PROGRAMMING ASSIGNMENT

REPORT
BY

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Files submitted :

1) 8_puzzle_astar.lisp - The 8 puzzle problem code.
2) Mandc.lisp – The missionaries and cannibals problem code.
3) ToRun.pdf – The script file.
4) Report.pdf – This file.

Missionaries and Cannibals problem:

Program Implementation Description:

I tried to code it the way I would solve it on the paper. I first take as many cannibals as I can from the right bank and send it to left bank. Then let one cannibal come from the left to the right. Then send as many missionaries to the left as there are cannibals. When the number of missionaries and number of cannibals at the same at both banks then what I do is fill half the boat with missionaries and half with cannibals and send it to the left. To get the boat back, one missionary and one cannibal is send form the left bank to the right bank. We keep doing this until all the missionaries and cannibals are transported from the right to the left.

At each step, I print the state of the system. To be more precise I print the state when the boat is at one bank twice, when the boat is being boarded and disembarked.

This approach works for all the problems where the solution is feasible.

I have taken a greedy sort of approach, I am not thinking of it as a search problem i.e. I am not using the state representation and the graph algorithms like the BFS, A-star etc like how it is given in Russell's code. Hence I am not sure of the optimality and the correctness of my approach.

I didn't find the Lisp way of code styling intuitive. Hence I have used somewhat the K & R styling that we use for C or Java.

8 puzzle problem:

The 8 puzzle problem is solved using the A star algorithm. For the A star algorithm I referred the pseudo code as given on the Wikipedia. It's a beautiful pseudo code, and I find it more clear than the one in the textbook.

For the A star, a list of open nodes and closed nodes is maintained. Hash tables for path, the g-score and the f-score are maintained. The start node added to the list of open nodes, it's g-score set to 0 and f-score is given by the heuristic function. Then the loop starts. The loop is exited if the openSet is empty in which case the goal state is not reachable. Then the list of open nodes is sorted based on the f-scores and the node with the smallest f-score is picked as the current node. If the current node is the goal state then the algorithm stops and the path is printed. Then the current node is added to the closed set and removed from the open set. Then the successor function is called. The successor function has to provide a tuple with the next node and the distance from the current node to this node. For each neighbor not in the closed set we add it to the open set if it is not present in the open set. The tentative-g-score is calculated by adding the the g-score of the current node fetched from the hashmap and the distance given in the tuple form the successor function. If the tentative g-score of this neighbor is better than it's previous g-score value then it is updated, the path hash map is updated, g-score is updated and we also update the f-score by adding the g-score and calling the heuristic function.

For the successor function, the position of the "E" is found. And given the position of "E" a list, called the swap-list, of positions where the move can be made is computed. Then for each a copy of the current state is made and the "E" replaced by the character at the number in the swap-list and vice versa. All such copies are now returned by the successor function.

For the heuristic function, the number of misplaced tiles are calculated by moving over the list i.e. the given position and the goal state and counting the different values.

Deficiencies :

1. Haven't implemented the in-feasibility check. The program will end after all nodes in the open set have been evaluated and the goal state is not reached.
2. The format of the 8 board is different from the one in the question.