| **EX.N0:7** | **AO\* SEARCH ALGORITHM** |
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| **DATE:17/04/2024** |

**AIM:**

To implement the AO\* Search Algorithm using  python

**ALGORITHM:**

Step1:Start

Step2:Initialize an open list with the start node and an empty closedlist

Step3: While the open list is not empty:

1. Select the node with the lowest estimated total cost (f-value).
2. If the selected node is the goal, return the solution.
3. Generate successor nodes ,calculate their costs, and add them to the openlist if they are better or not in the closed list.
4. Add the selected node to the closed list.

Step 4: If the open list becomes empty, and no solution is found, the problem has no solution.

Step5:Stop

**PROGRAM:**

import heapq

class Node:

    def \_\_init\_\_(self, state, g\_value, h\_value, parent=None):

        self.state = state

        self.g\_value = g\_value

        self.h\_value = h\_value

        self.parent = parent

    def f\_value(self):

        return self.g\_value + self.h\_value

def a\_star\_search(initial\_state, is\_goal, successors, heuristic):

    open\_list = [Node(initial\_state, 0, heuristic(initial\_state), None)]

    closed\_set = set()

    while open\_list:

        open\_list.sort(key=lambda node: node.f\_value())

        current\_node = open\_list.pop(0)

        if is\_goal(current\_node.state):

            path = []

            while current\_node:

                path.append(current\_node.state)

                current\_node = current\_node.parent

            return list(reversed(path))

        closed\_set.add(current\_node.state)

        for child\_state in successors(current\_node.state):

            if child\_state in closed\_set:

                continue

            g\_value = current\_node.g\_value + 1

            h\_value = heuristic(child\_state)

            child\_node = Node(child\_state, g\_value, h\_value, current\_node)

            for i, node in enumerate(open\_list):

                if node.state == child\_state:

                    if node.g\_value > g\_value:

                        open\_list.pop(i)

                        break

                elif node.g\_value > g\_value:

                    open\_list.insert(i, child\_node)

                    break

            else:

                open\_list.append(child\_node)

    return None

if \_\_name\_\_ == "\_\_main\_\_":

    def is\_goal(state):

        return state == (4, 4)

    def successors(state):

        x, y = state

        return [(x+1, y), (x, y+1)]

    def heuristic(state):

        x, y = state

        return abs(4 - x) + abs(4 - y)

    initial\_state = (0, 0)

    path = a\_star\_search(initial\_state, is\_goal, successors, heuristic)

    if path:

        print("Path found:", path)

    else:

        print("No path found")

**OUTPUT:**

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

**RESULT:** Thus the experiment to solve AO\* search algorithm by using python has been executed and verified Successfully.