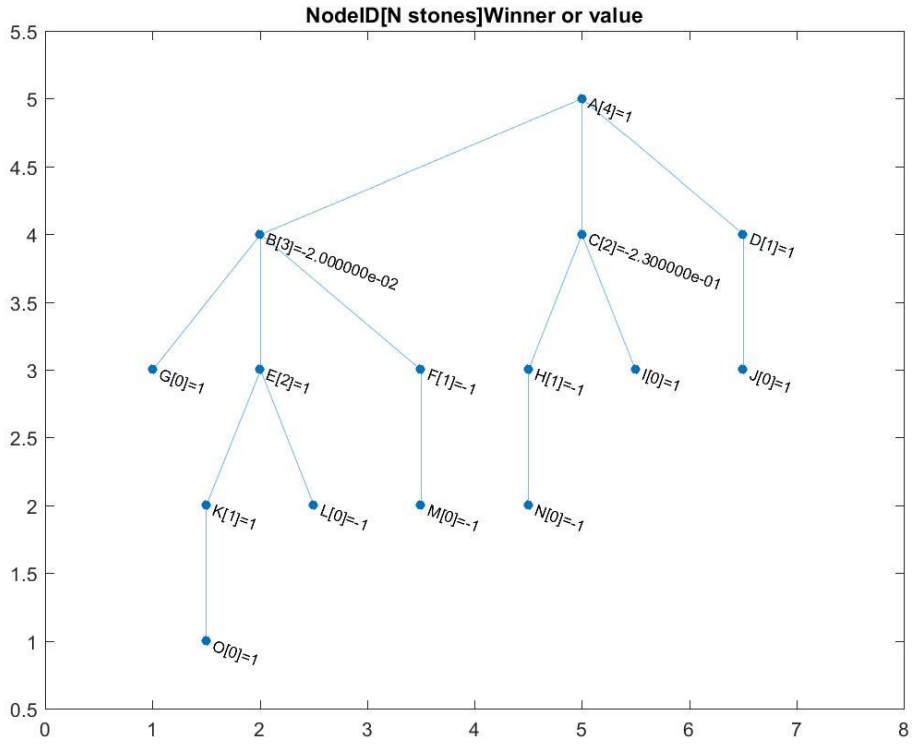
Given the following search tree for *the stone game(4,3)*, use expectiminimax algorithm to calculate the value of each node hence decide the winner for that game.
Assume the following switching probabilities for min player:

| Action | p |
|---|---|
| H[1] | 0.62 |
| I[0] | 0.38 |
| E[2] | 0.18 |
| F[1] | 0.51 |
| G[0] | 0.31 |

The game tree is:




The game tree after evaluation is:




Based on the above graph Max player will win

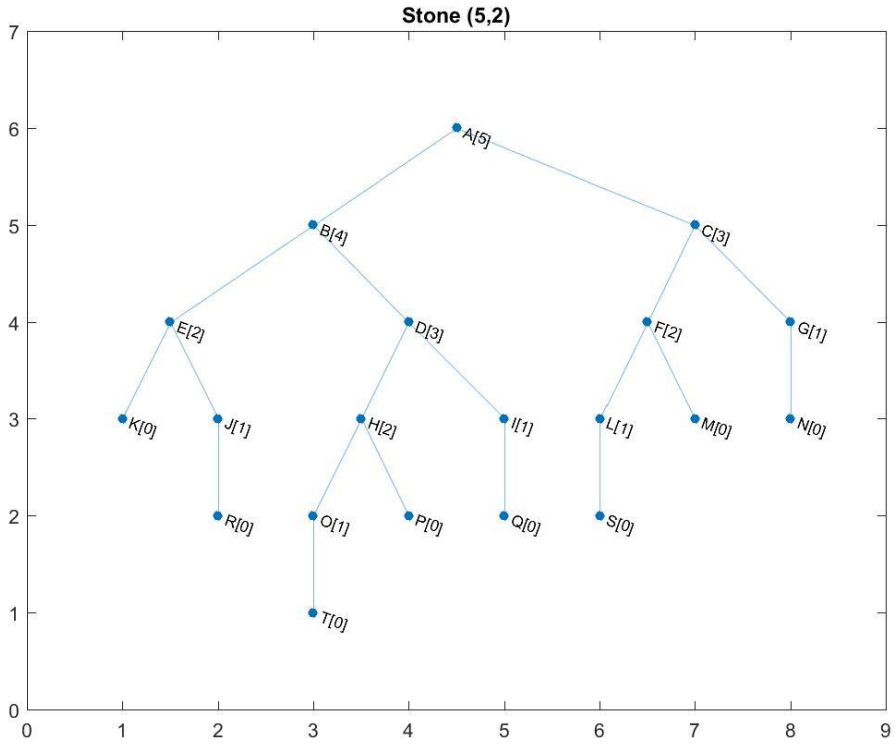
# Question 4

Given the following search tree for *the stone game(5,2)*, use expectiminimax algorithm to calculate the value of each node hence decide the winner for that game.
Assume the following switching probabilities for min player:

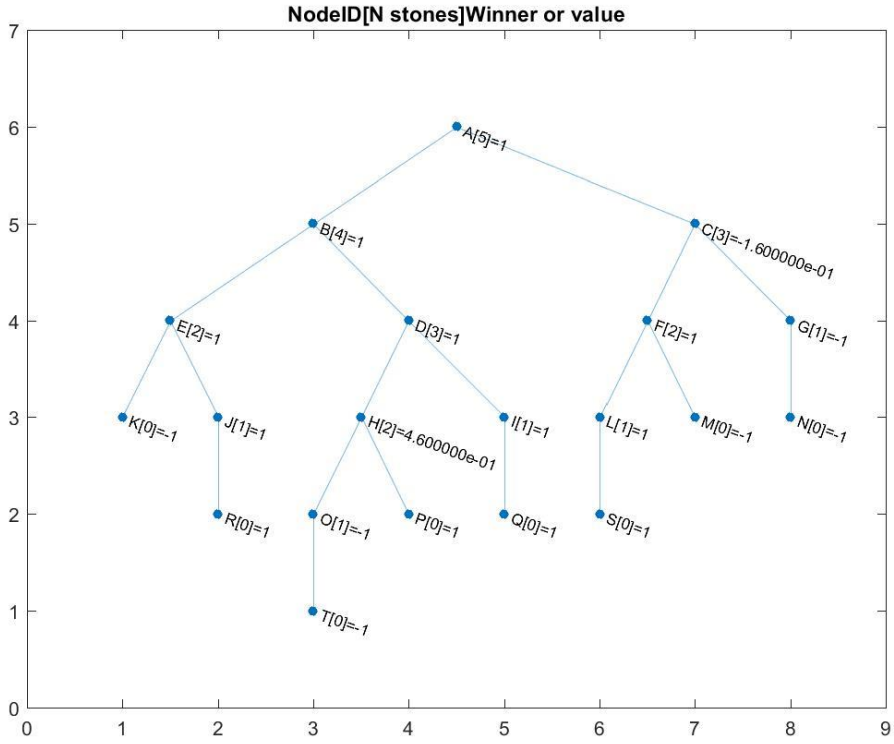
| Action | p |
|---|---|
| O[1] | 0.27 |
| P[0] | 0.73 |
| F[2] | 0.42 |
| G[1] | 0.58 |
| D[3] | 0.77 |
| E[2] | 0.23 |

---

The game tree is:




The game tree after evaluation is:




Based on the above graph Max player will win

# Question 5

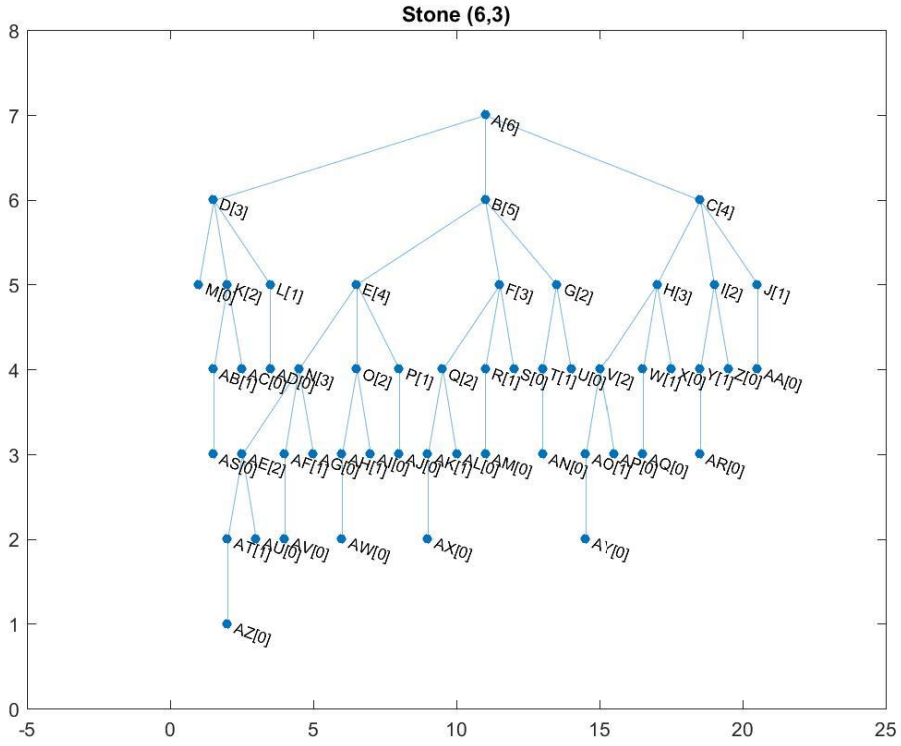
Given the following search tree for *the stone game(6,3)*, use expectiminimax algorithm to calculate the value of each node hence decide the winner for that game.
Assume the following switching probabilities for min player:

| Action | p |
|---|---|
| AH[1] | 0.06 |
| AI[0] | 0.94 |
| AK[1] | 0.27 |
| AL[0] | 0.73 |
| AO[1] | 0.38 |
| AP[0] | 0.62 |
| K[2] | 0.39 |
| L[1] | 0.45 |
| M[0] | 0.16 |
| AE[2] | 0.24 |
| AF[1] | 0.20 |

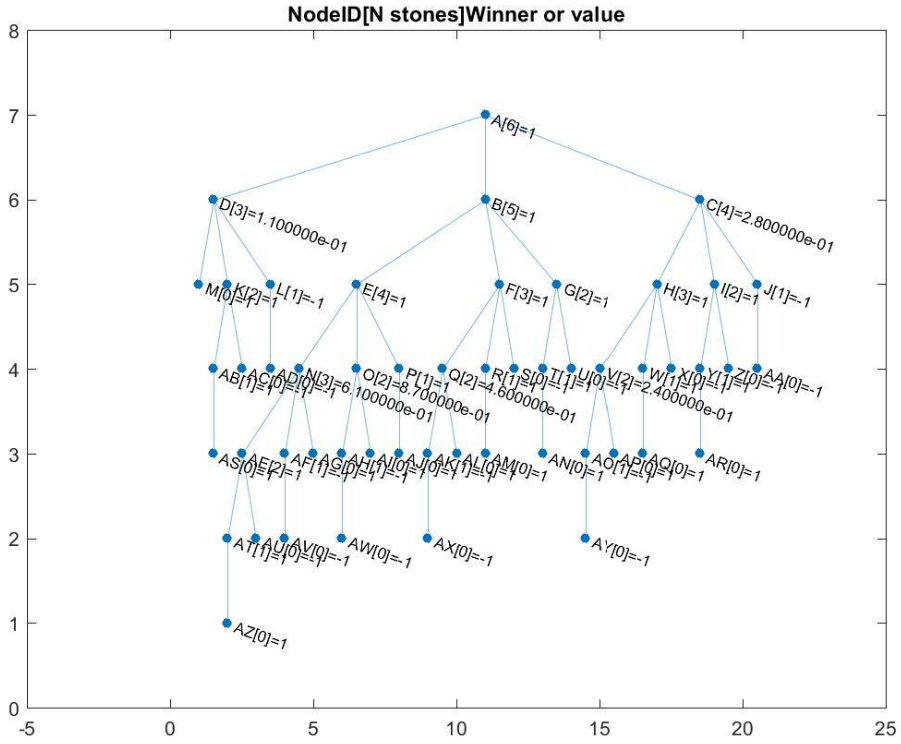
| | |
|---|---|
| AG[0] | 0.56 |
| H[3] | 0.39 |
| I[2] | 0.25 |
| J[1] | 0.36 |
| E[4] | 0.40 |
| F[3] | 0.27 |
| G[2] | 0.33 |

---

The game tree is:




The game tree after evaluation is:



