CS561 - ARTIFICIAL INTELLIGENCE LAB

ASSIGNMENT-4: Simulated Annealing

(Read all the instructions carefully & adhere to them.)

Date: 12th September, 2022   **Deadline:25th September, 2022**

Total Credit: 30

Instructions:

1. The assignment should be completed and uploaded by **25th Sep, 2022, 11:59 PM IST.**

2. Markings will be based on the correctness and soundness of the outputs. Marks will be deducted in case of plagiarism.

3. Proper indentation and appropriate comments are mandatory.

4. You should zip all the required files and name the zip file as:
    roll_no_of_all_group_members .zip , eg. 1501cs11_1201cs03_1621cs05.zip.

5. Upload your assignment (**the zip file**) in the following link:
    https://www.dropbox.com/request/WMEM9SyaWXD0JQgll6bf

For any queries regarding this assignment you can contact:

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Questions

Simulated Annealing (SA) is a generic probabilistic metaheuristic for the global optimization problem of applied mathematics, namely locating a good approximation to the global minimum of a given function in a large search space.

A. Input is given in a file in the following format. Read the input and store the information in a matrix. Configuration of the start state and the goal state can be anything. For example, given below, T1, T2, …, T8 are tile numbers, and B is blank space.

Start State

T6	T7	T3
T8	T4	T2
T1	B	T5

Goal State

T1	T2	T3
T4	T5	T6
T7	T8	B

B. Implement a **Simulated Annealing Search Algorithm** for solving the 8-puzzle problem. Your start and Goal state should as given in A.

C. **Input:** Input should be taken from an input file and processed as a matrix. Other inputs are Temperature variable T, heuristic function, neighborhood generating function, probability function to decide state change, and a cooling function.

D. **Output:** All the following results should be stored in an output file:

    a. The success or failure message

    b. Heuristics chosen, Temperature chosen, cooling function chosen, Start state, and Goal state.

    c. (Sub) Optimal Path (on success),

    d. Total number of states explored.

    e. Total amount of time taken.

E. Objective functions to be checked:

    a. h1 (n)= Number of displaced titles.

    b. h2 (n)= Total Manhattan distance.

F. Constraints to be checked:

    a. Check whether the heuristics are admissible.

    b. What happens if we make a new heuristics h3 (n)= h1 (n) * h2 (n).

c. What happens if you consider the blank tile as another tile?
d. What if the search algorithm got stuck into the Local optimum? Is there any way to get out of this?
e. Compare Hill Climbing (previous assignment) and the Simulated Annealing with respect to optimality, completeness, and running time complexity (only for this specific problem).

Instructions:

1. The output should have the following information:
   a. **On success:**
      i. Success Message
      ii. Start State / Goal State
      iii. Total number of states explored
      iv. Total number of states to the optimal path
      v. Optimal Path
      vi. Optimal Path Cost
      vii. Time taken for execution
   b. **On failure:**
      i. Failure Message
      ii. Start State / Goal State
      iii. Total number of states explored before termination