# **EX:05 AO \* Algorithm**

**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 ao\_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 = ao\_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)]**