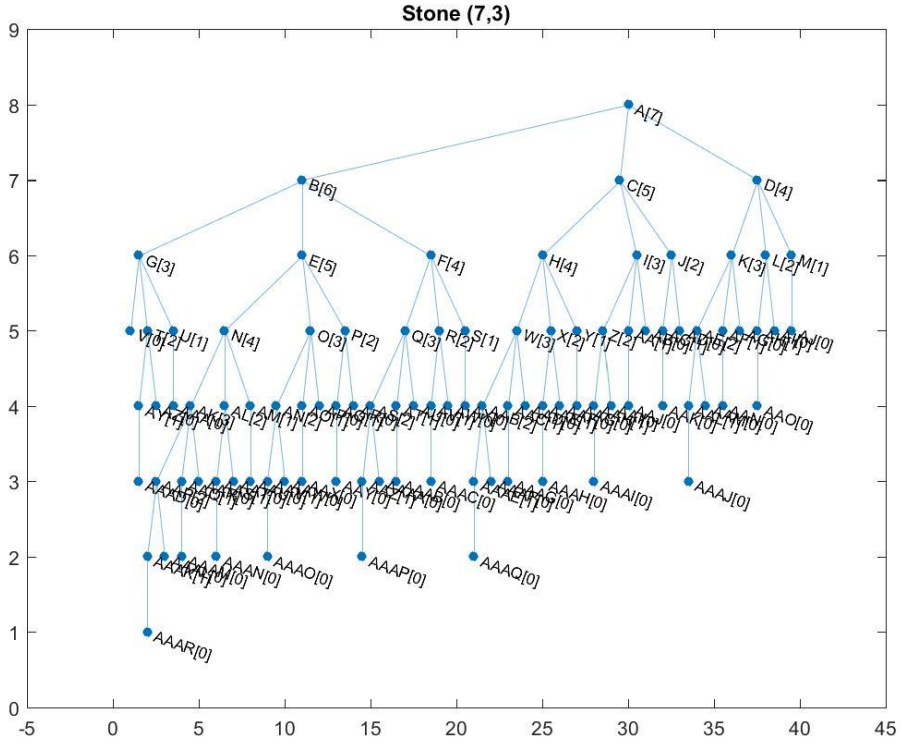

Based on the above graph Max player will win

# Question 1

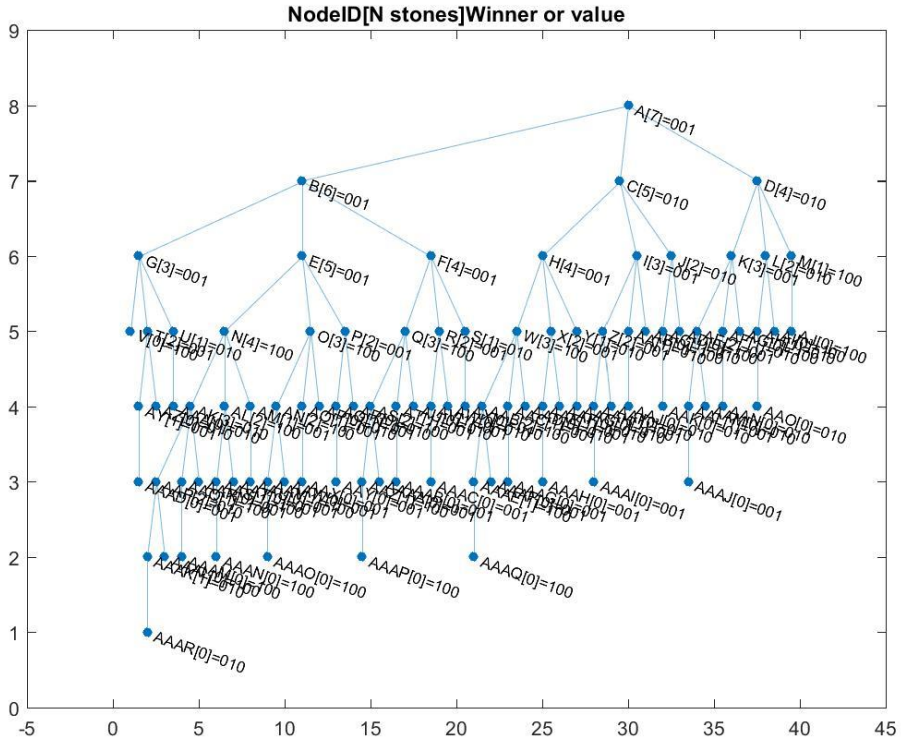
Generate the search tree for *the stone game(7,3)*and use minimax algorithm to calculate the value of each node hence decide the winner for that game assuming rational steps for 3 players

---

The game tree is:




The game tree after evaluation is:



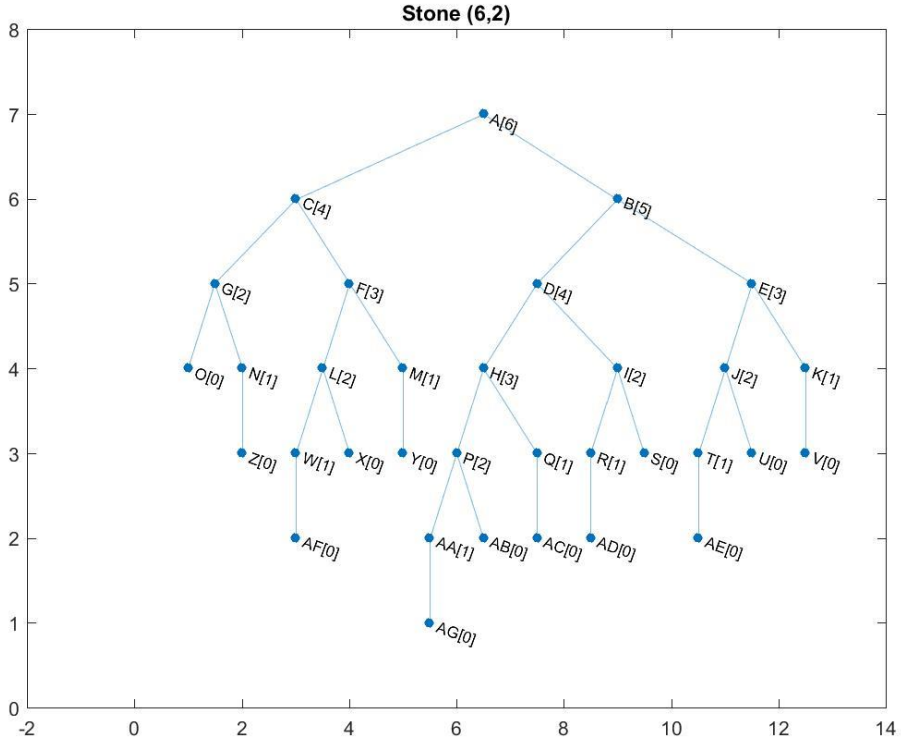

Based on the above graph Min player will win

# Question 3

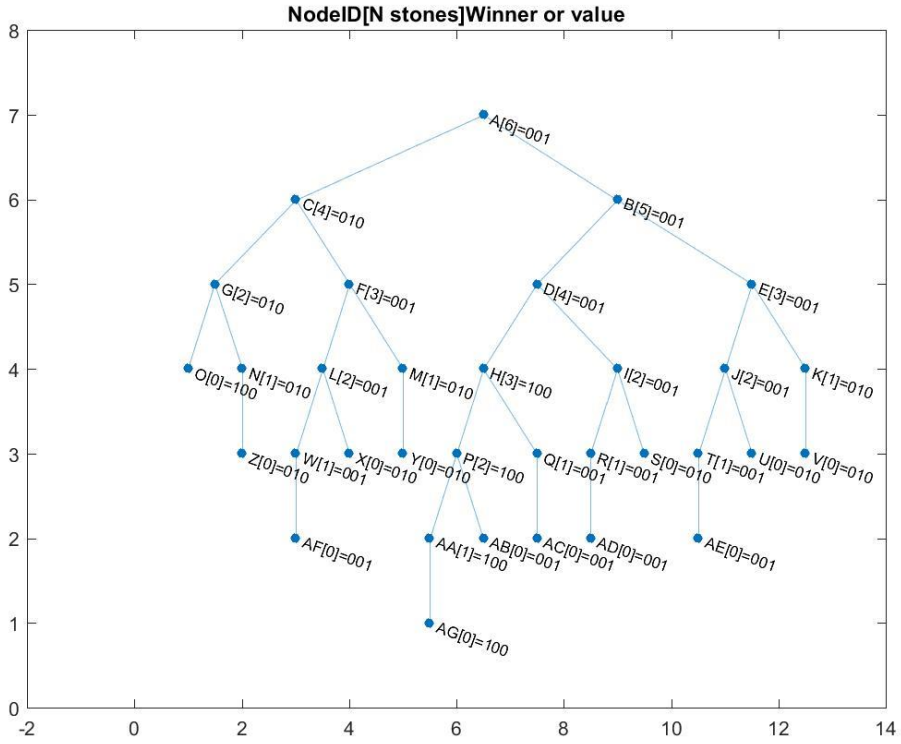
Generate the search tree for *the stone game(6,2)*and use minimax algorithm to calculate the value of each node hence decide the winner for that game assuming rational steps for 3 players

---

The game tree is:



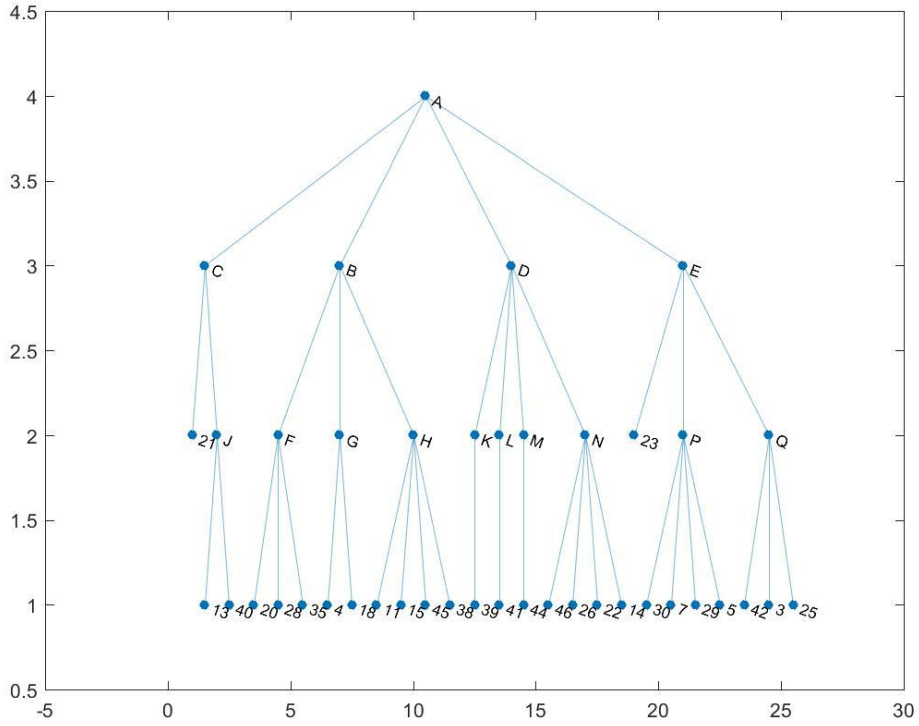

The game tree after evaluation is:




Based on the above graph Min player will win

# Question 1

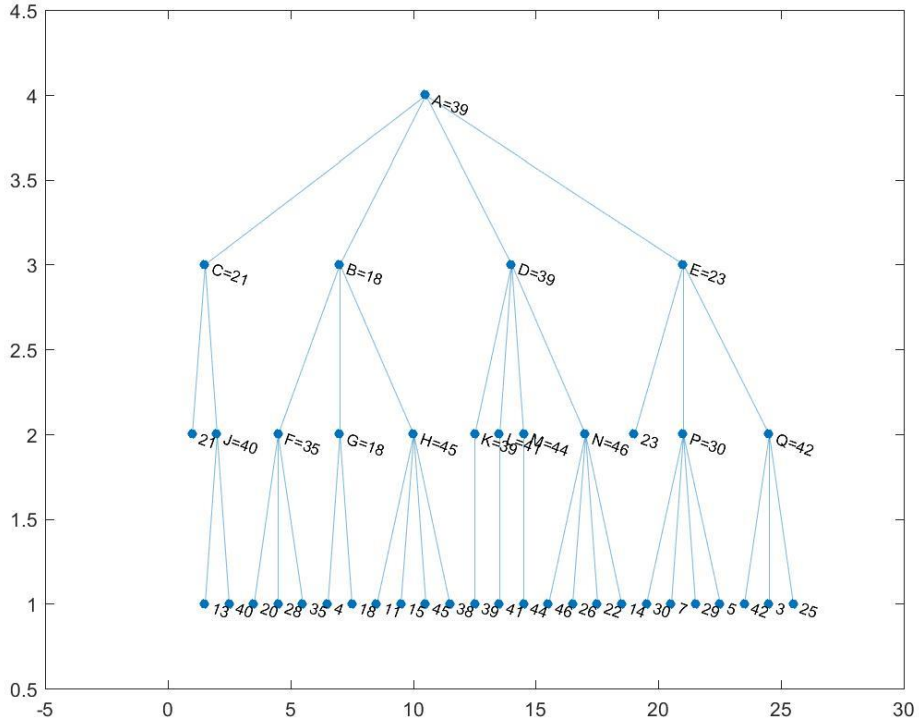
Given the following tree, use minimax algorithm to evaluate each node in the tree.




