Terminal Lab

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Artificial Intelligence

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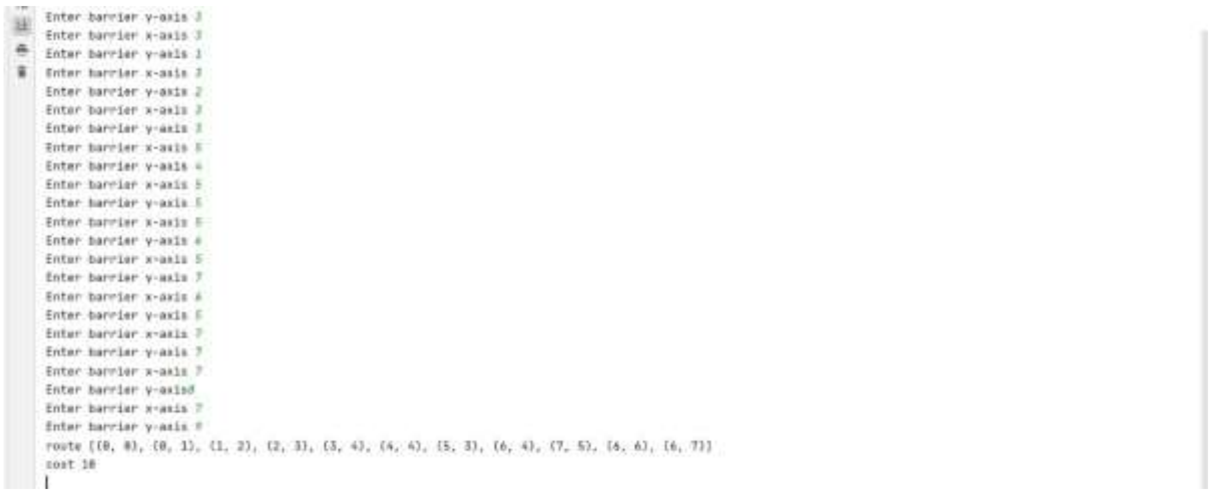
1. Code

```
class AStarGraph(object):
    # Define a class board like grid with two barriers

    def init(self):
        self.barriers = []
        t=int(input("Enter number of boxes you want to include in barrier"))
        for i in range(t):
            x=int(input("Enter barrier x-axis"))
            y=int(input("Enter barrier y-axis"))
            self.barriers.append([x,y])
    def heuristic(self, start, goal):
        # Use Chebyshev distance heuristic if we can move one square either
        # adjacent or diagonal
        D = 1
        D2 = 1
        dx = abs(start[0] - goal[0])
        dy = abs(start[1] - goal[1])
        return D * (dx + dy) + (D2 - 2 * D) * min(dx, dy)

    def get_vertex_neighbours(self, pos):
        n = []
        # Moves allow link a chess king
        for dx, dy in [(1, 0), (-1, 0), (0, 1), (0, -1), (1, 1), (-
1, 1), (1, -1), (-1, -1)]:
            x2 = pos[0] + dx
            y2 = pos[1] + dy
            if x2 < 0 or x2 > 7 or y2 < 0 or y2 > 7:
                continue
            n.append((x2, y2))
        return n

    def move_cost(self, a, b):
        for barrier in self.barriers:
            if b in barrier:
                return 100  # Extremely high cost to enter barrier squares
        return 1  # Normal movement cost


def AStarSearch(start, end, graph):
    G = {}  # Actual movement cost to each position from the start position
    F = {}  # Estimated movement cost of start to end going via this position

    # Initialize starting values
    G[start] = 0
    F[start] = graph.heuristic(start, end)

    closedVertices = set()
```

```python
    openVertices = set([start])
    cameFrom = {}

    while len(openVertices) > 0:
        # Get the vertex in the open list with the lowest F score
        current = None
        currentFscore = None
        for pos in openVertices:
            if current is None or F[pos] < currentFscore:
                currentFscore = F[pos]
                current = pos

        # Check if we have reached the goal
        if current == end:
            # Retrace our route backward
            path = [current]
            while current in cameFrom:
                current = cameFrom[current]
                path.append(current)
            path.reverse()
            return path, F[end]  # Done!

        # Mark the current vertex as closed
        openVertices.remove(current)
        closedVertices.add(current)

        # Update scores for vertices near the current position
        for neighbour in graph.get_vertex_neighbours(current):
            if neighbour in closedVertices:
                continue  # We have already processed this node exhaustively
            candidateG = G[current] + graph.move_cost(current, neighbour)

            if neighbour not in openVertices:
                openVertices.add(neighbour)  # Discovered a new vertex
            elif candidateG >= G[neighbour]:
                continue  # This G score is worse than previously found

            # Adopt this G score
            cameFrom[neighbour] = current
            G[neighbour] = candidateG
            H = graph.heuristic(neighbour, end)
            F[neighbour] = G[neighbour] + H

    raise RuntimeError("A* failed to find a solution")

if _name_ == "_main_":
    graph = AStarGraph()
    RS=int(input("Enter x-axis of current position"))
    CS= int(input("Enter y-axis of current position"))
    RG=int(input("Enter x-axis of goal position"))
    CG= int(input("Enter y-axis of goal position"))
    result, cost = AStarSearch((RS, CS), (RG, CG), graph)
    print("route  ", result)
    print("cost ", cost)
```

