NAME: SIDDHARTH R

REGISTER NO: 241801269

EXP NO: 4

EXP NAME: IMPLEMENTATION OF A* SEARCH

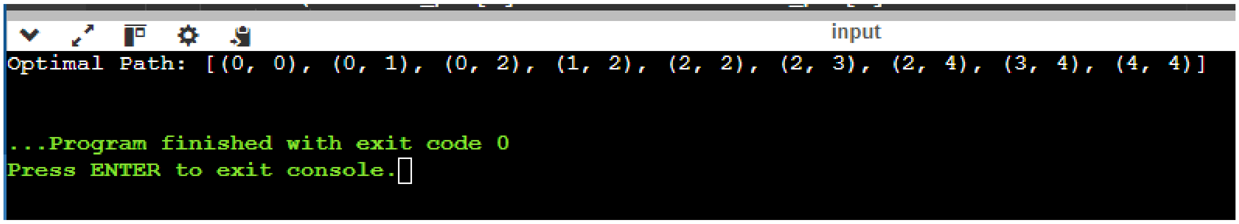
PROGRAM:

```
import heapq

# Define the grid and movements
class Node:
    def __init__(self, position, parent=None, g=0, h=0):
        self.position = position  # (row, col)
        self.parent = parent      # Parent node
        self.g = g                # Cost from start node
        self.h = h                # Heuristic cost to goal
        self.f = g + h            # Total cost

    def __lt__(self, other):
        return self.f < other.f  # Priority queue comparison

def heuristic(a, b):
    return abs(a[0] - b[0]) + abs(a[1] - b[1])  # Manhattan Distance

def a_star(grid, start, goal):
    rows, cols = len(grid), len(grid[0])
    open_list = []
```

```
heapq.heappush(open_list, Node(start, None, 0, heuristic(start, goal)))
closed_set = set()

while open_list:
    current_node = heapq.heappop(open_list)  # Get node with lowest f-value

    if current_node.position == goal:
        path = []
        while current_node:
            path.append(current_node.position)
            current_node = current_node.parent
        return path[::-1]  # Return reversed path

    closed_set.add(current_node.position)

    for dr, dc in [(-1, 0), (1, 0), (0, -1), (0, 1)]:  # Possible moves
        new_pos = (current_node.position[0] + dr, current_node.position[1] + dc)

        if (0 <= new_pos[0] < rows and 0 <= new_pos[1] < cols and
                grid[new_pos[0]][new_pos[1]] == 0 and new_pos not in closed_set):
            new_node = Node(new_pos, current_node, current_node.g + 1, heuristic(new_pos, goal))
            heapq.heappush(open_list, new_node)

return None  # No path found
```

```
# Example grid: 0 = free space, 1 = obstacle

warehouse_grid = [

    [0, 0, 0, 0, 1],

    [1, 1, 0, 1, 0],

    [0, 0, 0, 0, 0],

    [0, 1, 1, 1, 0],

    [0, 0, 0, 0, 0]

]

start_position = (0, 0)

goal_position = (4, 4)


path = a_star(warehouse_grid, start_position, goal_position)

print("Optimal Path:", path)
```

OUTPUT



```
Optimal Path: [(0, 0), (0, 1), (0, 2), (1, 2), (2, 2), (2, 3), (2, 4), (3, 4), (4, 4)]


...Program finished with exit code 0
Press ENTER to exit console.
```