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2020BTECS00035

TY CSE AY-2022-23 Sem-I

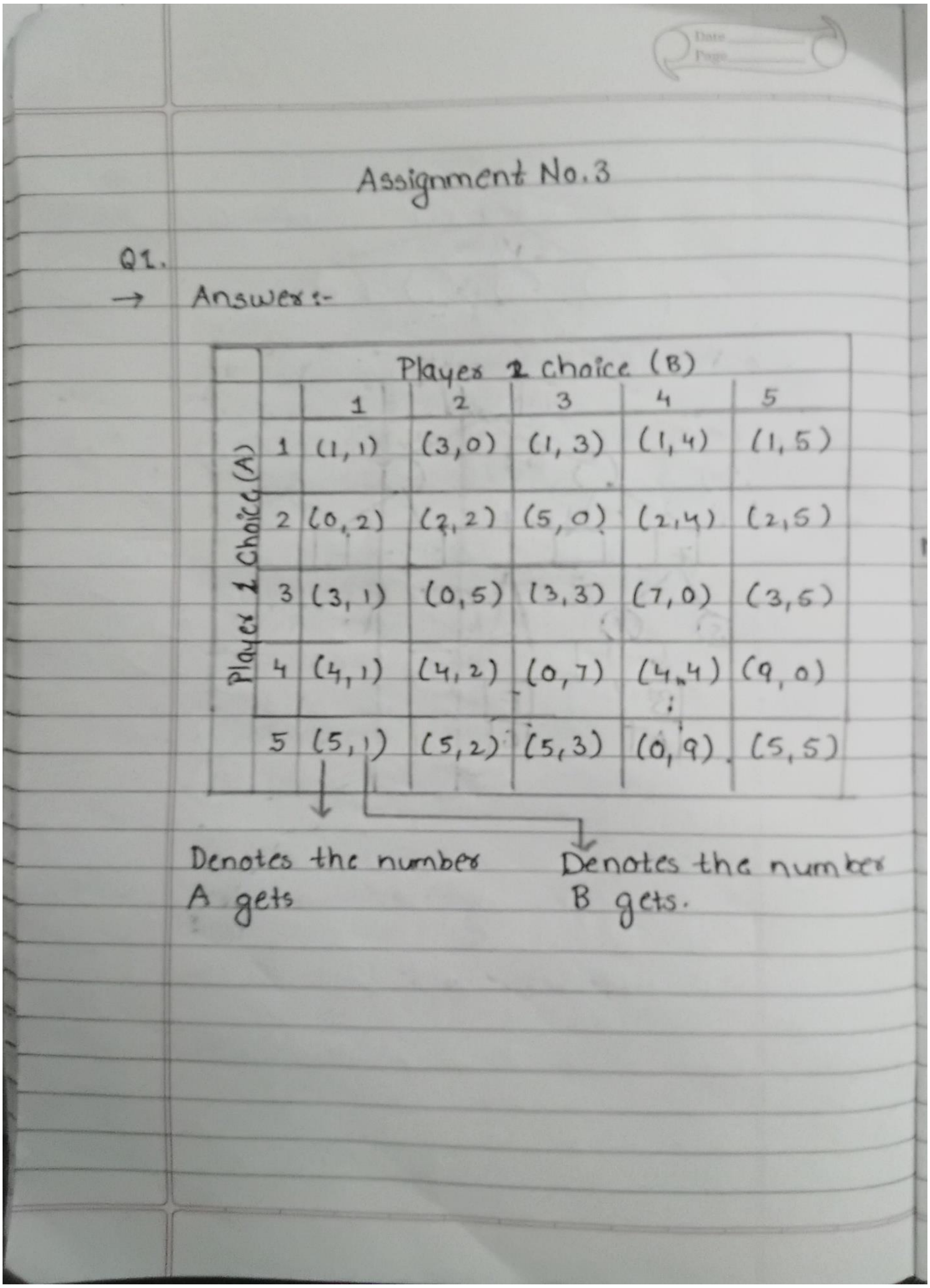
Artificial Intelligence and Machine Learning Lab

Assignment No 3

Due date- 14/09/2022

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

Answer:



Assignment No. 3

Q1.
→ Answer:-

		Player 2 choice (B)				
		1	2	3	4	5
Player 1 Choice (A)	1	(1, 1)	(3, 0)	(1, 3)	(1, 4)	(1, 5)
	2	(0, 2)	(2, 2)	(5, 0)	(2, 4)	(2, 5)
	3	(3, 1)	(0, 5)	(3, 3)	(7, 0)	(3, 5)
	4	(4, 1)	(4, 2)	(0, 7)	(4, 4)	(9, 0)
	5	(5, 1)	(5, 2)	(5, 3)	(0, 9)	(5, 5)

Denotes the number A gets

Denotes the number B gets.

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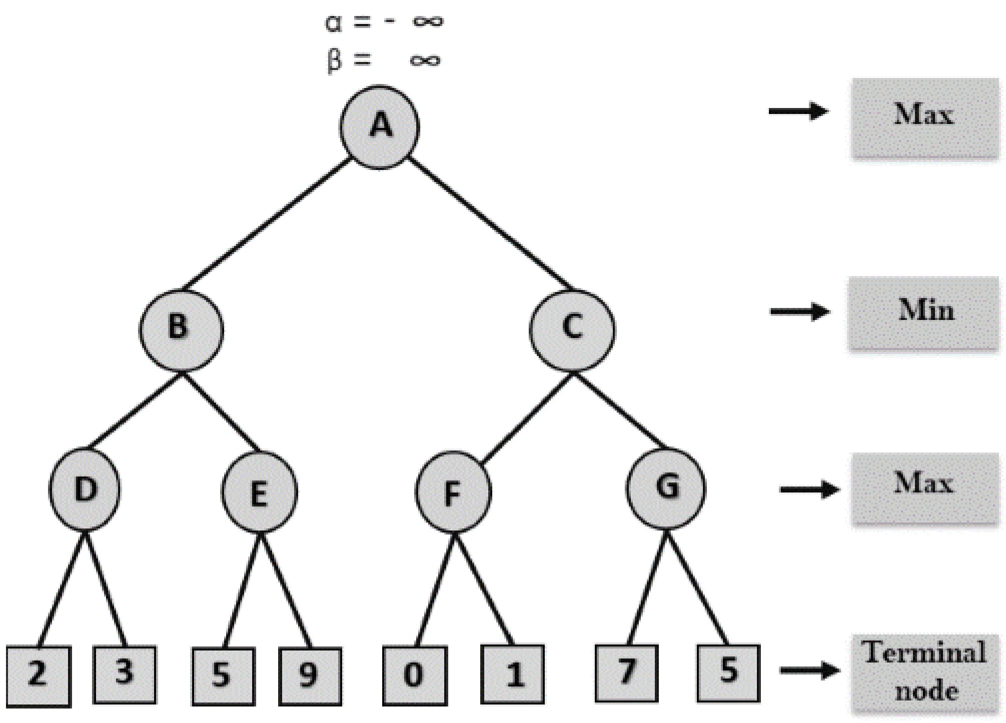
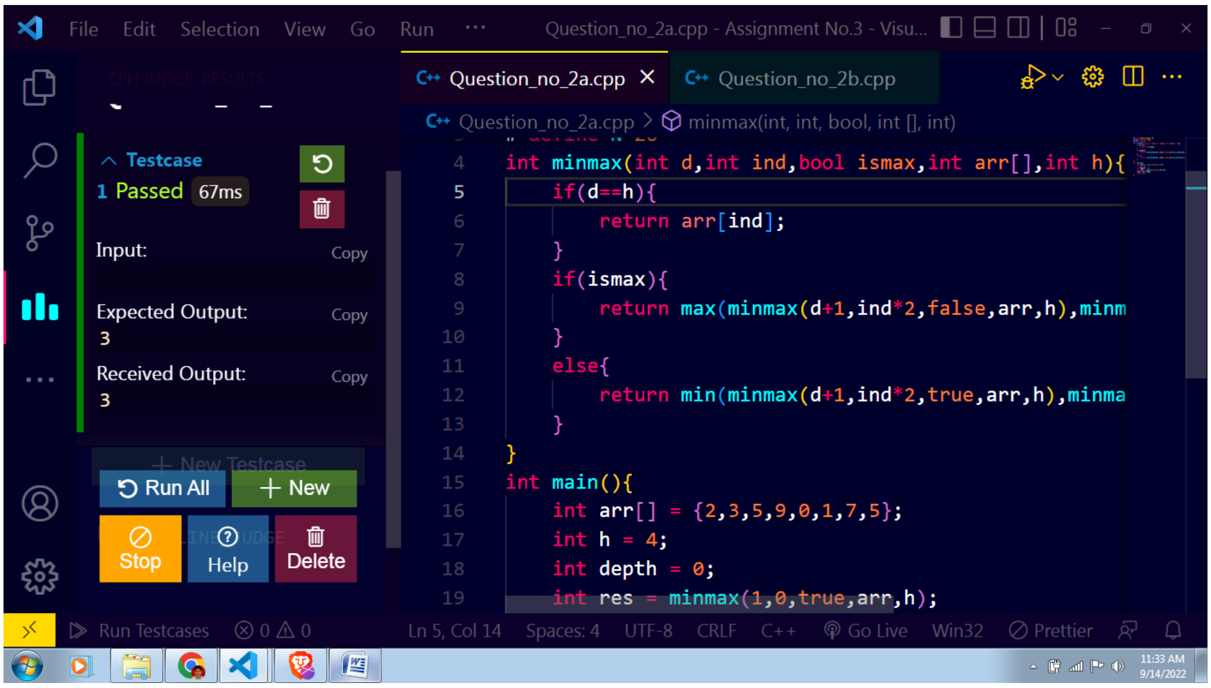
2. To identify the optimal move in the game tree given below, implement