1.1 Output



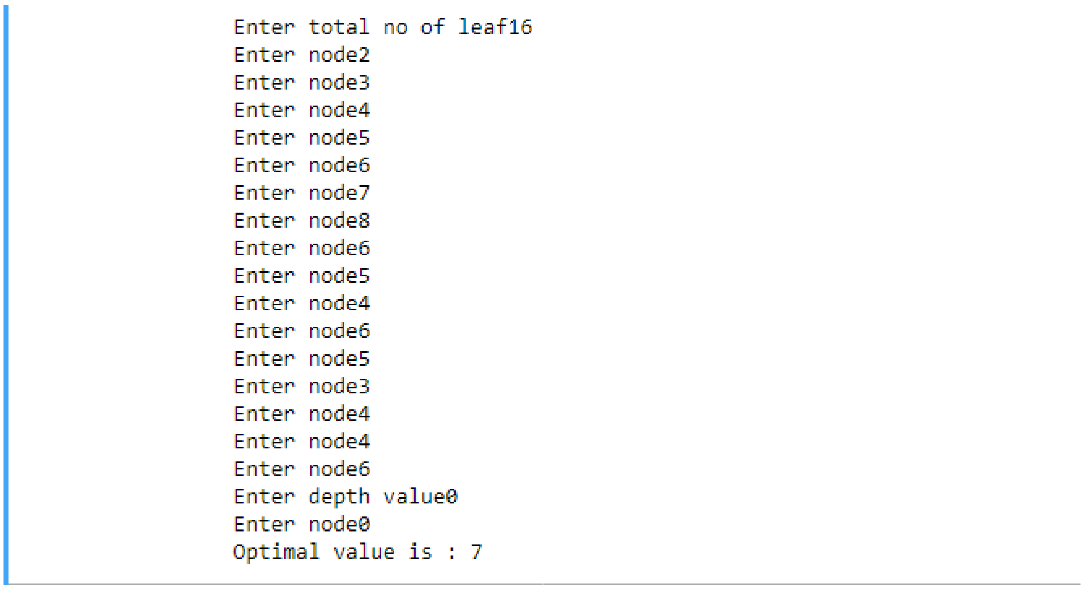
```
Enter barrier y-axis 2
Enter barrier x-axis 3
Enter barrier y-axis 1
Enter barrier x-axis 3
Enter barrier y-axis 2
Enter barrier x-axis 3
Enter barrier y-axis 3
Enter barrier x-axis 5
Enter barrier y-axis 4
Enter barrier x-axis 5
Enter barrier y-axis 5
Enter barrier x-axis 5
Enter barrier y-axis 4
Enter barrier x-axis 5
Enter barrier y-axis 7
Enter barrier x-axis 6
Enter barrier y-axis 5
Enter barrier x-axis 7
Enter barrier y-axis 7
Enter barrier x-axis 7
Enter barrier y-axis6
Enter barrier x-axis 7
Enter barrier y-axis 8
route [(0, 0), (0, 1), (1, 2), (2, 3), (3, 4), (4, 4), (5, 3), (6, 4), (7, 5), (6, 6), (6, 7)]
cost 10
```

