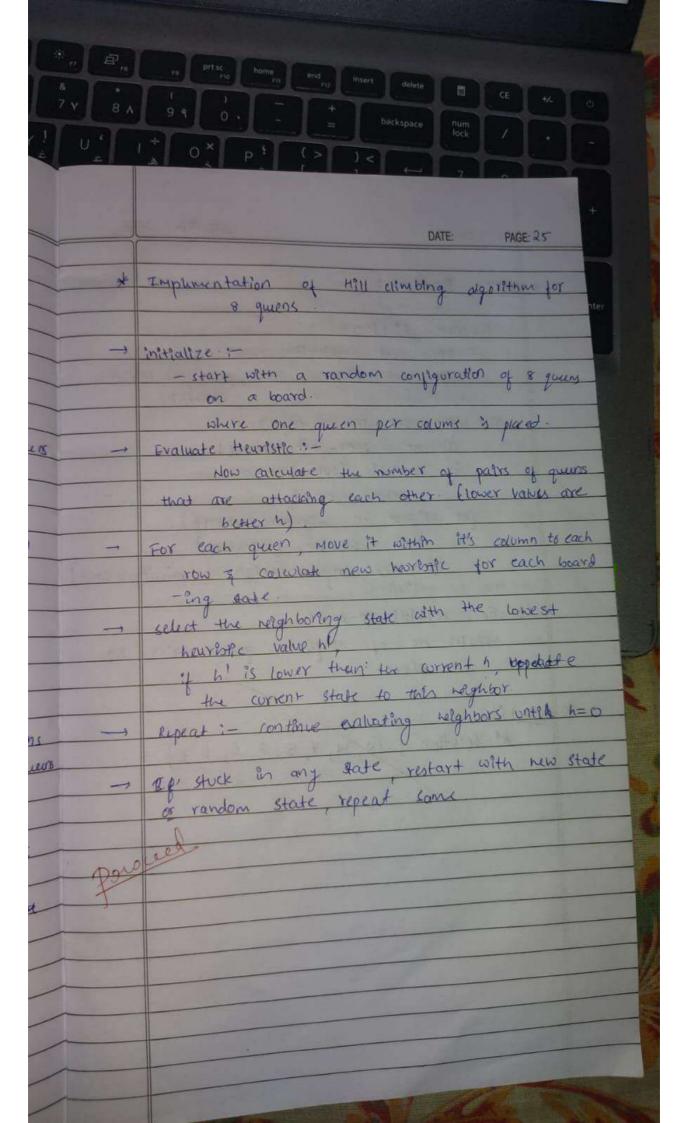
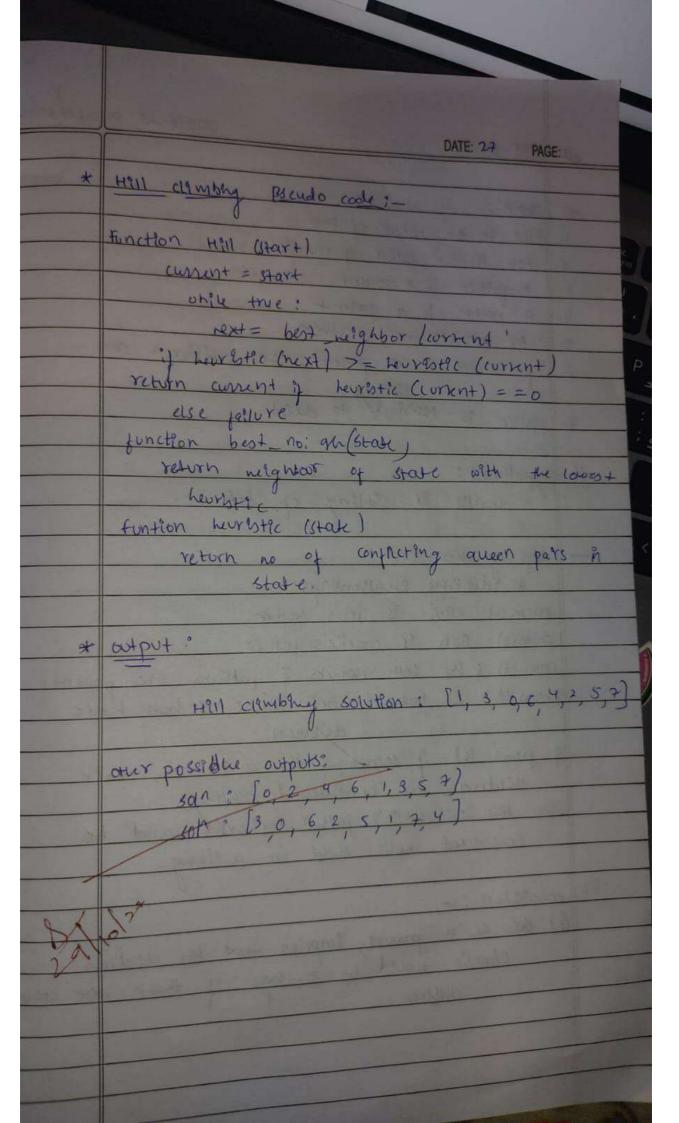
DATE: 29 holey PAGE: 21 * LAB-06:-* Implementation of A* search algorithm for & queens - * Algorithm -1. create an empty board where no queens are placed which start state. 2. Heurstic (h): h is the number of attacking que pairs, where lower values are bette 3. pinovity on : p(n) = g(n) + h(n)
where g(n) is the number of queens placed
so far where as & prioritizes states with fewer attacking queens. 4. Add start state to the priority queux: * Add the Instial empty board with 1=0 & while queue Not empty - select states with lowest attacking quent - Now check for the soln: - if all the 8 que are placed without any difficulties ther return the board - place a guren in the next row in valid columns & add each state to the queen 5. Return solvion sental rympation of guest