Which algorithm is efficient? Why? Justify.

a. Min Max algorithm

```
#include<bits/stdc++.h>
using namespace std;
# define N 26
int minmax(int d,int ind,bool ismax,int arr[],int h){
    if(d==h){
        return arr[ind];
    }
    if(ismax){
        return
max(minmax(d+1,ind*2,false,arr,h),minmax(d+1,ind*2+1,false,arr,h));
    }
    else{
        return
min(minmax(d+1,ind*2,true,arr,h),minmax(d+1,ind*2+1,true,arr,h));
    }
}
int main(){
    int arr[] = {2,3,5,9,0,1,7,5};
    int h = 4;
    int depth = 0;
    int res = minmax(1,0,true,arr,h);
    cout<<res<<endl;
    return 0;
}
```



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Question_no_2a.cpp - Assignment No.3 - Visu...
Question_no_2a.cpp
Question_no_2b.cpp
Question_no_2a.cpp > minmax(int, int, bool, int [], int)
Testcase
Copy
New Testcase
Run All
New
Stop
Help
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Run Testcases
Ln 5, Col 14 Spaces: 4 UTF-8 CRLF C++ Go Live Win32 Prettier
11:33 AM
9/14/2022

1 Passed 67ms

Input:

Expected Output:
3

Received Output:
3

```
int minmax(int d,int ind,bool ismax,int arr[],int h){
    if(d==h){
        return arr[ind];
    }
    if(ismax){
        return max(minmax(d+1,ind*2,false,arr,h),minm
    }
    else{
        return min(minmax(d+1,ind*2,true,arr,h),minma
    }
}
int main(){
    int arr[] = {2,3,5,9,0,1,7,5};
    int h = 4;
    int depth = 0;
    int res = minmax(1,0,true,arr,h);
```

b. Alpha Beta algorithm

```
#include <bits/stdc++.h>
using namespace std;

const int MAX = 1000;
const int MIN = -1000;

int minimax(int depth, int nodeIndex,
            bool maximizingPlayer,
            int values[], int alpha,
            int beta)
{

    if (depth == 3)
        return values[nodeIndex];

    if (maximizingPlayer)
    {
        int best = MIN;
        for (int i = 0; i < 2; i++)
        {

            int val = minimax(depth + 1, nodeIndex * 2 + i,
                                false, values, alpha, beta);
            best = max(best, val);
            alpha = max(alpha, best);

            if (beta <= alpha)
                break;
        }
        return best;
    }
    else
    {
        int best = MAX;
        for (int i = 0; i < 2; i++)
        {
            int val = minimax(depth + 1, nodeIndex * 2 + i,
                              true, values, alpha, beta);
            best = min(best, val);
            beta = min(beta, best);
            if (beta <= alpha)
                break;
        }
        return best;
    }
}

int main()
{
    int values[8] = {2, 3, 5, 9, 0, 1, 7, 5};
    cout << minimax(0, 0, true, values, MIN, MAX);
    return 0;
}
```