---

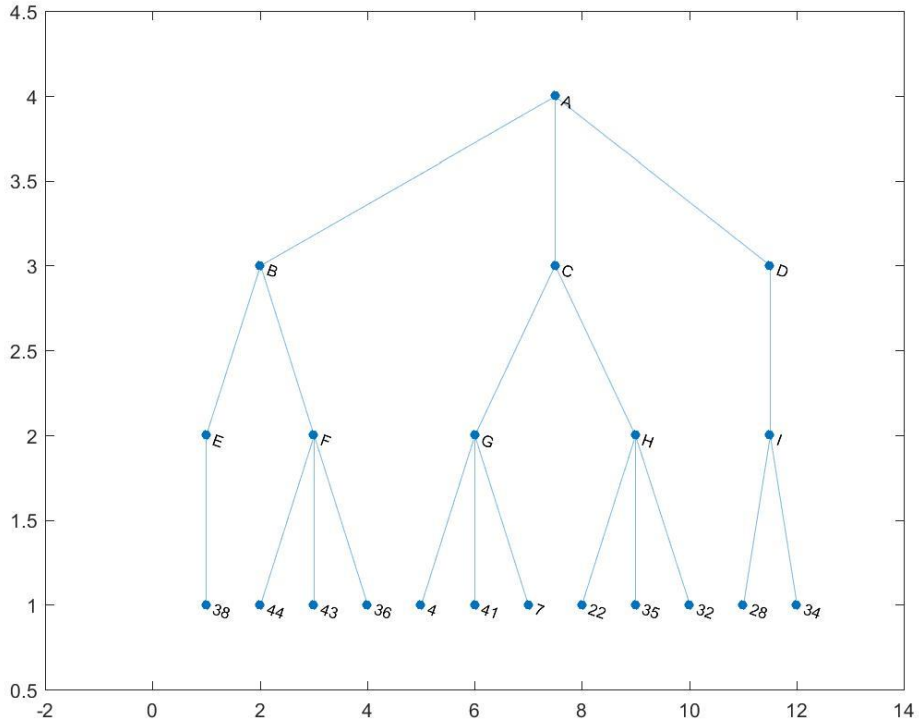
[Award 1 mark for each correct node value with a maxium of 10 marks]

The tree after evaluation is:




# Question 2

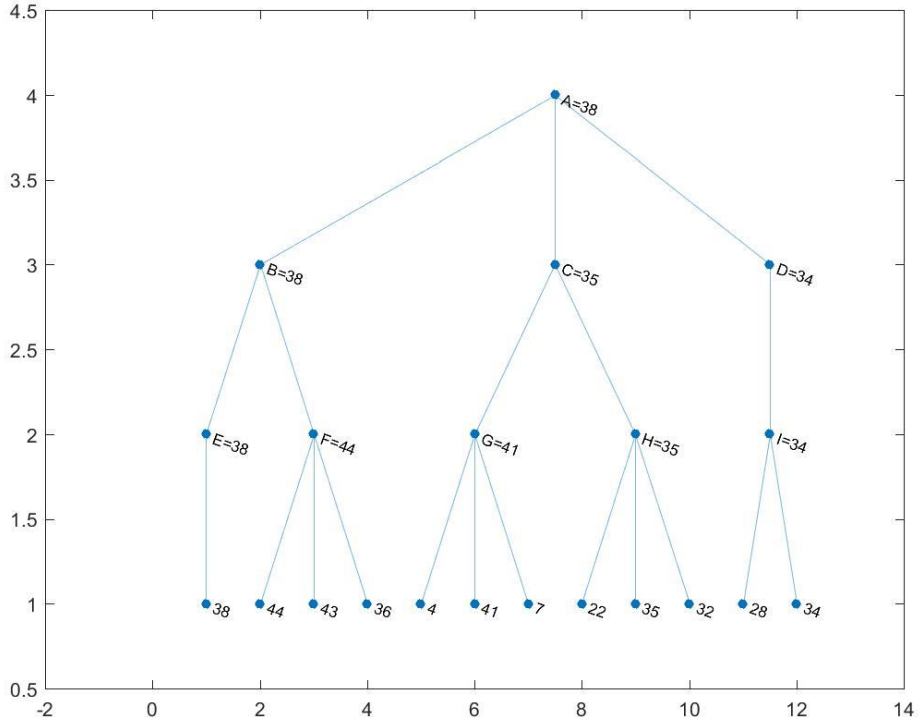
Given the following tree, use minimax algorithm to evaluate each node in the tree.




---

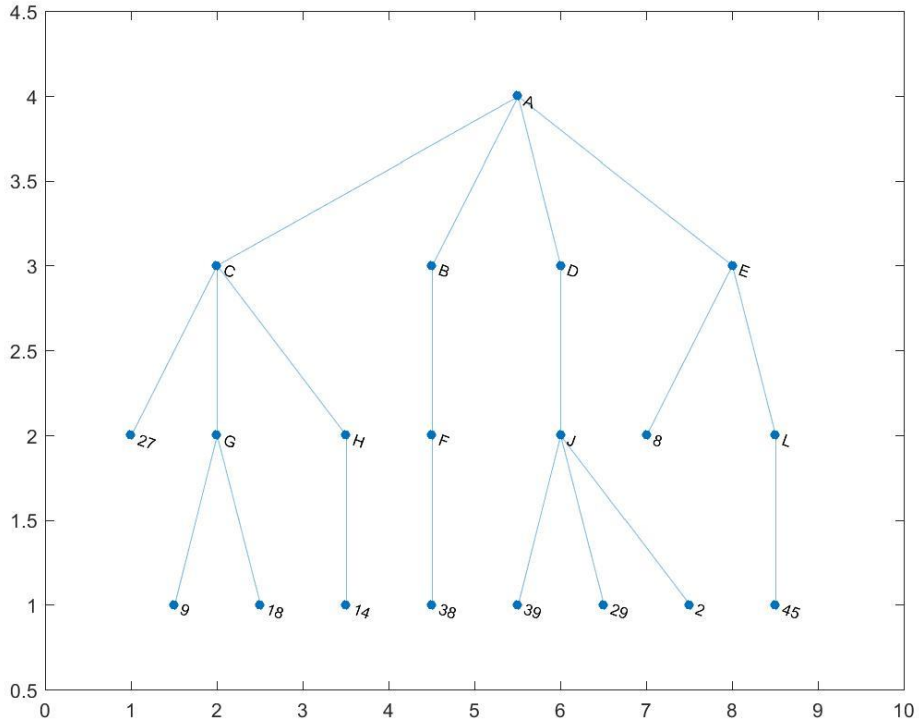
[Award 1 mark for each correct node value with a maxium of 10 marks]

The tree after evaluation is:




# Question 3

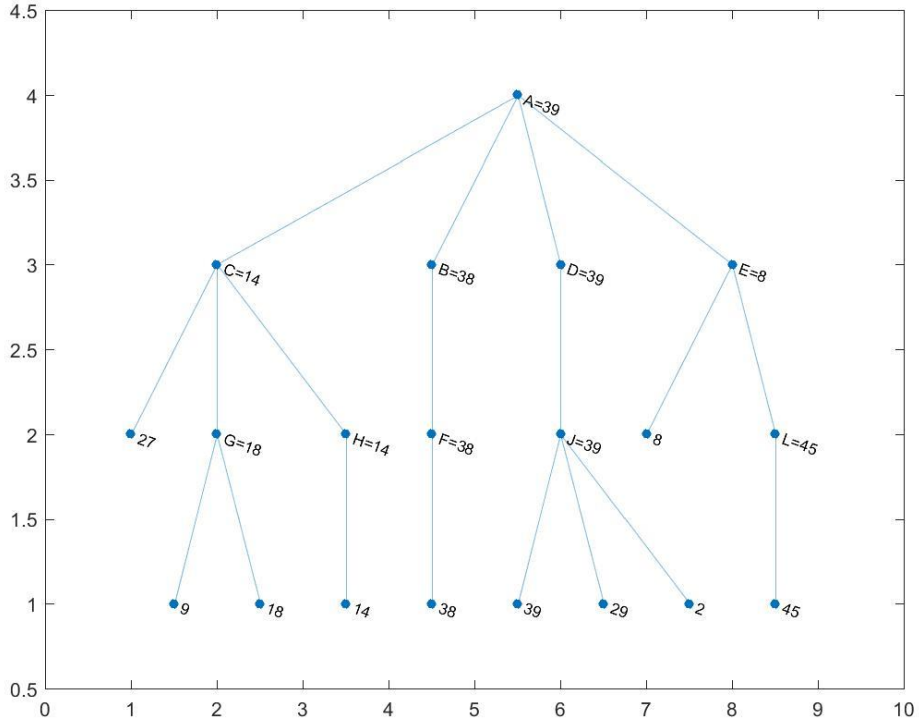
Given the following tree, use minimax algorithm to evaluate each node in the tree.




---

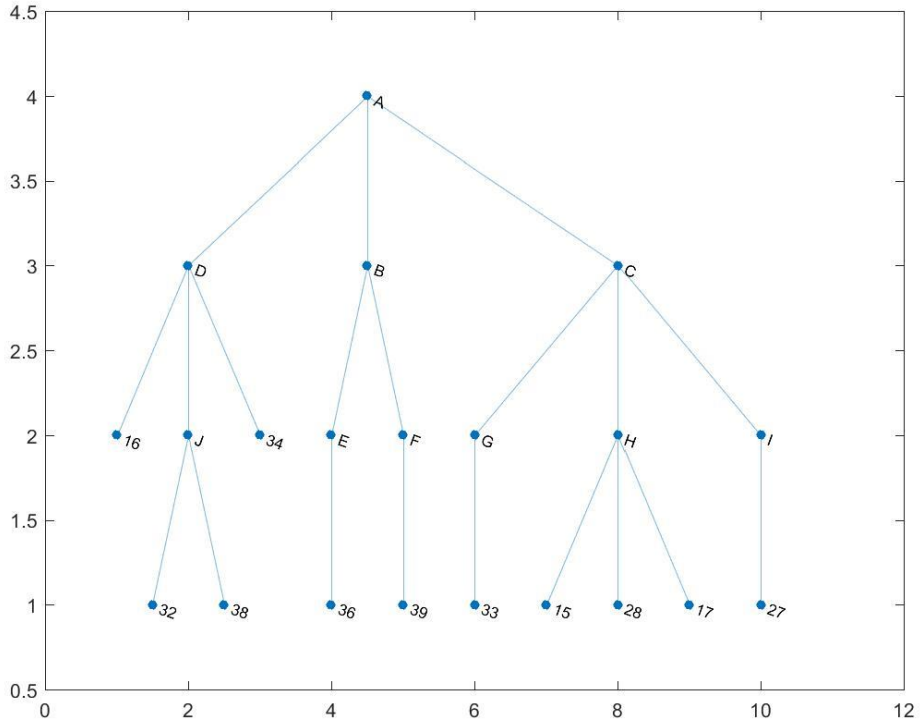
[Award 1 mark for each correct node value with a maxium of 10 marks]

The tree after evaluation is:




# Question 4

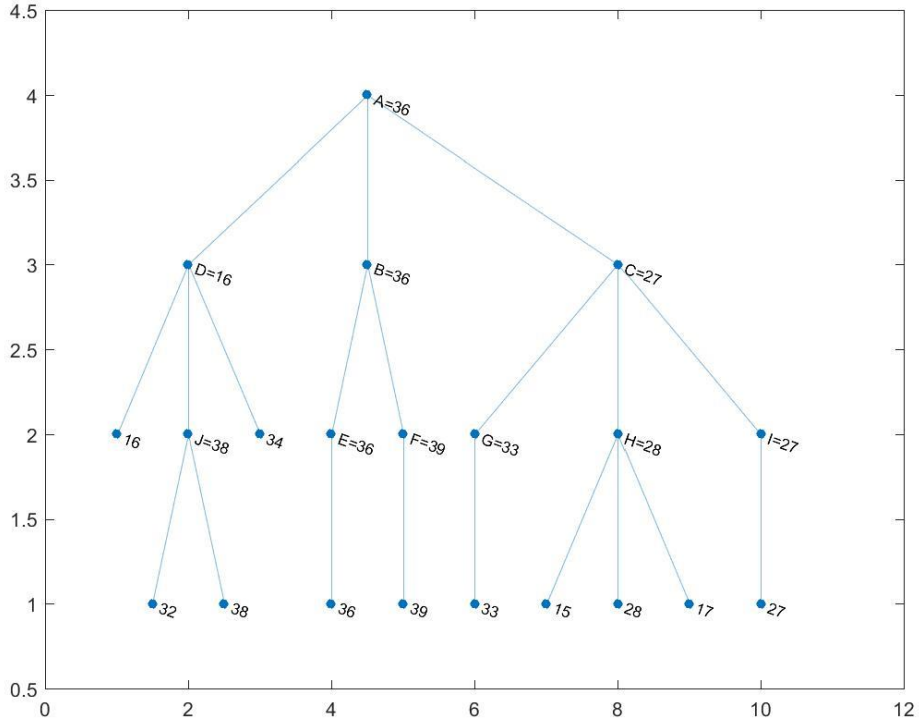
Given the following tree, use minimax algorithm to evaluate each node in the tree.




---

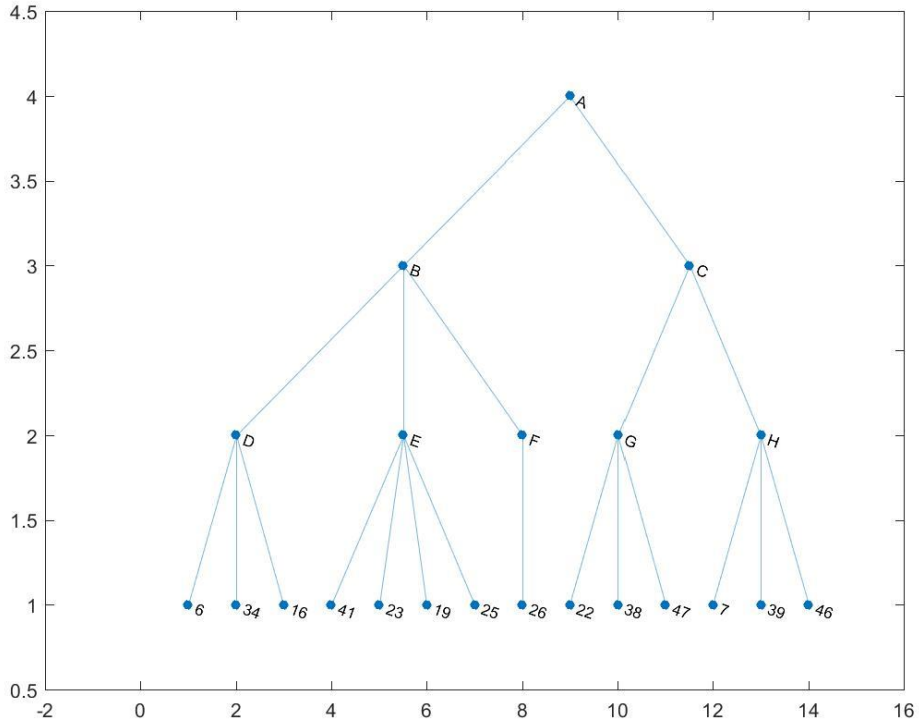
[Award 1 mark for each correct node value with a maxium of 10 marks]

The tree after evaluation is:




# Question 5

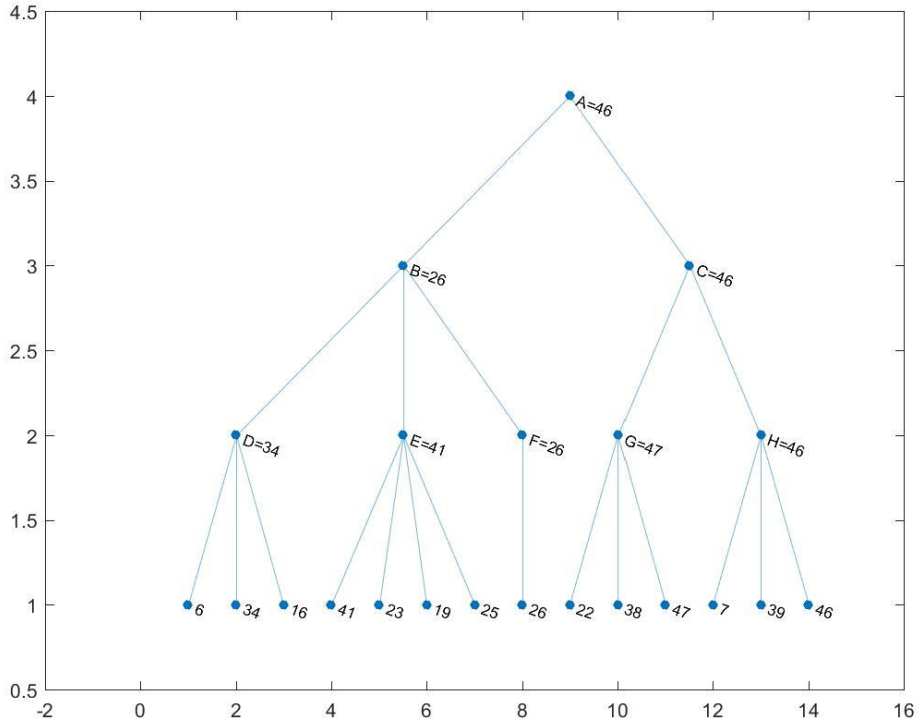
Given the following tree, use minimax algorithm to evaluate each node in the tree.




