Jiachang (Ernest) Xu

CSCI 360: Introduction to Artificial Intelligence

Project 1: Theoretical Part

25 Sept. 2017

**Performing the Experiments**

Ernest-MacBook:8-Puzzle-Solver xujiachang1024$ make

g++ -std=c++11 -o 8PuzzleSolver main.cpp Puzzle8Solver.cpp CPUTimer.cpp

Ernest-MacBook:8-Puzzle-Solver xujiachang1024$ ./8PuzzleSolver 000

     w      Cost    Time(ms)  Expansions

  0.00     21.34      549.43    98846.50

  0.25     21.34      256.79    46278.64

  0.50     21.34       77.51    15775.46

  0.75     21.34       20.94     4498.74

  1.00     21.54        7.57     1602.92

  1.50     21.86        2.81      686.20

  2.00     22.54        2.41      618.46

  3.00     25.94        2.03      541.74

  5.00     31.06        1.65      441.54

 10.00     35.86        2.36      459.66

**Interpreting the Results**

1. As the weight *w* increases, the solution cost slightly increases, the running time drastically decreases, and the number of expansions drastically decreases as well.
2. When we choose the weight *w* = 0, it becomes Dijkstra’s algorithm, *f(x) = g(x)*. Dijkstra’s algorithm is a uniform cost search algorithm. Dijkstra’s algorithm guarantees to find an optimal solution, a.k.a. the shortest path. When we choose any weight *w* > 0, it includes a heuristic cost function, *f(x) = g(x) + h’(x)*, which guarantees completeness, but not an optimal solution.
3. As the weight *w* increases, I observe a relatively small increase in solution cost. Even when the weight *w* jumps from 1.00 to 10.00, the solution cost increases no more than 2 times of the optimal solution (*w* = 0.00).