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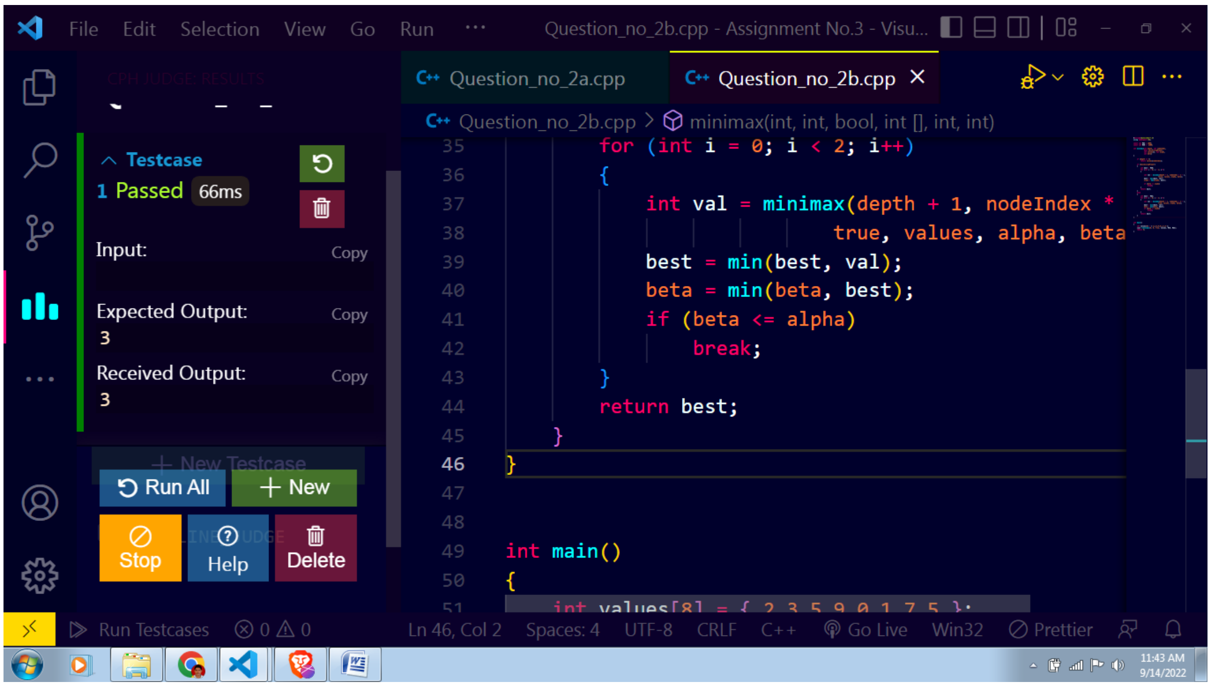
File Edit Selection View Go Run ···
Question_no_2b.cpp - Assignment No.3 - Visu...
Question_no_2a.cpp
Question_no_2b.cpp
Question_no_2b.cpp > minimax(int, int, bool, int [], int, int)
Run All
New
Stop
Help
Delete
Run Testcases
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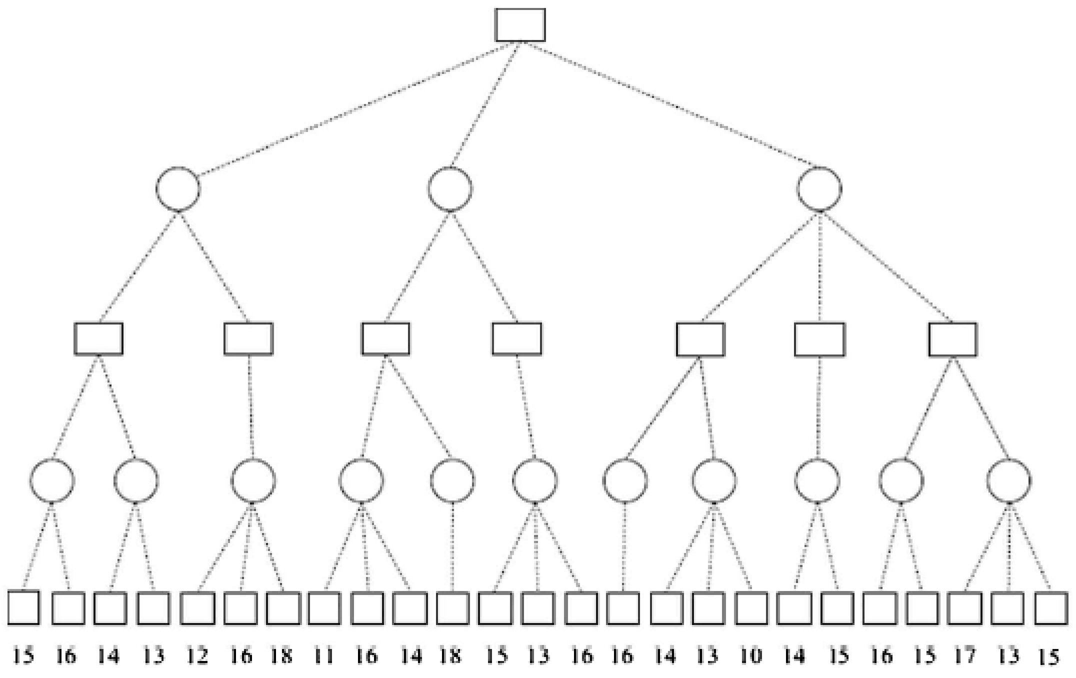
9/14/2022

```
Testcase
1 Passed 66ms
Input:
Expected Output:
3
Received Output:
3
```

