SSN College of Engineering

Department of Computer Science and Engineering

CS1403 — Design and Analysis of Algorithms

2019 – 2020

Session — 13

March 14, 2020

- This homework is due by 4pm on March 14, 2020
- Grace period may be given up to midnight of March 15, 2020
- You can upload only one ZIP file
- The naming convention is "<Your first name (first letter capital and all the other letters small)>-CS1403-S13.zip"
- The questions marked as "OPTIONAL" are, as the name implies, optional! Complete your core assignment first and attempt the optional problems only if you have sufficient time

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1. Consider the n-puzzle, where we have tiles numbered from $1 \ldots (n^2 - 1)$ placed in a grid of $n \times n$. Following is an instance of 3-puzzle where tiles numbered $1 \ldots 8$ are placed on a 3×3 grid.

3	2	7
5	8	
1	4	6

The objective is to slide the tiles (using the empty space) and reach the following goal state

1	2	3
4	5	6
7	8	

The goal state should be preferably reached from a given initial state with minimal number of moves.

(a) Implement a heuristics function $h(s)$ that returns the estimated cost of reaching the goal state from the state s

(b) Implement best-first greedy search using your heuristics.

(c) Consider an evaluation function f that evaluates a state as $f(s) = g(s) + h(s)$, where $g(s)$ is the actual cost of reaching the state s from the start state. Implement A^* search algorithm to find a solution to the n-puzzle problem.

(d) (OPTIONAL) Find an initial state for the n-puzzle problem for which greedy search does not find an optimal solution. Does A^* search find the optimal solution for that instance?