

Practical 4

Q1) Demonstrate the Astar Algorithm.

Ans:

p4_astar.py

```
"""
p4_astar.py
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Practical: 4
Objective: Demonstrate Astar Algorithm
"""

class Node():
    """A node class for A* Pathfinding"""

    def __init__(self, parent=None, position=None):
        self.parent = parent
        self.position = position

        self.g = 0
        self.h = 0
        self.f = 0

    def __eq__(self, other):
        return self.position == other.position

def astar(maze, start, end):
    """Returns a list of tuples as a path from the given start to the given end
    in the given maze"""

    # Create start and end node
    start_node = Node(None, start)
    start_node.g = start_node.h = start_node.f = 0
    end_node = Node(None, end)
    end_node.g = end_node.h = end_node.f = 0

    # Initialize both open and closed list
    open_list = []
    closed_list = []

    # Add the start node
    open_list.append(start_node)
```

```
# Loop until you find the end
while len(open_list) > 0:

    # Get the current node
    current_node = open_list[0]
    current_index = 0
    for index, item in enumerate(open_list):
        if item.f < current_node.f:
            current_node = item
            current_index = index

    # Pop current off open list, add to closed list
    open_list.pop(current_index)
    closed_list.append(current_node)

    # Found the goal
    if current_node == end_node:
        path = []
        current = current_node
        while current is not None:
            path.append(current.position)
            current = current.parent
        return path[::-1] # Return reversed path

    # Generate children
    children = []
    for new_position in [(0, -1), (0, 1), (-1, 0), (1, 0), (-1, -1), (-1, 1),
(1, -1), (1, 1)]: # Adjacent squares

        # Get node position
        node_position = (current_node.position[0] + new_position[0],
current_node.position[1] + new_position[1])

        # Make sure within range
        if node_position[0] > (len(maze) - 1)\
or node_position[0] < 0\
or node_position[1] > (len(maze[len(maze)-1]) - 1)\
or node_position[1] < 0:
            continue

        # Make sure walkable terrain
        if maze[node_position[0]][node_position[1]] != 0:
            continue

        # Create new node
```

```
new_node = Node(current_node, node_position)

# Append
children.append(new_node)

# Loop through children
for child in children:

    # Child is on the closed list
    for closed_child in closed_list:
        if child == closed_child:
            continue

    # Create the f, g, and h values
    child.g = current_node.g + 1
    child.h = ((child.position[0] - end_node.position[0]) ** 2) +
((child.position[1] - end_node.position[1]) ** 2)
    child.f = child.g + child.h

    # Child is already in the open list
    for open_node in open_list:
        if child == open_node and child.g > open_node.g:
            continue

    # Add the child to the open list
    open_list.append(child)

def main():

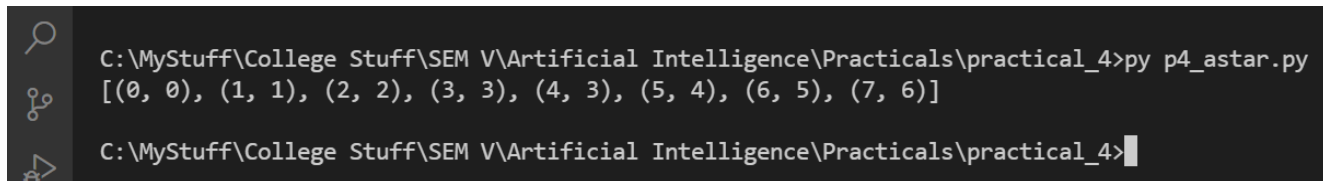
    maze = [[0, 0, 0, 0, 1, 0, 0, 0, 0, 0],
            [0, 0, 0, 0, 1, 0, 0, 0, 0, 0],
            [0, 0, 0, 0, 1, 0, 0, 0, 0, 0],
            [0, 0, 0, 0, 1, 0, 0, 0, 0, 0],
            [0, 0, 0, 0, 1, 0, 0, 0, 0, 0],
            [0, 0, 0, 0, 0, 0, 0, 0, 0, 0],
            [0, 0, 0, 0, 1, 0, 0, 0, 0, 0],
            [0, 0, 0, 0, 1, 0, 0, 0, 0, 0],
            [0, 0, 0, 0, 1, 0, 0, 0, 0, 0],
            [0, 0, 0, 0, 0, 0, 0, 0, 0, 0]]

    start = (0, 0)
    end = (7, 6)

    path = astar(maze, start, end)
```

```
print(path)
```

```
if __name__ == '__main__':  
    main()
```

A terminal window with a dark background. On the left side, there is a vertical toolbar with three icons: a magnifying glass, a link, and a play button. The terminal text shows a command being executed in a Windows command prompt, followed by its output.

```
C:\MyStuff\College Stuff\SEM V\Artificial Intelligence\Practicals\practical_4>py p4_astar.py  
[(0, 0), (1, 1), (2, 2), (3, 3), (4, 3), (5, 4), (6, 5), (7, 6)]  
C:\MyStuff\College Stuff\SEM V\Artificial Intelligence\Practicals\practical_4>
```