---

[Award 1 mark for each correct node value with a maxium of 10 marks]

The tree after evaluation is:




# Question 1

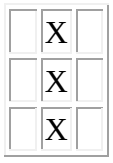
Having the following goal state for the XO game:

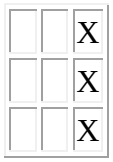
| | | |
|---|---|---|
| X | X | X |
| | | |
| | | |

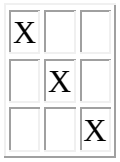
| | | |
|---|---|---|
| | | |
| X | X | X |
| | | |

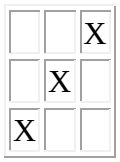
| | | |
|---|---|---|
| | | |
| | | |
| X | X | X |

| | | |
|---|---|---|
| X | | |
| X | | |
| X | | |

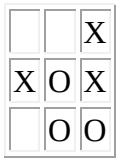








and having the following current state s=

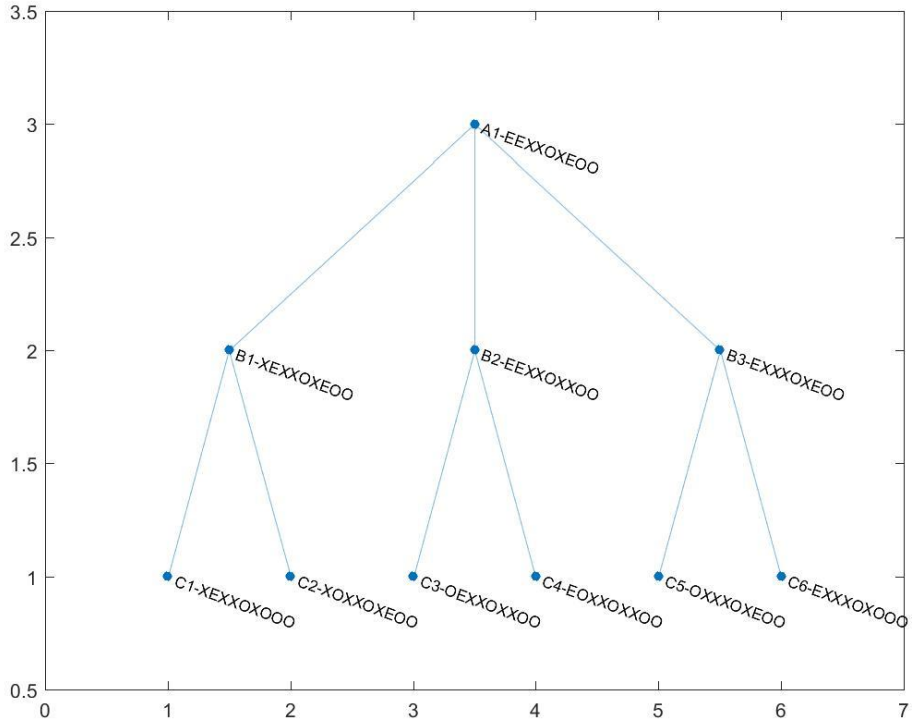


a. Generate the game tree until reaching the leaf nodes.

b. Using mini-max algorithm set the value for each node
c. Decide the winner for the game if any.

---

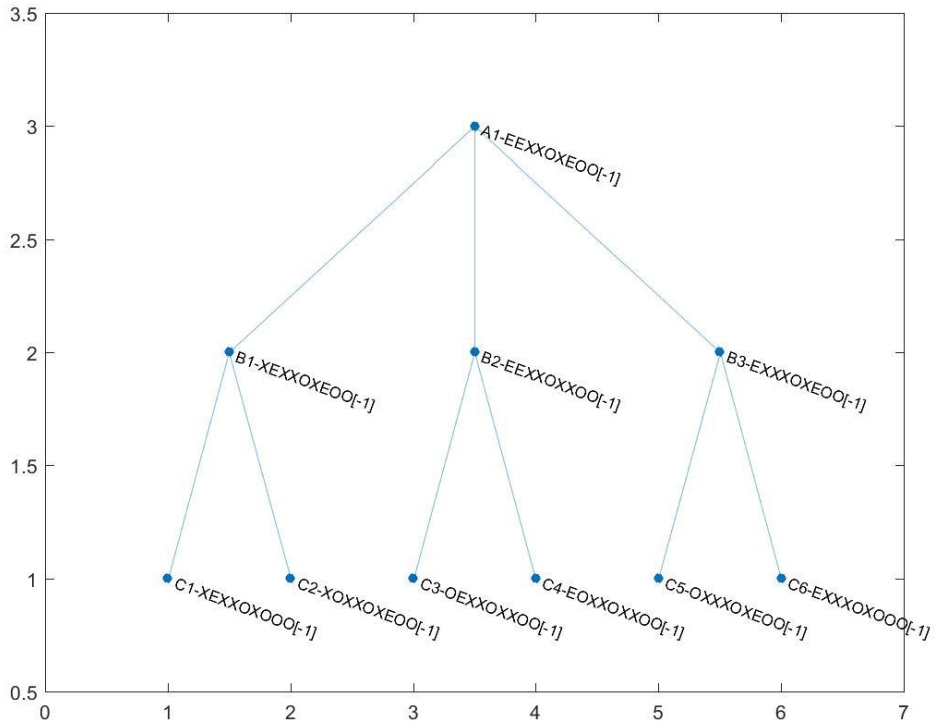
Answer:
The game tree is:




| | | |
|---|---|---|
| 1 | A1 | <table><tr><td></td><td></td><td>X</td></tr><tr><td>X</td><td>O</td><td>X</td></tr><tr><td></td><td>O</td><td>O</td></tr></table> |
| 2 | B1 | <table><tr><td>X</td><td></td><td>X</td></tr><tr><td>X</td><td>O</td><td>X</td></tr><tr><td></td><td>O</td><td>O</td></tr></table> |
| 3 | B2 | <table><tr><td></td><td></td><td>X</td></tr><tr><td>X</td><td>O</td><td>X</td></tr><tr><td>X</td><td>O</td><td>O</td></tr></table> |
| 4 | B3 | <table><tr><td></td><td>X</td><td>X</td></tr><tr><td>X</td><td>O</td><td>X</td></tr><tr><td></td><td>O</td><td>O</td></tr></table> |
| 5 | C1 | <table><tr><td>X</td><td></td><td>X</td></tr><tr><td>X</td><td>O</td><td>X</td></tr><tr><td>O</td><td>O</td><td>O</td></tr></table> |
| 6 | C2 | <table><tr><td>X</td><td>O</td><td>X</td></tr></table> |

| | | |
|---|---|---|
| | | X O X<br>  O O |
| 7 | C3 | O  X<br>X O X<br>X O O |
| 8 | C4 | O X<br>X O X<br>X O O |
| 9 | C5 | O X X<br>X O X<br>  O O |
| 10 | C6 | X X<br>X O X<br>O O O |

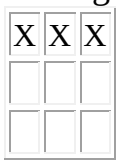
The game tree after evaluation is:

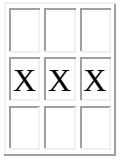


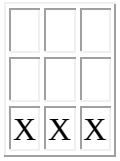

For the first player the game is O lose

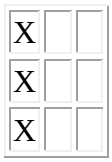
# Question 2

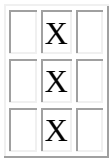
Having the following goal state for the XO game:

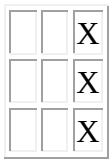


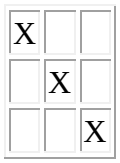


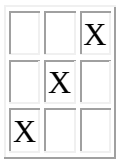












and having the following current state s=

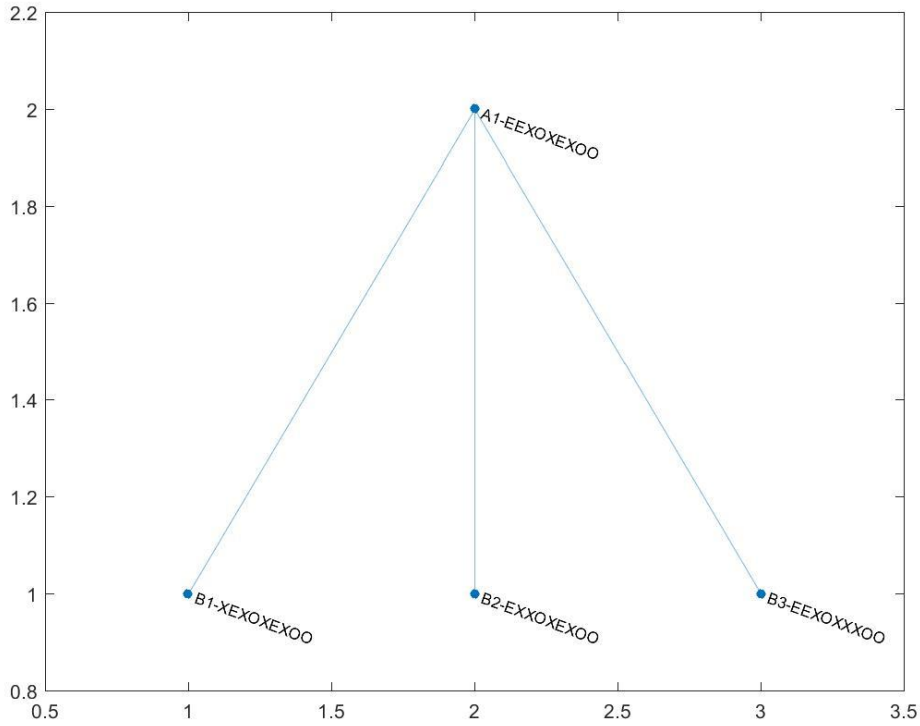
| | | |
|---|---|---|
| | | X |
| O | X | |
| X | O | O |

a. Generate the game tree until reaching the leaf nodes.

b. Using mini-max algorithm set the value for each node
c. Decide the winner for the game if any.

---

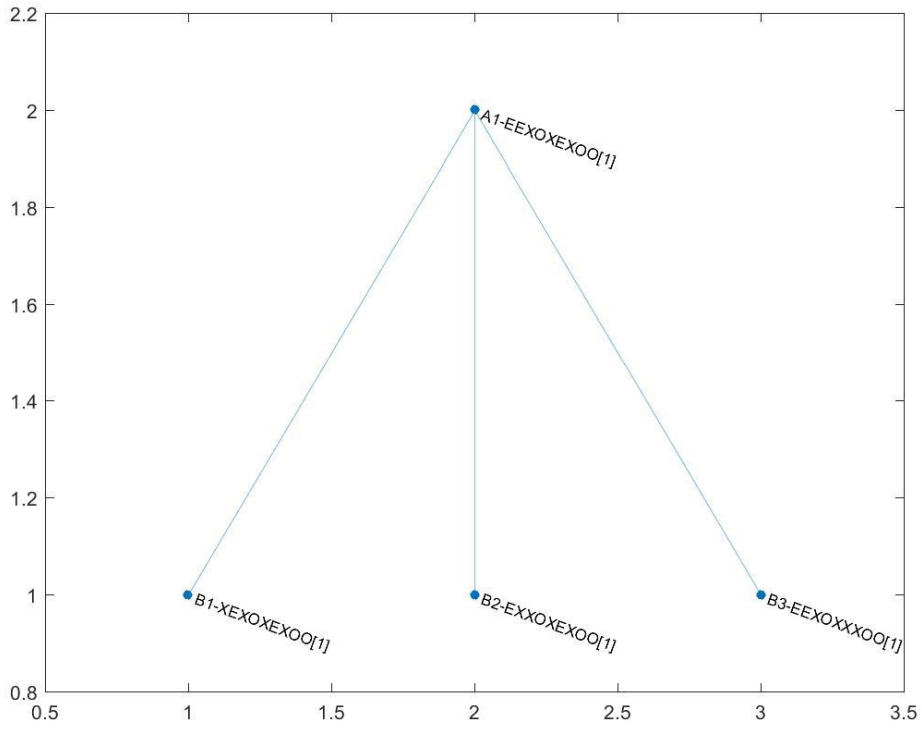
Answer:
The game tree is:




| | | |
|---|---|---|
| 1 | A1 | <table><tr><td></td><td></td><td>X</td></tr><tr><td>O</td><td>X</td><td></td></tr><tr><td>X</td><td>O</td><td>O</td></tr></table> |
| 2 | B1 | <table><tr><td>X</td><td></td><td>X</td></tr><tr><td>O</td><td>X</td><td></td></tr></table> |

| | | |
|---|---|---|
| | | X O O |
| 3 | B2 | X X<br>O X<br>X O O |
| 4 | B3 | X<br>O X X<br>X O O |

The game tree after evaluation is:

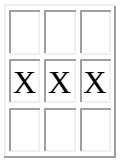


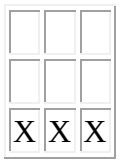

For the first player the game is X Wins

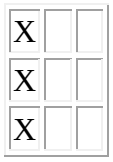
# Question 3

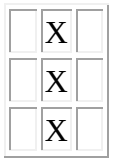
Having the following goal state for the XO game:

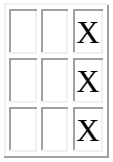
| | | |
|---|---|---|
| X | X | X |
| | | |
| | | |

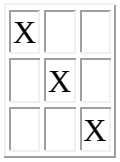


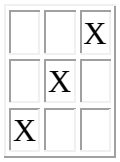




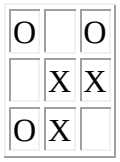








and having the following current state s=



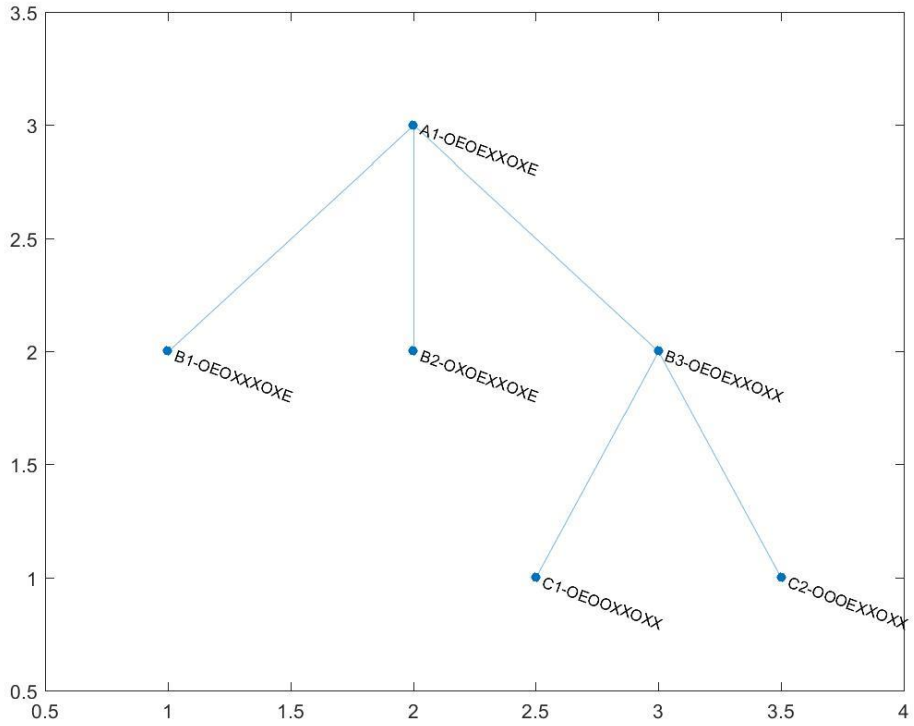
a. Generate the game tree until reaching the leaf nodes.

b. Using mini-max algorithm set the value for each node

c. Decide the winner for the game if any.

---

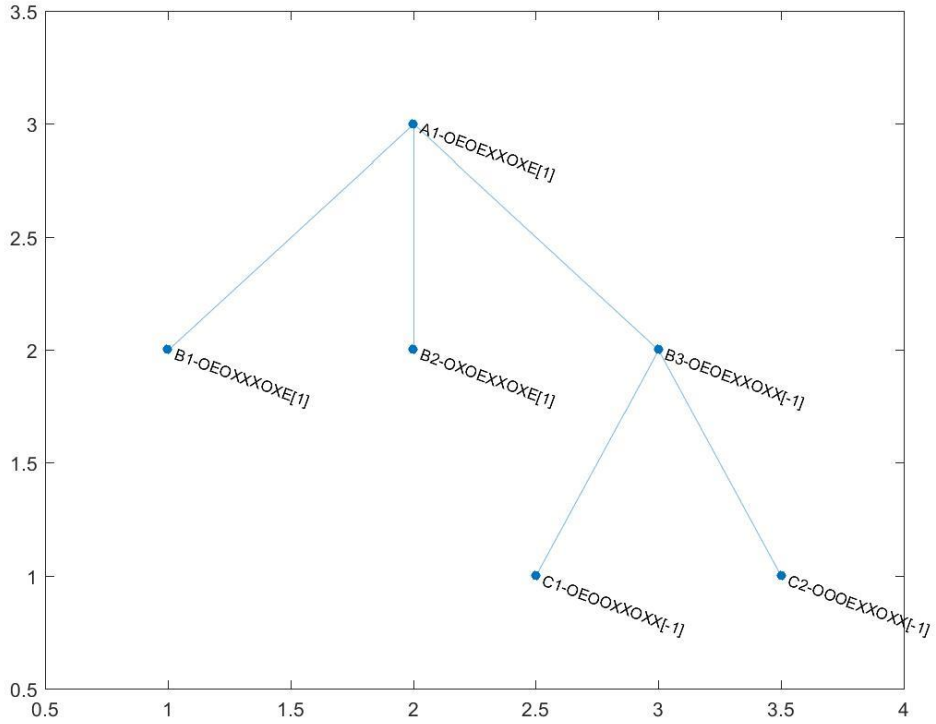
Answer:
The game tree is:




| | | | | |
|---|---|---|---|---|
| 1 | A1 | O | | O |
| | | | X | X |
| | | O | X | |
| 2 | B1 | O | | O |
| | | X | X | X |
| | | O | X | |
| 3 | B2 | O | X | O |
| | | | X | X |
| | | O | X | |
| 4 | B3 | O | | O |
| | | | X | X |
| | | O | X | X |
| 5 | C1 | O | | O |
| | | O | X | X |

| | | |
|---|---|---|
| | | O X X |
| 6 | C2 | O O O<br>X X<br>O X X |

The game tree after evaluation is:



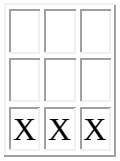

For the first player the game is X Wins

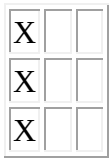
# Question 4

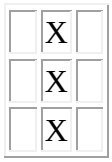
Having the following goal state for the XO game:

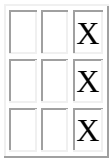
| | | |
|---|---|---|
| X | X | X |
| | | |
| | | |

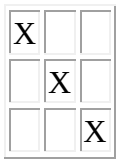
| | | |
|---|---|---|
| | | |
| X | X | X |
| | | |

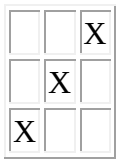




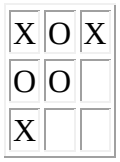








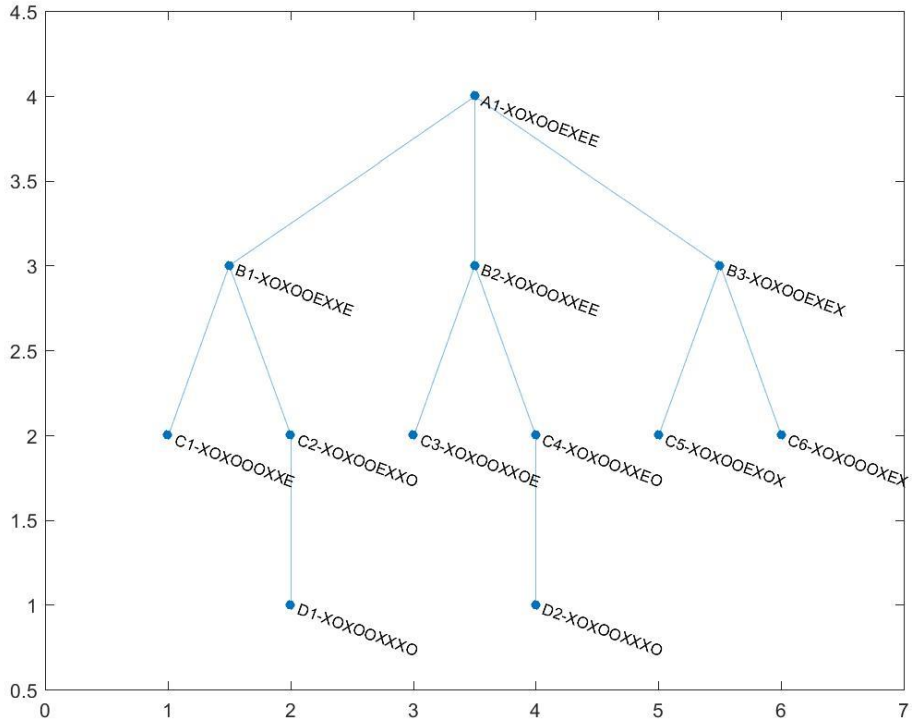
and having the following current state s=



a. Generate the game tree until reaching the leaf nodes.

b. Using mini-max algorithm set the value for each node
c. Decide the winner for the game if any.

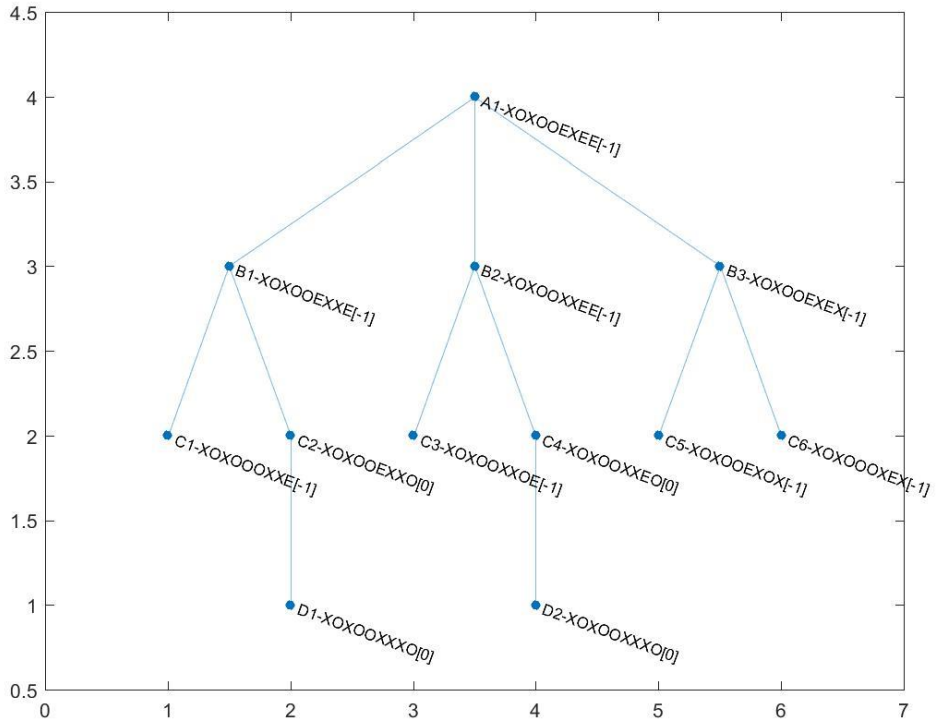
Answer:
The game tree is:




| | | | | |
|---|---|---|---|---|
| 1 | A1 | X | O | X |
| | | O | O | |
| | | X | | |
| 2 | B1 | X | O | X |
| | | O | O | |
| | | X | X | |
| 3 | B2 | X | O | X |
| | | O | O | X |
| | | X | | |
| 4 | B3 | X | O | X |
| | | O | O | |
| | | X | | X |
| 5 | C1 | X | O | X |
| | | O | O | O |
| | | X | X | |
| 6 | C2 | X | O | X |

| | | |
|---|---|---|
| | | O O<br>X X O |
| 7 | C3 | X O X<br>O O X<br>X O |
| 8 | C4 | X O X<br>O O X<br>X O |
| 9 | C5 | X O X<br>O O<br>X O X |
| 10 | C6 | X O X<br>O O O<br>X X |
| 11 | D1 | X O X<br>O O X<br>X X O |
| 12 | D2 | X O X<br>O O X<br>X X O |

The game tree after evaluation is:




For the first player the game is O lose

# Question 5

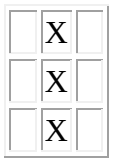
Having the following goal state for the XO game:

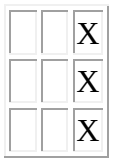
| | | |
|---|---|---|
| X | X | X |
| | | |
| | | |

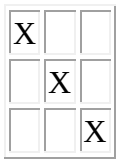
| | | |
|---|---|---|
| | | |
| X | X | X |
| | | |

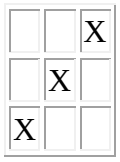
| | | |
|---|---|---|
| | | |
| | | |
| X | X | X |

| | | |
|---|---|---|
| X | | |
| X | | |

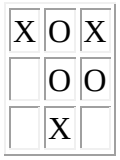








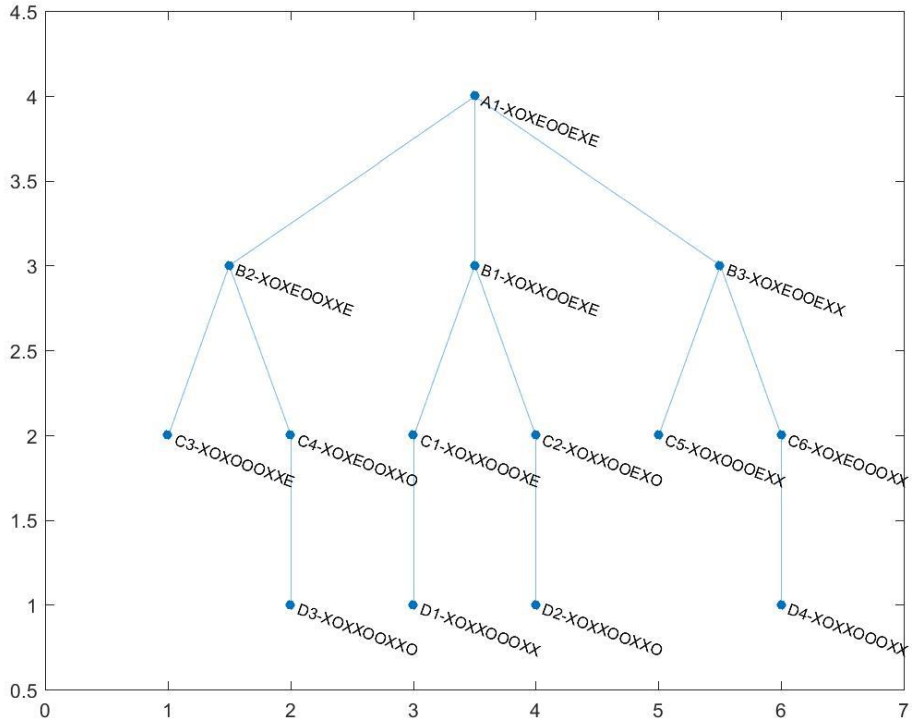
and having the following current state s=



a. Generate the game tree until reaching the leaf nodes.

b. Using mini-max algorithm set the value for each node
c. Decide the winner for the game if any.