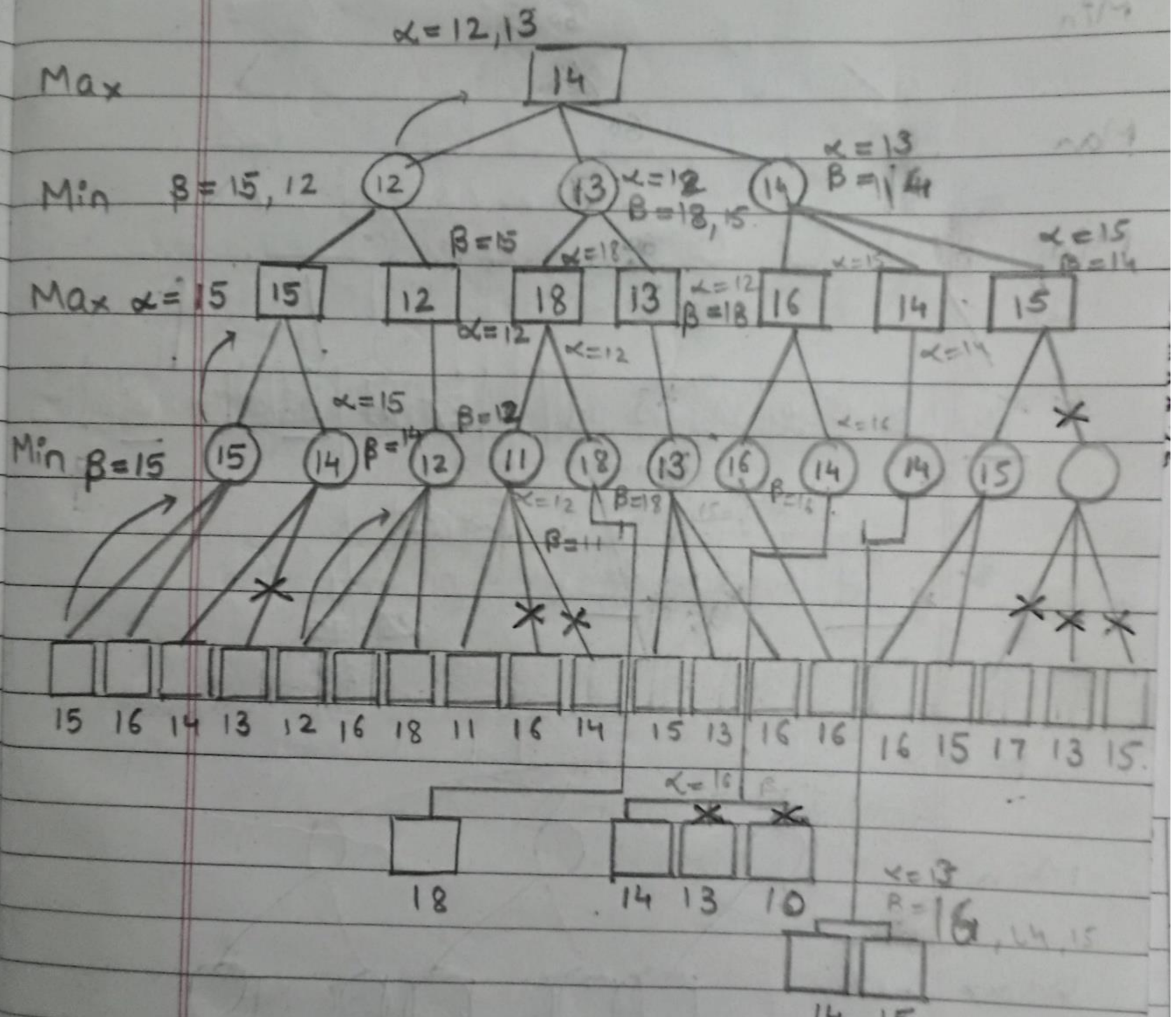
```cpp
        for (int i = 0; i < 2; i++)
        {
            int val = minimax(depth + 1, nodeIndex *
                              true, values, alpha, beta
            best = min(best, val);
            beta = min(beta, best);
            if (beta <= alpha)
                break;
        }
        return best;
    }
}


int main()
{
    int values[8] = { 2, 3, 5, 9, 0, 1, 7, 5 };
```

