

CS 411 - Artificial Intelligence I  
Fall 2018  
Assignment 4  
Department of Computer Science, University of Illinois at Chicago

Total Points: 25

15 puzzle is a sliding puzzle game with numbered squares arranged in 4X4 grid with one tile missing.

Initial State

1		2	4
5	7	3	8
9	6	11	12
13	10	14	15

The puzzle is solved when the numbers are arranged in order.

Goal State

1	2	3	4
5	6	7	8
9	10	11	12
13	14	15	

The actions are defined in terms of direction where empty square can be moved to

UP (U), Down(D), Left(L), Right(R)

**Write a program which performs breadth first search to find the solution to any given board position for 15 puzzle**

Input

The input should be given in form of sequence of numbered tiles for initial board configuration, '0' indicating the empty space (see example below)

Output

1. Moves
2. Number of Nodes expanded
3. Time Taken
4. Memory Used

Example

> 1 0 2 4 5 7 3 8 9 6 11 12 13 10 14 15

Moves: RDLDDRR

Number of Nodes expanded: 2642

Time Taken: 42ms

Memory Used: 8624kb

Unsolvable puzzle

There can be some puzzle for which the solved state cannot be reached

If the solution doesn't exist, display the message "solution cannot be found"

> 1 2 3 4 5 6 7 8 9 10 11 12 13 15 14

Solution cannot be found

Hint

Check for repeated state to avoid "out of memory" error

Submission

Please submit a zip file with filename <netid>\_bfs.zip including following files:

- Source Code
- Readme.txt including instruction to run the code

### Programming Language

You can choose from C++, Java or Python

### Rubric

Print the moves to reach the solution => 10

Print "solution cannot be found" for unsolvable initial state => 3

Print number of nodes expanded => 3

Print total memory usage => 3

Print total time taken => 3

Coding style, comments, readme instruction => 3

### AIMA code

You can use the code from the textbook found in following github repo

<https://github.com/aimacode>