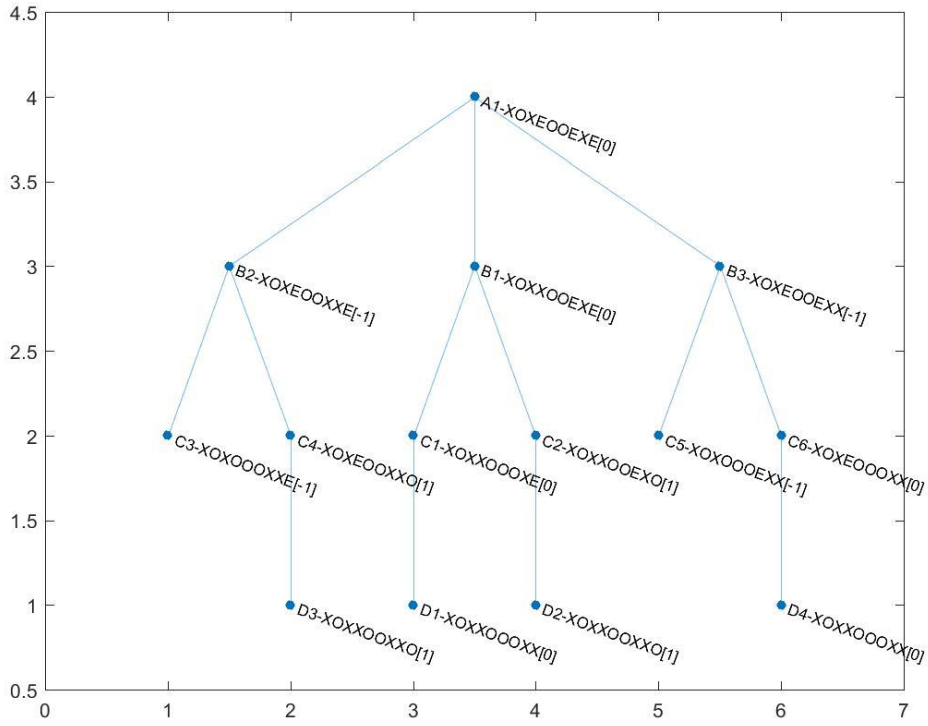
Answer:
The game tree is:




| | | |
|---|---|---|
| 1 | A1 | X O X<br>  O O<br>  X  |
| 2 | B1 | X O X<br>X O O<br>  X  |
| 3 | B2 | X O X<br>  O O<br>X X  |
| 4 | B3 | X O X<br>  O O<br>  X X |
| 5 | C1 | X O X<br>X O O<br>O X  |
| 6 | C2 | X O X |

| | | |
|---|---|---|
| | | X O O<br>  X O |
| 7 | C3 | X O X<br>O O O<br>X X  |
| 8 | C4 | X O X<br>  O O<br>X X O |
| 9 | C5 | X O X<br>O O O<br>  X X |
| 10 | C6 | X O X<br>  O O<br>O X X |
| 11 | D1 | X O X<br>X O O<br>O X X |
| 12 | D2 | X O X<br>X O O<br>X X O |
| 13 | D3 | X O X<br>X O O<br>X X O |
| 14 | D4 | X O X<br>X O O<br>O X X |

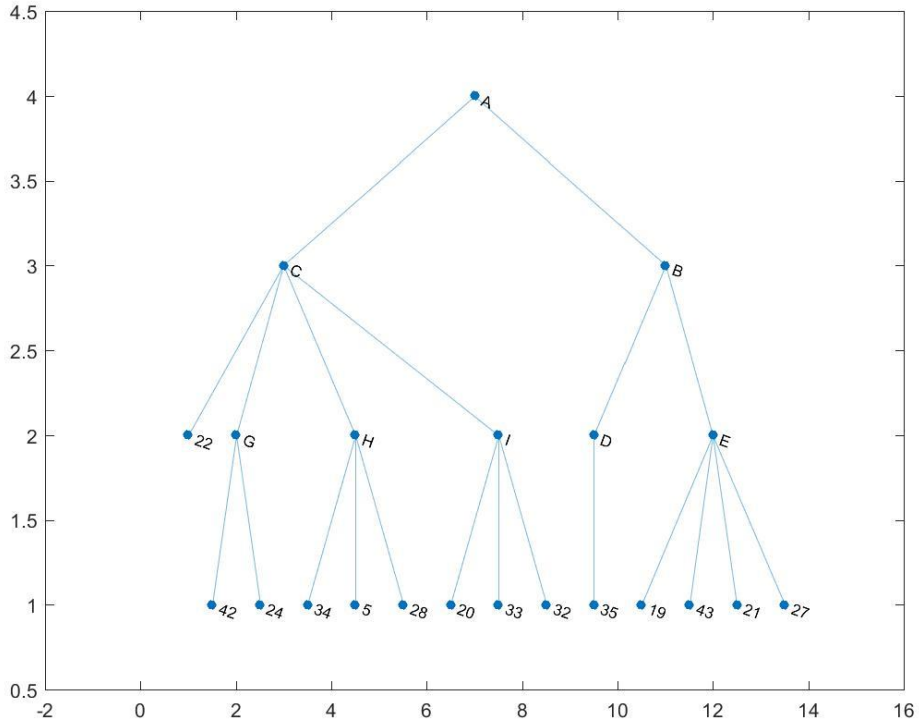
The game tree after evaluation is:




For the first player the game is Deal game

# Question 1

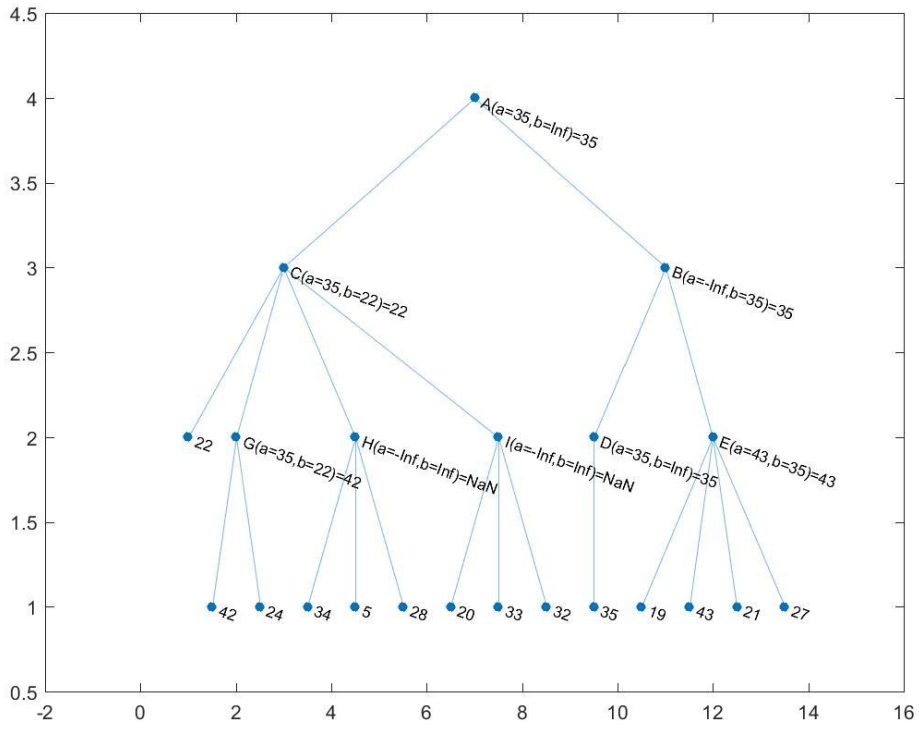
Given the tree, use α-β pruning minimax algorithm to evaluate each node in the tree.




---

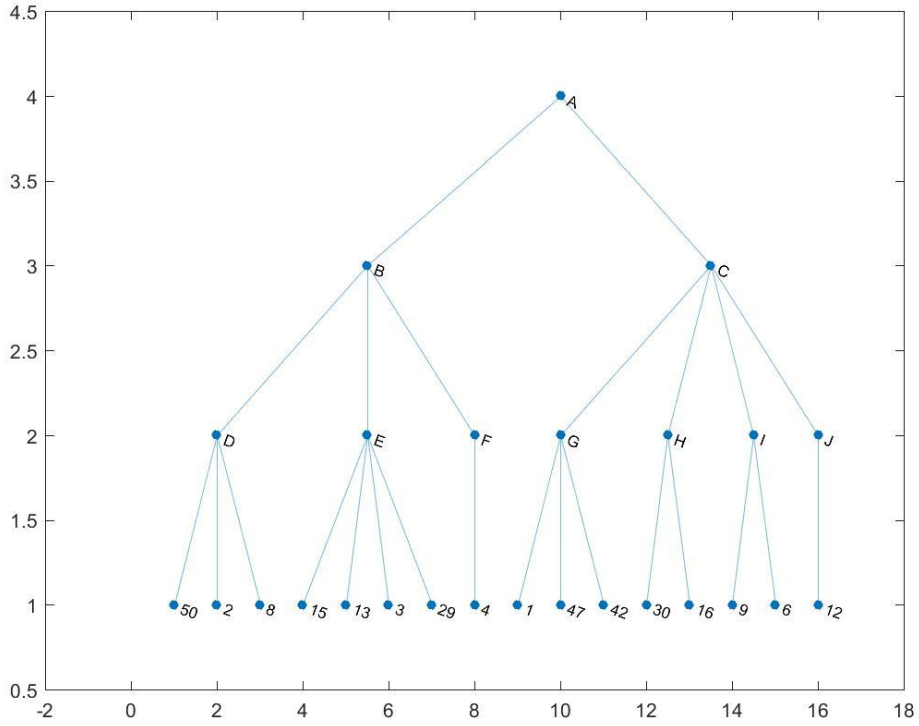
[Award 1 mark for each correct node value with a maxium of 10 marks]

The tree after evaluation is:




# Question 2

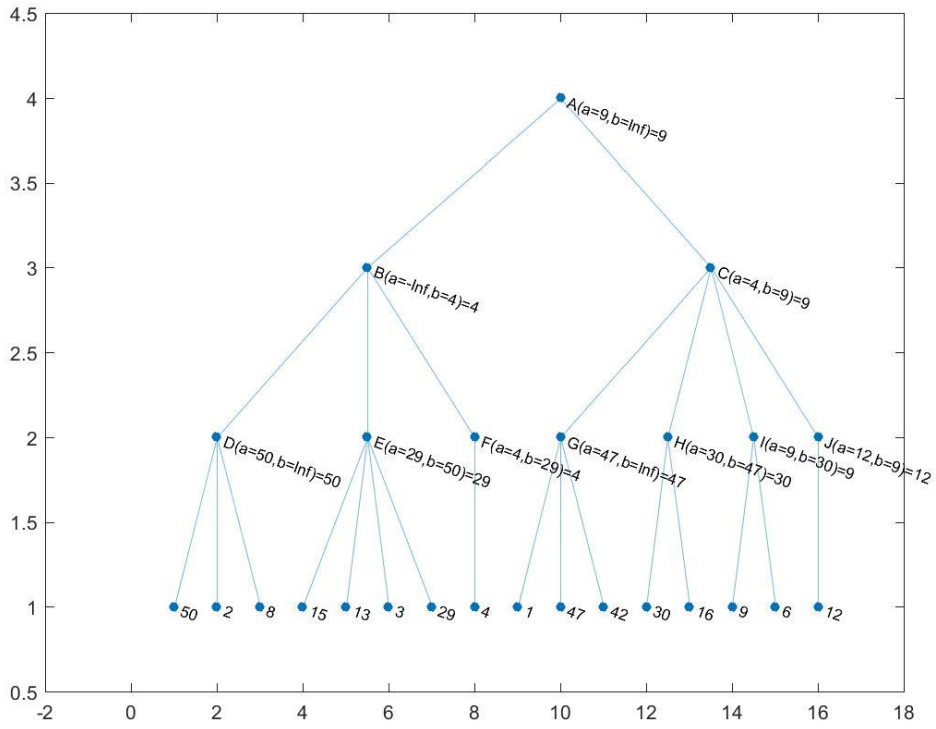
Given the tree, use α-β pruning minimax algorithm to evaluate each node in the tree.