2. Code

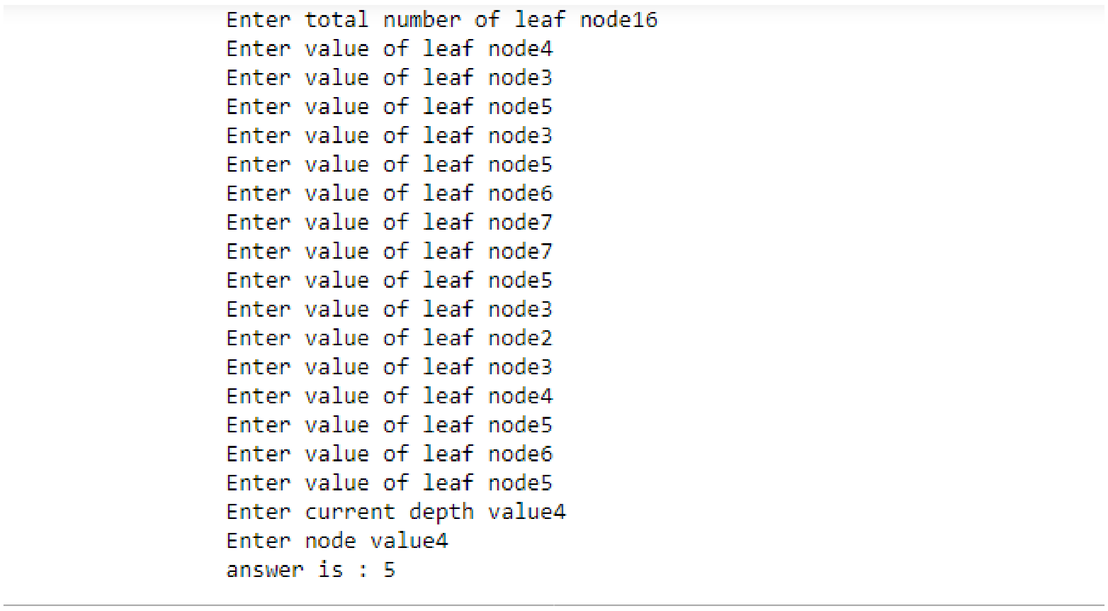
```
###### alpha-beta pruning
Maximum, Minimum = 1000, -1000
# Returns optimal value for current player
# (Initially called for root and maximizer)
def minimax(depth, node, maxP,
            values, alpha, beta):
    # Terminating condition. i.e
    # leaf node is reached
    if depth == 3:
        return values[node]

    if maxP:

        best = Minimum

        # Recur for left and right children
        for i in range(0, 2):

            val = minimax(depth + 1, node * 2 + i,
                          False, values, alpha, beta)
            best = max(best, val)
            alpha = max(alpha, best)

            # Alpha Beta Pruning
            if beta <= alpha:
                break

        return best

    else:
        best = Maximum

        # Recur for left and
        # right children
        for i in range(0, 2):

            val = minimax(depth + 1, node * 2 + i, True, values, alpha, beta)
            best = min(best, val)
            beta = min(beta, best)

            # Alpha Beta Pruning
            if beta <= alpha:
                break

        return best
scr=[]
x=int(input("Enter total no of leaf"))
for i in range(x):
    y=int(input("Enter node"))
    scr.append(y)

depth=int(input("Enter depth value"))
node=int(input("Enter node"))
print("Optimal value is :",minimax(depth, node, True, scr, Minimum, Maximum))
Min-Max
#min-max
import math
def minimax(cdepth,nodeval,maxterm,src,tdepth):
    if(cdepth==tdepth):
        return src[nodeval]
    if(maxterm):
        return max(minimax(cdepth+1,nodeval*2,False,src,tdepth),
                   minimax(cdepth+1,nodeval*2+1,False,src,tdepth))
    else:
        return min(minimax(cdepth+1, nodeval*2, True, src, tdepth),
                   minimax(cdepth+1, nodeval*2+1, True, src, tdepth))


src=[]
x=int(input("Enter total number of leaf node"))
for i in range(x):
    y = int(input("Enter value of leaf node"))
    src.append(y)
```

```
tdepth=math.log(len(src),2)
cdepth=int(input("Enter current depth value"))
nodeval=int(input("Enter node value"))
maxterm=True

print("answer is :", end=" ")
answer=minimax(cdepth,nodeval,maxterm,src,tdepth)
print(answer)
```