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.



Q3]

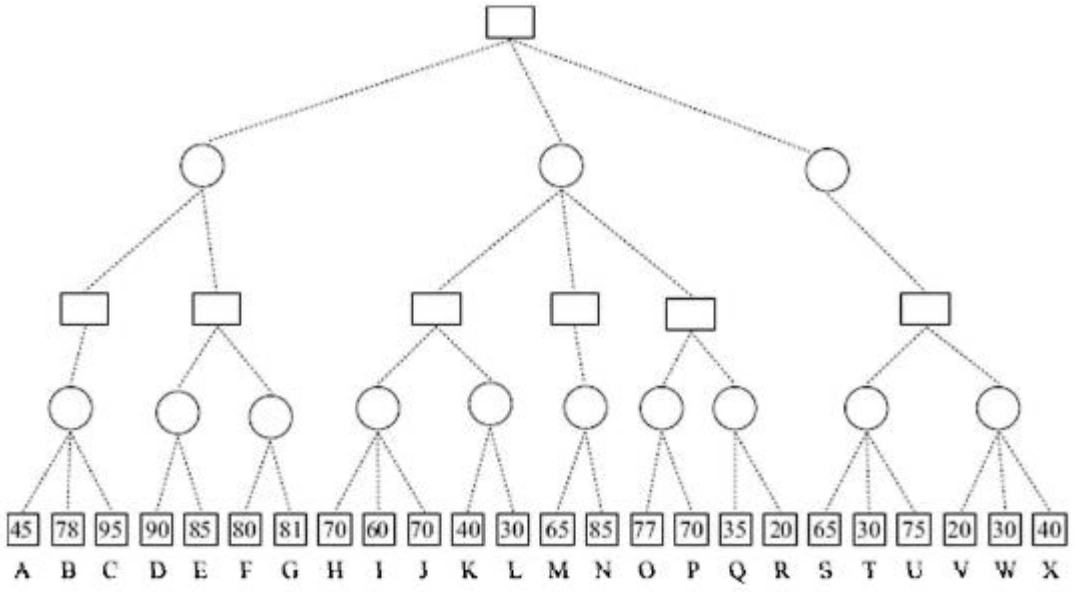
→ Answer:-

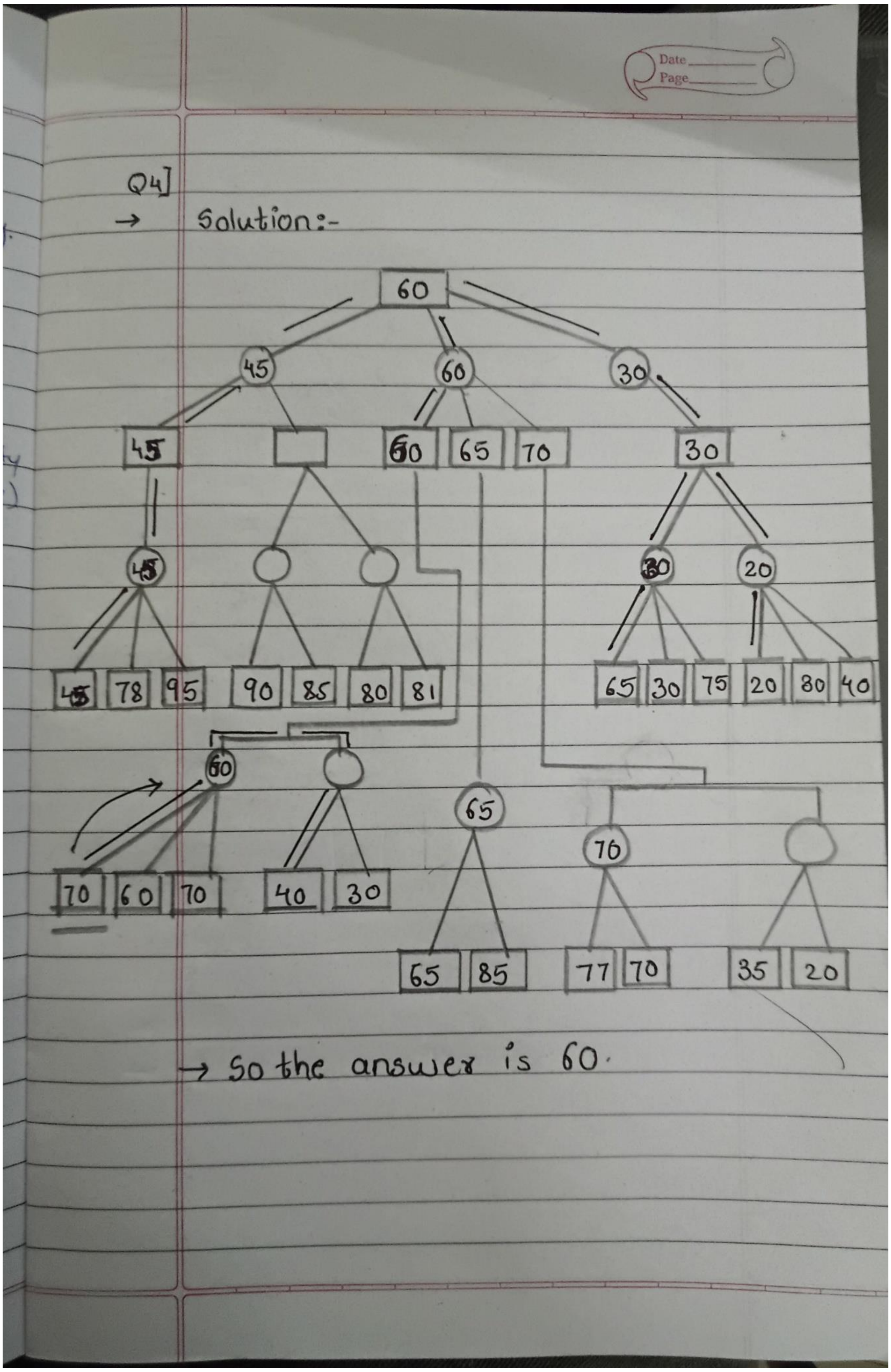


→ 9 cutoffs are there.

→ So there are 9 edges which are pruned.

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?




Q4]

→ Solution:-

→ So the answer is 60.

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