---

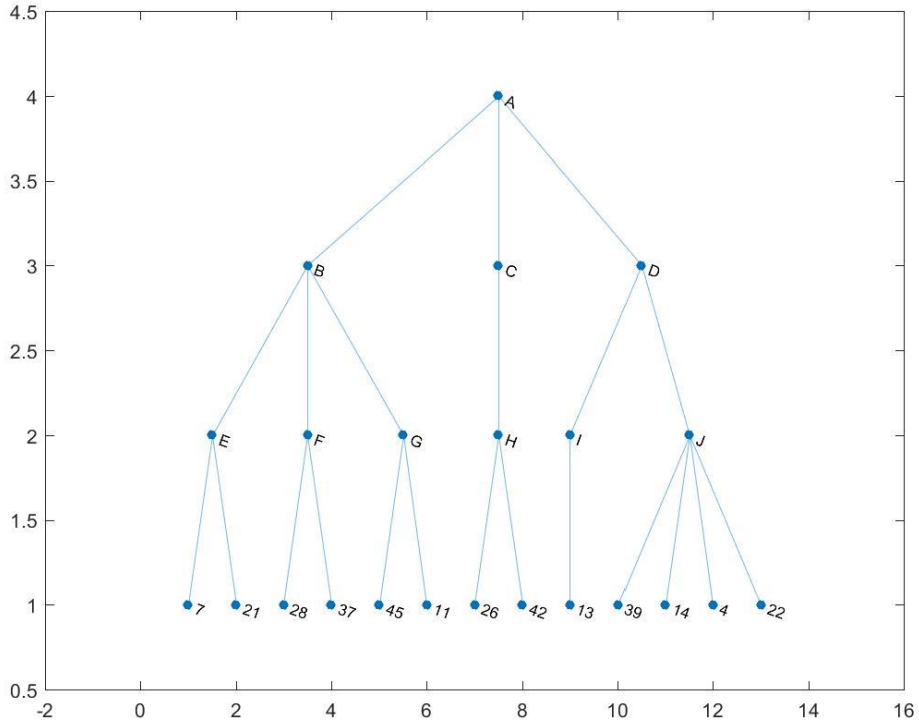
[Award 1 mark for each correct node value with a maxium of 10 marks]

The tree after evaluation is:




# Question 3

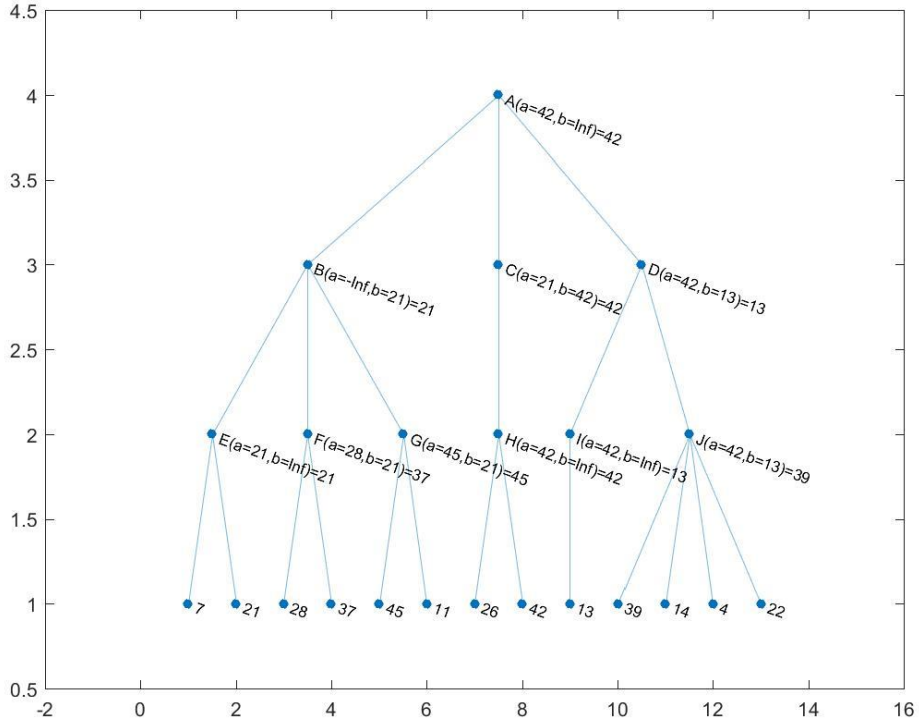
Given the tree, use α-β pruning minimax algorithm to evaluate each node in the tree.




---

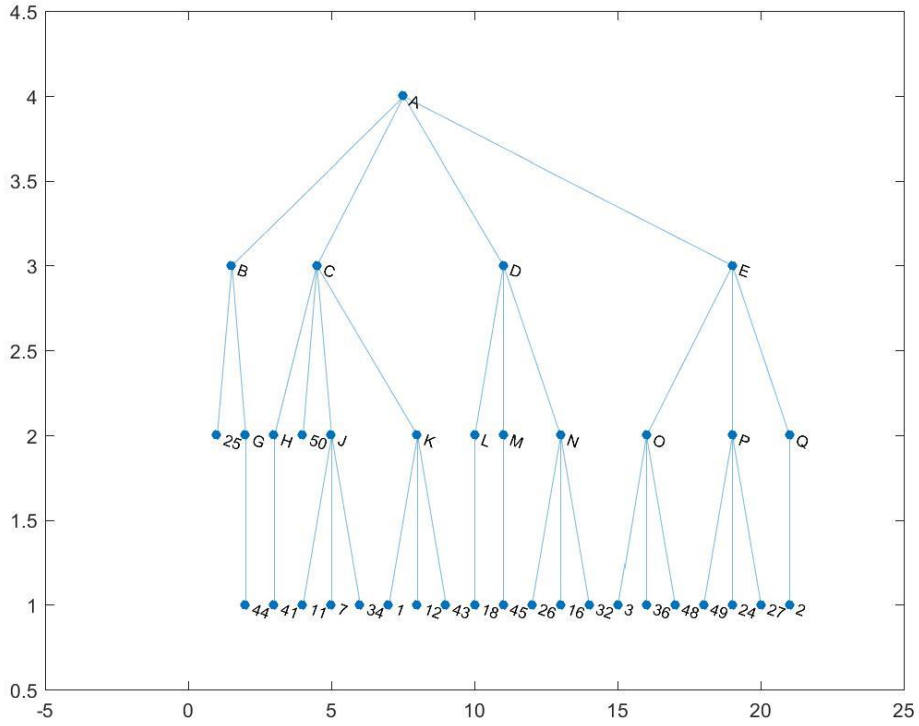
[Award 1 mark for each correct node value with a maxium of 10 marks]

The tree after evaluation is:




# Question 4

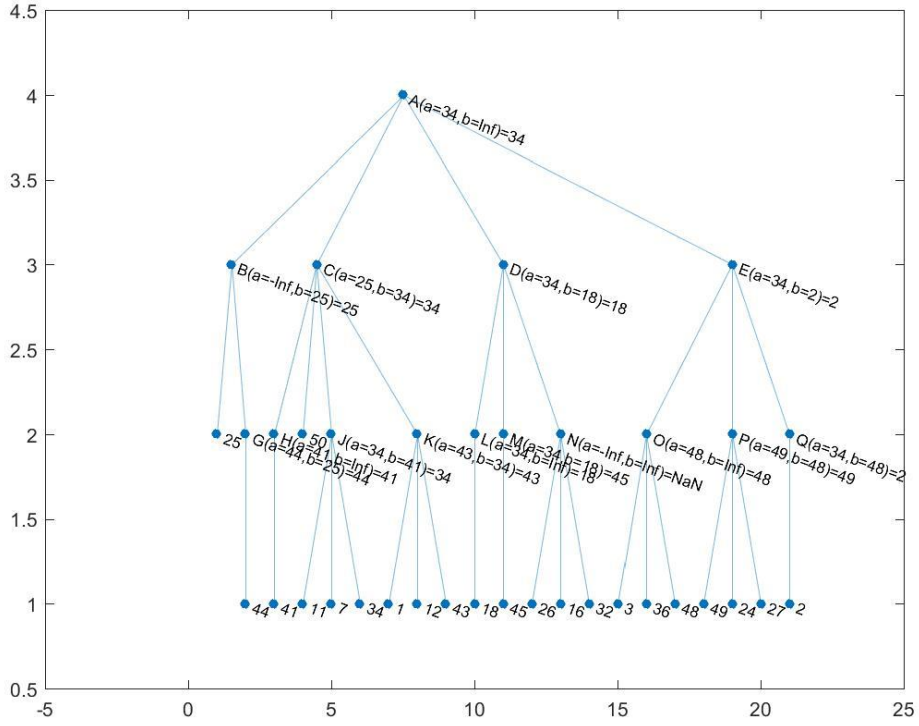
Given the tree, use α-β pruning minimax algorithm to evaluate each node in the tree.




---

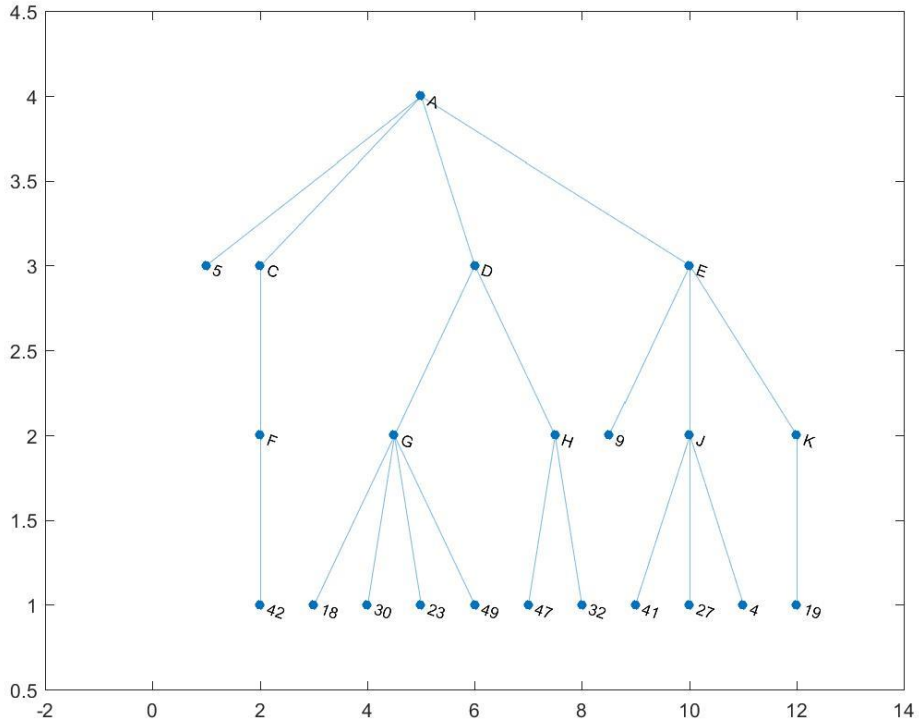
[Award 1 mark for each correct node value with a maxium of 10 marks]

The tree after evaluation is:




# Question 5

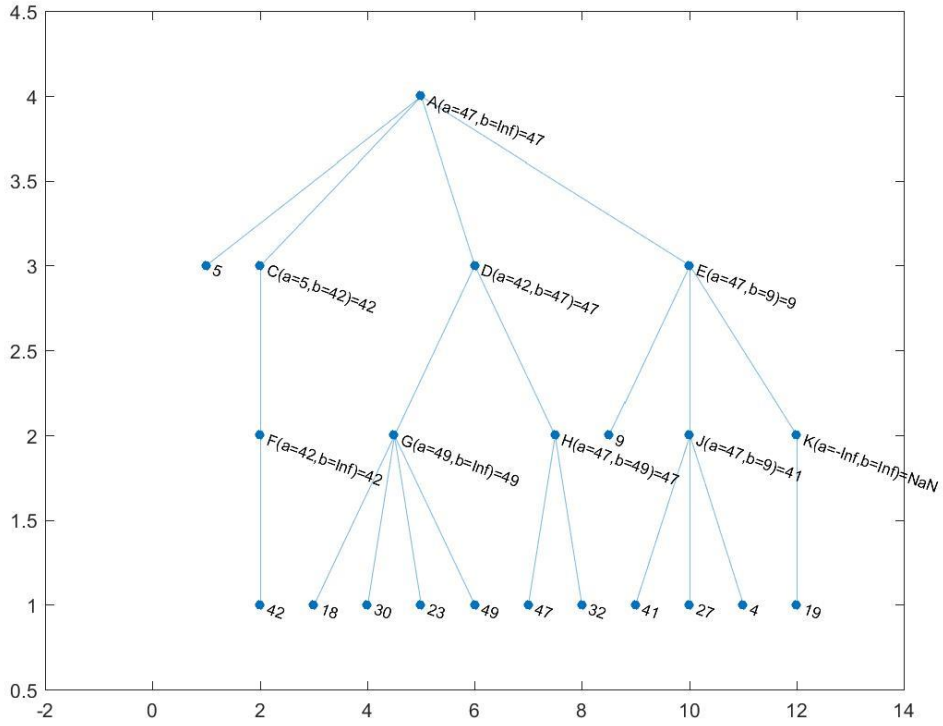
Given the tree, use α-β pruning minimax algorithm to evaluate each node in the tree.




---

[Award 1 mark for each correct node value with a maxium of 10 marks]

The tree after evaluation is:



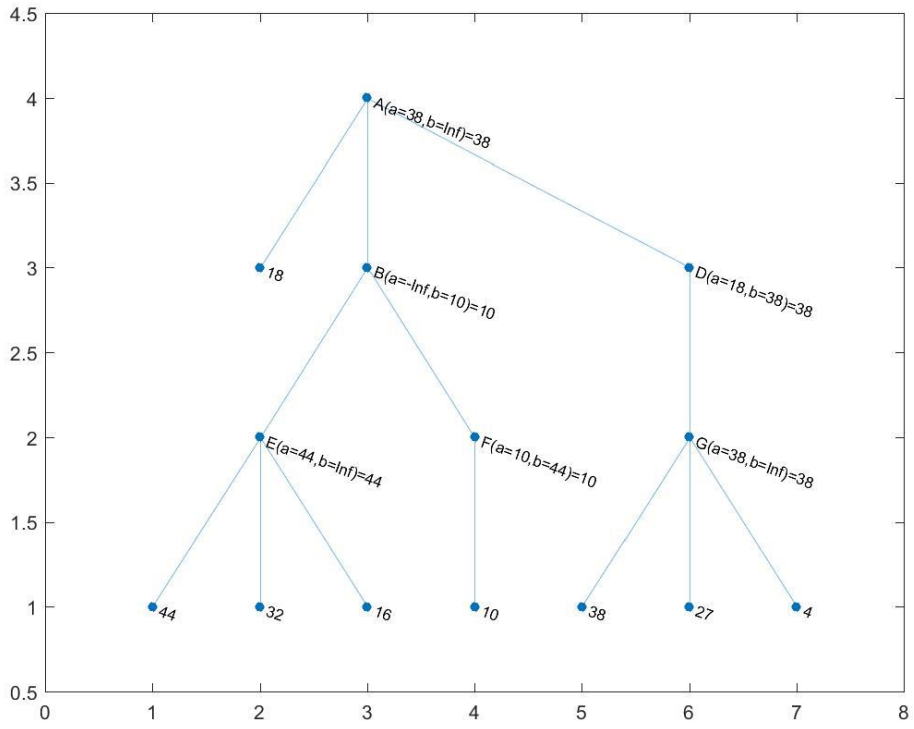

# Question 1

A tree can be defined by two vectors. The first vector is the parents vector -s. The second vector is the children vector -t. Each entry in t matrix is a child to the corresponding parents in the same index in the s matrix.Assuming s, t in order for a given tree as:
s=[A,A,A,B,B,D,E,E,E,F,G,G,G,]
,t=[B,18,D,E,F,G,44,32,16,10,38,27,4,] Given the aforementioned tree, use α-β pruning minimax algorithm to evaluate each node in the tree.