2.1 Output



```
Enter total no of leaf16
Enter node2
Enter node3
Enter node4
Enter node5
Enter node6
Enter node7
Enter node8
Enter node6
Enter node5
Enter node4
Enter node6
Enter node5
Enter node3
Enter node4
Enter node4
Enter node6
Enter depth value0
Enter node0
Optimal value is : 7
```

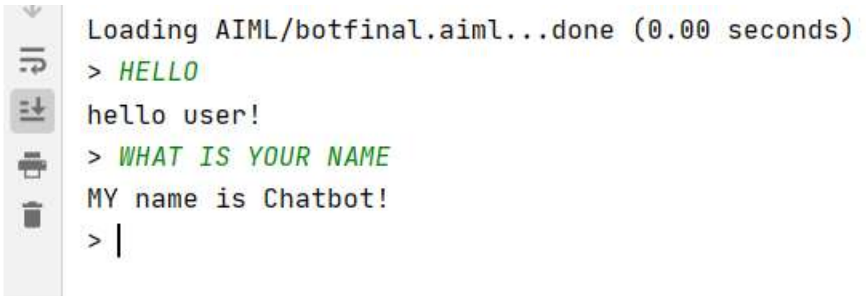


```
Enter total number of leaf node16
Enter value of leaf node4
Enter value of leaf node3
Enter value of leaf node5
Enter value of leaf node3
Enter value of leaf node5
Enter value of leaf node6
Enter value of leaf node7
Enter value of leaf node7
Enter value of leaf node5
Enter value of leaf node3
Enter value of leaf node2
Enter value of leaf node3
Enter value of leaf node4
Enter value of leaf node5
Enter value of leaf node6
Enter value of leaf node5
Enter current depth value4
Enter node value4
answer is : 5
```

3. Code

```
<aiml version="1.0.1" encoding="UTF-8">

    <category>
        <pattern>HELLO</pattern>
        <template>
            hello user!
        </template>
    </category>

    <category>
        <pattern>WHAT IS YOUR NAME</pattern>
        <template>
            MY name is Chatbot!
        </template>
    </category>

</aiml>
```

3.1 Output



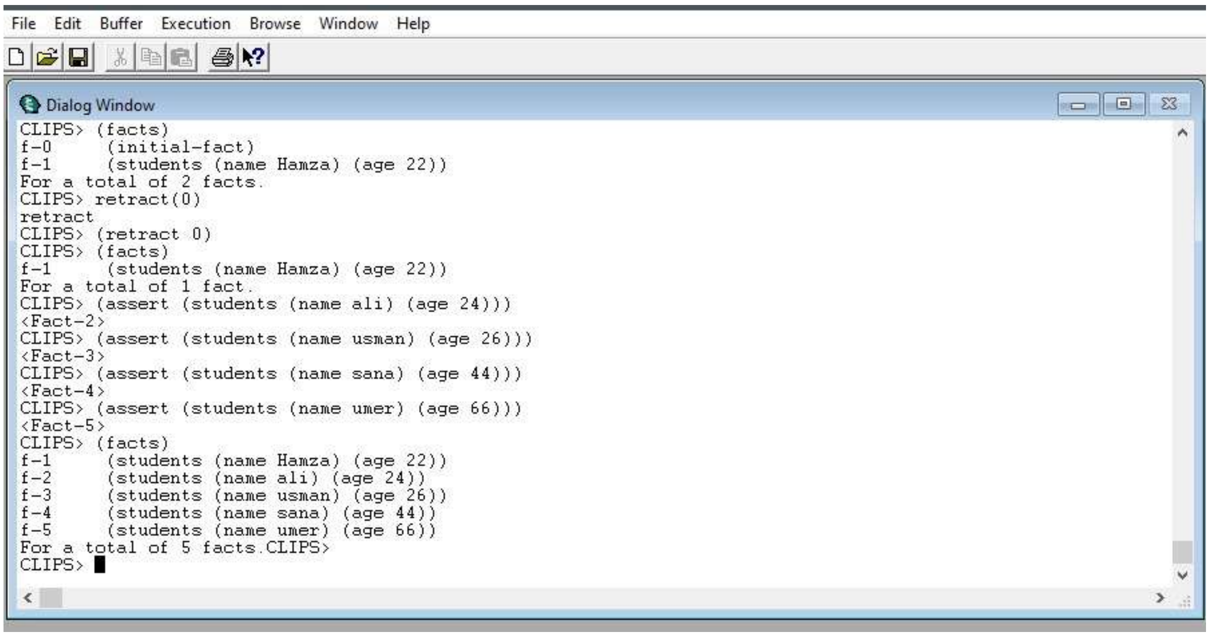
```
Loading AIML/botfinal.aiml...done (0.00 seconds)
> HELLO
hello user!
> WHAT IS YOUR NAME
MY name is Chatbot!
>
```

