PROGRAM TITLE 10

A* ALGORITHM

AIM:

To Write the python program to implement A* algorithm

PROCEDURE:

1. **Define the Grid**: Initialize a grid with nodes representing positions in a 2D space. Each node should contain information about its position, whether it's an obstacle, and its heuristic and cost values for A* algorithm.

2. **Calculate Heuristic**: Define a function to calculate the heuristic value between two nodes. In this case, the Manhattan distance is used.

3. **Get Neighbors**: Write a function to get valid neighboring nodes of a given node. This function should consider the grid boundaries and obstacles.

4. *A Algorithm**: Implement the A* algorithm to find the shortest path from a start node to a goal node on the grid. Use a priority queue (heap) to keep track of nodes to be explored.

5. **Main Program**: In the main section of the program, initialize the grid, start node, and goal node. Then, call the A* algorithm function to find the path from the start node to the goal node. Print the path if it exists; otherwise, indicate that no path was found.

CODING:

```
import heapq


class Node:     def __init__(self, x, y,
obstacle=False):
        self.x = x        self.y =
y        self.obstacle =
```

```
obstacle        self.g =
float('inf')        self.h = 0
        self.f = 0
self.parent = None

    def __lt__(self, other):
return self.f < other.f

def calculate_heuristic(current, goal):

    return abs(current.x - goal.x) + abs(current.y - goal.y)

def get_neighbors(grid, node):
    neighbors = []     rows, cols = len(grid),
len(grid[0])     directions = [(1, 0), (-1, 0),
(0, 1), (0, -1)]

    for dx, dy in directions:
        x, y = node.x + dx, node.y + dy         if 0 <= x < rows and 0
<= y < cols and not grid[x][y].obstacle:
            neighbors.append(grid[x][y])

    return neighbors

def astar(grid, start, goal):     open_set =
[]     heapq.heappush(open_set, start)
start.g = 0     start.h =
```

```
calculate_heuristic(start, goal)     start.f =
start.g + start.h

    while open_set:
        current = heapq.heappop(open_set)

        if current == goal:
            path = []
while current:
                path.append((current.x, current.y))
current = current.parent              return
path[::-1]

        for neighbor in get_neighbors(grid, current):
            tentative_g = current.g + 1               if tentative_g
< neighbor.g:                  neighbor.parent = current
neighbor.g = tentative_g                  neighbor.h =
calculate_heuristic(neighbor, goal)                neighbor.f =
neighbor.g + neighbor.h                  if neighbor not in
open_set:
                    heapq.heappush(open_set, neighbor)

    return None

if __name__ == "__main__":
```

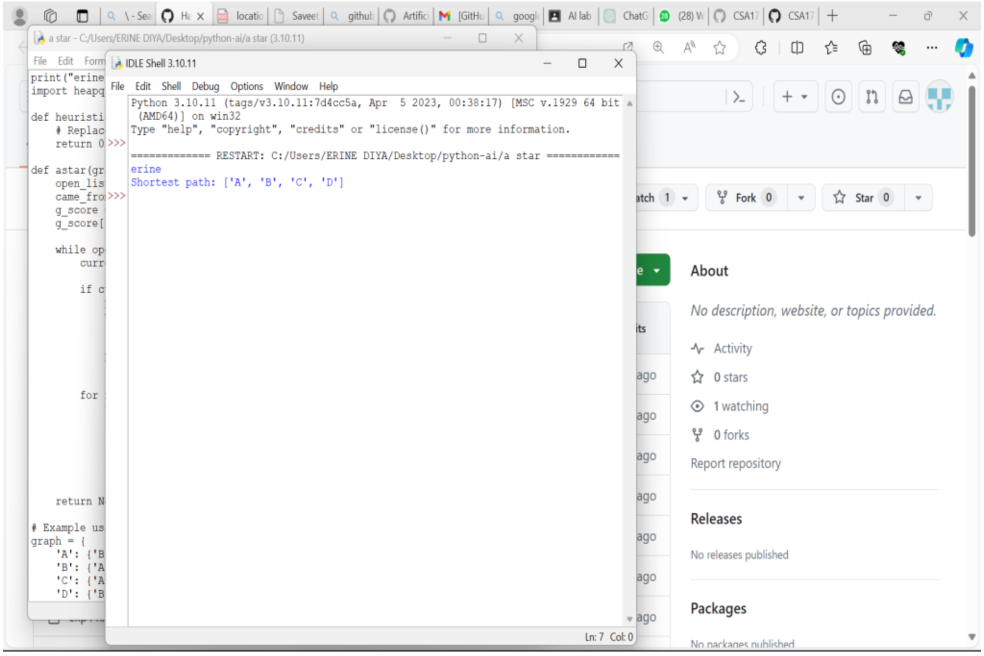
```
    grid = [[Node(x, y, obstacle=False) for y in range(5)] for x in range(5)]
grid[1][2].obstacle = True     grid[2][2].obstacle = True
grid[3][2].obstacle = True



    start_node = grid[0][0]
goal_node = grid[4][4]     path =
astar(grid, start_node, goal_node)


    if path:
        print("Path found:")
for x, y in path:
            print(f"({x}, {y})", end=" ")
else:
        print("No path found.")
```

OUTPUT:



RESULT:

Hence the program been successfully executed and verified.