---

[Award 1 mark for each correct node value with a maxium of 10 marks]

The tree after evaluation is:




| Name | Alpha | Beta | Value |
|---|---|---|---|
| A | 38 | Inf | 38 |
| B | -Inf | 10 | 10 |
| D | 18 | 38 | 38 |
| E | 44 | Inf | 44 |
| F | 10 | 44 | 10 |
| G | 38 | Inf | 38 |

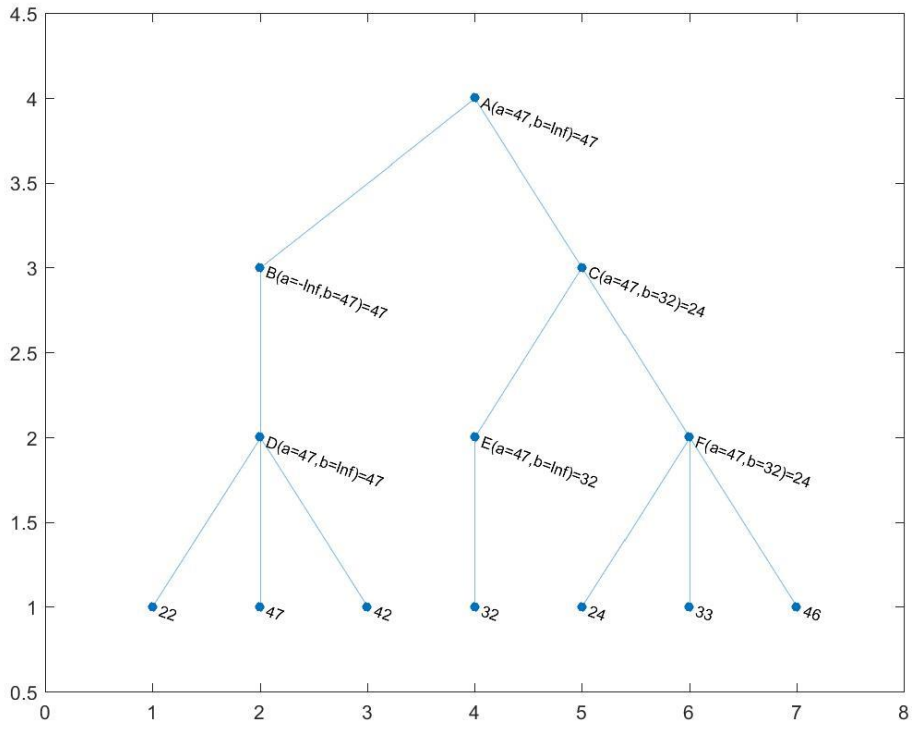
# Question 2

A tree can be defined by two vectors. The first vector is the parents vector -s. The second vector is the children vector -t. Each entry in t matrix is a child to the corresponding parents in the same index in the s matrix.Assuming s, t in order for a given tree as:
s=[A,A,B,C,C,D,D,D,E,F,F,F,]
,t=[B,C,D,E,F,22,47,42,32,24,33,46,] Given the aforementioned tree, use α-β pruning minimax algorithm to evaluate each node in the tree.

---

[Award 1 mark for each correct node value with a maxium of 10 marks]

The tree after evaluation is:



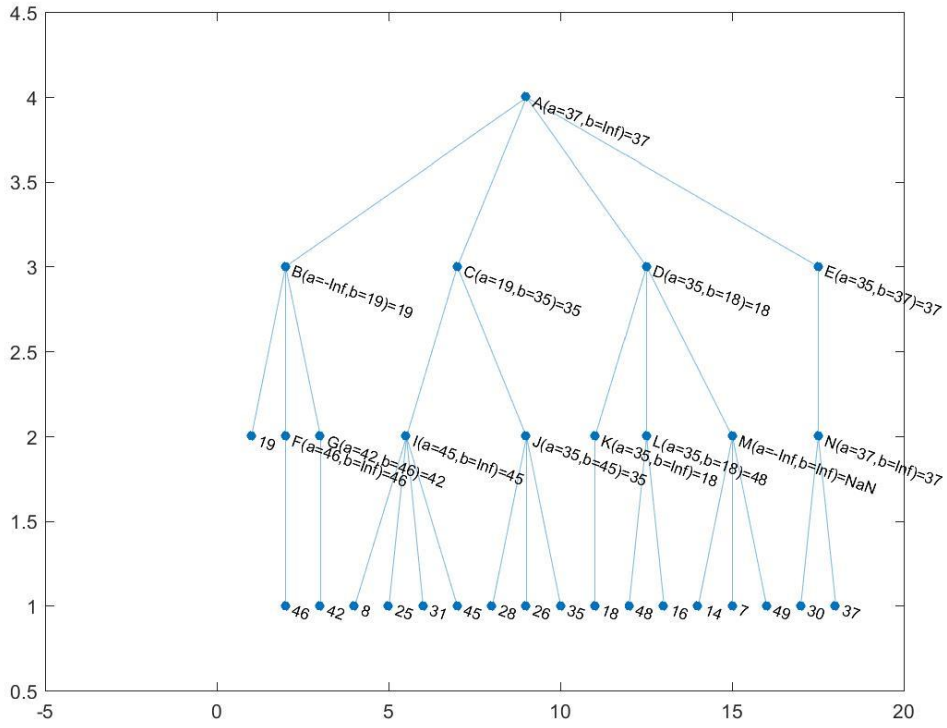

| Name | Alpha | Beta | Value |
|---|---|---|---|
| A | 47 | Inf | 47 |
| B | -Inf | 47 | 47 |
| C | 47 | 32 | 24 |
| D | 47 | Inf | 47 |
| E | 47 | Inf | 32 |
| F | 47 | 32 | 24 |

# Question 3

A tree can be defined by two vectors. The first vector is the parents vector -s. The second vector is the children vector -t. Each entry in t matrix is a child to the corresponding parents in the same index in the s matrix.Assuming s, t in order for a given tree as: s=[A,A,A,A,B,B,B,C,C,D,D,D,E,F,G,I,I,I,I,J,J,J,K,L,L,M,M,M,N,N,] ,t=[B,C,D,E,F,G,19,I,J,K,L,M,N,46,42,8,25,31,45,28,26,35,18,48,16,14,7,49,30,37,] Given the aforementioned tree, use α-β pruning minimax algorithm to evaluate each node in the tree.

---

[Award 1 mark for each correct node value with a maxium of 10 marks]
The tree after evaluation is:



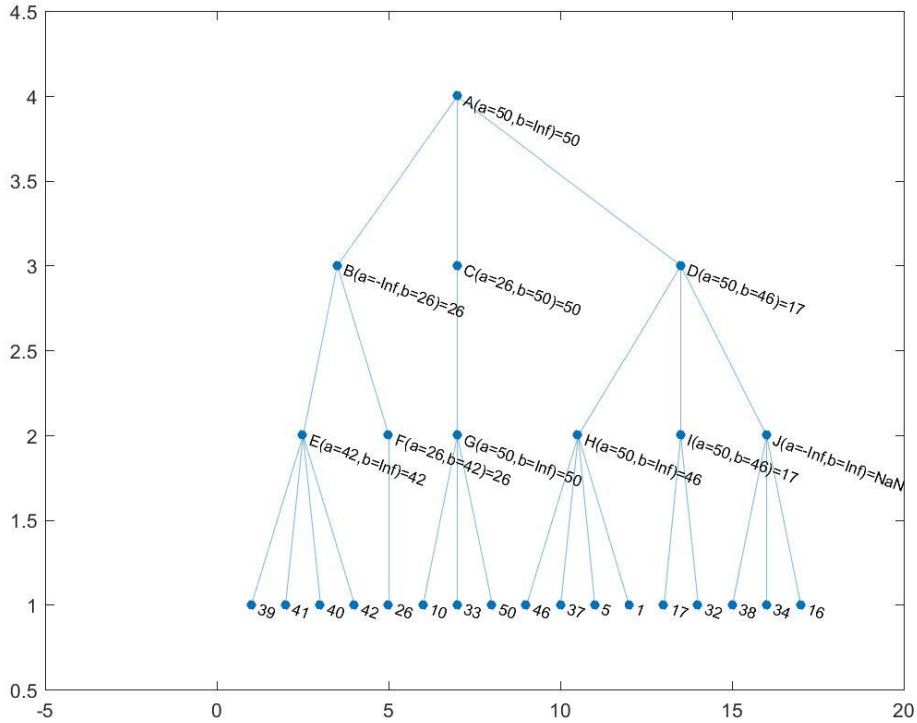

| Name | Alpha | Beta | Value |
|---|---|---|---|
| A | 37 | Inf | 37 |
| B | -Inf | 19 | 19 |
| C | 19 | 35 | 35 |
| D | 35 | 18 | 18 |
| E | 35 | 37 | 37 |
| F | 46 | Inf | 46 |
| G | 42 | 46 | 42 |
| I | 45 | Inf | 45 |
| J | 35 | 45 | 35 |
| K | 35 | Inf | 18 |
| L | 35 | 18 | 48 |
| M | -Inf | Inf | NaN |
| N | 37 | Inf | 37 |

# Question 4

A tree can be defined by two vectors. The first vector is the parents vector -s. The second vector is the children vector -t. Each entry in t matrix is a child to the corresponding parents in the same index in the s matrix.Assuming s, t in order for a given tree as: s=[A,A,A,B,B,C,D,D,D,E,E,E,E,F,G,G,G,H,H,H,H,I,I,J,J,J,] ,t=[B,C,D,E,F,G,H,I,J,39,41,40,42,26,10,33,50,46,37,5,1,17,32,38,34, 16,] Given the aforementioned tree, use α-β pruning minimax algorithm to evaluate each node in the tree.

---

[Award 1 mark for each correct node value with a maxium of 10 marks]
The tree after evaluation is:




| Name | Alpha | Beta | Value |
|---|---|---|---|
| A | 50 | Inf | 50 |
| B | -Inf | 26 | 26 |
| C | 26 | 50 | 50 |
| D | 50 | 46 | 17 |
| E | 42 | Inf | 42 |
| F | 26 | 42 | 26 |
| G | 50 | Inf | 50 |
| H | 50 | Inf | 46 |
| I | 50 | 46 | 17 |

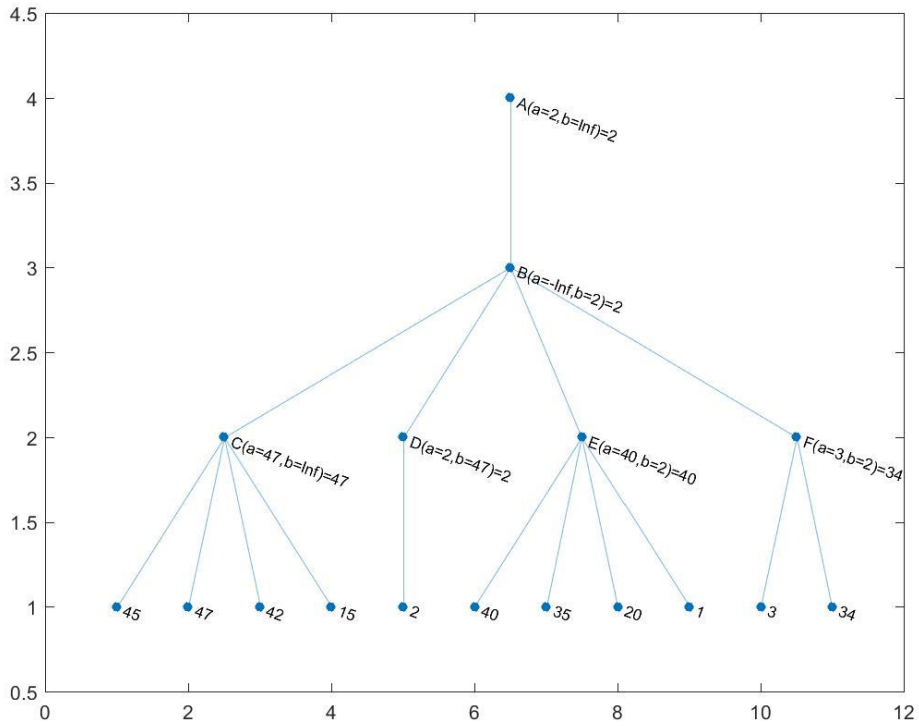
| | | | |
|---|---|---|---|
| J | -Inf | Inf | NaN |

# Question 5

A tree can be defined by two vectors. The first vector is the parents vector -s. The second vector is the children vector -t. Each entry in t matrix is a child to the corresponding parents in the same index in the s matrix. Assuming s, t in order for a given tree as:
s=[A,B,B,B,B,C,C,C,C,D,E,E,E,E,F,F,]
,t=[B,C,D,E,F,45,47,42,15,2,40,35,20,1,3,34,] Given the aforementioned tree, use α-β pruning minimax algorithm to evaluate each node in the tree.

---

[Award 1 mark for each correct node value with a maxium of 10 marks]
The tree after evaluation is:




| Name | Alpha | Beta | Value |
|---|---|---|---|
| A | 2 | Inf | 2 |
| B | -Inf | 2 | 2 |
| C | 47 | Inf | 47 |
| D | 2 | 47 | 2 |

| | | | |
|---|---|---|---|
| E | 40 | 2 | 40 |
| F | 3 | 2 | 34 |