4. Code

```
CLIPS> (deftemplate students (slot name)(slot age))
CLIPS> (assert (students (name Hamza) (age 22)))
<Fact-1>
CLIPS> (facts)
f-0     (initial-fact)
f-1     (students (name Hamza) (age 22))
For a total of 2 facts.
CLIPS> retract(0)
retract
CLIPS> (retract 0)
CLIPS> (facts)
f-1     (students (name Hamza) (age 22))
For a total of 1 fact.
CLIPS> (assert (students (name ali) (age 24)))
<Fact-2>
CLIPS> (assert (students (name usman) (age 26)))
<Fact-3>
```

```
CLIPS> (assert (students (name sana) (age 44)))
<Fact-4>
CLIPS> (assert (students (name umer) (age 66)))
<Fact-5>
CLIPS> (facts)
f-1     (students (name Hamza) (age 22))
f-2     (students (name ali) (age 24))
f-3     (students (name usman) (age 26))
f-4     (students (name sana) (age 44))
f-5     (students (name umer) (age 66))
For a total of 5 facts
```

4.1 Output



```
CLIPS> (facts)
f-0     (initial-fact)
f-1     (students (name Hamza) (age 22))
For a total of 2 facts.
CLIPS> retract(0)
retract
CLIPS> (retract 0)
CLIPS> (facts)
f-1     (students (name Hamza) (age 22))
For a total of 1 fact.
CLIPS> (assert (students (name ali) (age 24)))
<Fact-2>
CLIPS> (assert (students (name usman) (age 26)))
<Fact-3>
CLIPS> (assert (students (name sana) (age 44)))
<Fact-4>
CLIPS> (assert (students (name umer) (age 66)))
<Fact-5>
CLIPS> (facts)
f-1     (students (name Hamza) (age 22))
f-2     (students (name ali) (age 24))
f-3     (students (name usman) (age 26))
f-4     (students (name sana) (age 44))
f-5     (students (name umer) (age 66))
For a total of 5 facts.CLIPS>
CLIPS>
```

5. Code

```
CLIPS> (assert (weight heavy))
<Fact-1>
CLIPS> (assert (horse <= 86))
<Fact-2>
CLIPS> (defrule checkweight
(weight heavy)
=> (printout t"Horse Power"clrf))
CLIPS> run
run
CLIPS> (run)
Horse PowerclrfCLIPS> (defrule checkhorsepower
(horse <= 86)
=> (printout t"Low mileage"))
CLIPS> run
run
CLIPS> (run)
Low mileageCLIPS> (reset)
CLIPS> (assert (weight heavy))
<Fact-1>
CLIPS> (assert (horse <= 86))
<Fact-2>
CLIPS> (defrule checkweight
(weight heavy)
=> (printout t"Horse Power"clrf))
CLIPS>
```