LAB 06

A* Algorithm code for 8 Queens:

Code:

```
import numpy as np
import heapq
class Node:
  def __init__(self, state, g, h):
     self.state = state # current state of the board
     self.q = q
                  # cost to reach this state
     self.h = h # heuristic cost to reach goal
     self.f = g + h # total cost
  def __lt__(self, other):
     return self.f < other.f
def heuristic(state):
  # Count pairs of queens that can attack each other
  attacks = 0
  for i in range(len(state)):
     for j in range(i + 1, len(state)):
```

```
if state[i] == state[j] or abs(state[i] - state[j]) == j - i:
    attacks += 1

return attacks

def a_star_8_queens():
  initial_state = [-1] * 8 # -1 means no queen placed
  open_list = []
  closed_set = set()
```

```
initial_h = heuristic(initial_state)
  heapq.heappush(open_list, Node(initial_state, 0, initial_h))
  while open_list:
    current_node = heapq.heappop(open_list)
    current_state = current_node.state
    closed_set.add(tuple(current_state))
    # Check if we reached the goal
    if current_node.h == 0:
       return current_state
    for col in range(8):
       for row in range(8):
          if current_state[col] == -1: # Only place a queen if none is present in this column
            new_state = current_state.copy()
            new_state[col] = row
            if tuple(new_state) not in closed_set:
               g_cost = current_node.g + 1
               h_cost = heuristic(new_state)
               heapq.heappush(open_list, Node(new_state, g_cost, h_cost))
  return None
solution = a_star_8_queens()
print("A* solution:", solution)
```

qoutput:

```
→ A* solution: [7, 0, 6, 3, 1, -1, 4, 2]
```

```
Hill Climbing for 8 queens
import random
def heuristic(state):
  attacks = 0
  for i in range(len(state)):
     for j in range(i + 1, len(state)):
       if state[i] == state[j] or abs(state[i] - state[j]) == j - i:
          attacks += 1
  return attacks
def hill_climbing_8_queens():
  state = [random.randint(0, 7) for _ in range(8)] # Random initial state
  while True:
     current_h = heuristic(state)
     if current_h == 0: # Found a solution
       return state
     next_state = None
     next_h = float('inf')
     for col in range(8):
       for row in range(8):
          if state[col] != row: # Only consider moving the queen
             new_state = state.copy()
```

```
new_state[col] = row
h = heuristic(new_state)
if h < next_h:
    next_h = h
    next_state = new_state

if next_h >= current_h: # No better neighbor found
    return None # Stuck at local maximum
    state = next_state

solution = hill_climbing_8_queens()
print("Hill Climbing solution:", solution)
```

Output:

Hill Climbing solution: [4, 2, 7, 3, 6, 0, 5, 1]

LAB 06

A* Algorithm code for 8 Queens:

Code:

```
import numpy as np
import heapq
class Node:
  def __init__(self, state, g, h):
     self.state = state # current state of the board
     self.q = q
                  # cost to reach this state
     self.h = h # heuristic cost to reach goal
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def heuristic(state):
  # Count pairs of queens that can attack each other
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  for i in range(len(state)):
     for j in range(i + 1, len(state)):
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```
if state[i] == state[j] or abs(state[i] - state[j]) == j - i:
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return attacks

def a_star_8_queens():
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```
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            new_state = current_state.copy()
            new_state[col] = row
            if tuple(new_state) not in closed_set:
               g_cost = current_node.g + 1
               h_cost = heuristic(new_state)
               heapq.heappush(open_list, Node(new_state, g_cost, h_cost))
  return None
solution = a_star_8_queens()
print("A* solution:", solution)
```

qoutput:

```
→ A* solution: [7, 0, 6, 3, 1, -1, 4, 2]
```

```
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     next_state = None
     next_h = float('inf')
     for col in range(8):
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          if state[col] != row: # Only consider moving the queen
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```

```
new_state[col] = row
h = heuristic(new_state)
if h < next_h:
    next_h = h
    next_state = new_state

if next_h >= current_h: # No better neighbor found
    return None # Stuck at local maximum
    state = next_state

solution = hill_climbing_8_queens()
print("Hill Climbing solution:", solution)
```

Output:

Hill Climbing solution: [4, 2, 7, 3, 6, 0, 5, 1]