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Assignment 4:

Description:

This python file contains the Iterative Deepening Depth First Search implementation to solve the 15 Puzzle. The implementation is done in a generic way so that the program can solve any square matrix puzzle, but implementation assumes there is a '0' input in the matrix. This implementation also makes the assumption that the empty tile in the goal state is always at the end of the matrix (at [3, 3] in the case of 4x4 matrix puzzle).

The program implementation consists of two classes, one **PuzzleNode** class to store the state, action, parent, depth of the node in the tree and empty tile position. Another **PuzzleSolver** class to implement the Depth first search part, check the goal state, compute the child nodes and check for cycles. The **PuzzleSolver** class keeps count of expanded nodes in **explored_nodes** and nodes to be expanded in a **nodeStack** which is a LIFO queue. When the desired goal state is found, the list moves to be exeecuted is found by backtracking from the goal state node to the root node. This limited Depth first search is implemented with varying depth limits starting from 0 until we get a solution or a failure in which case there is no solution. When the limited Depth first search reaches a certain depth limit, we do not explore the nodes children. This is done in order to handle infinite states in DFS.

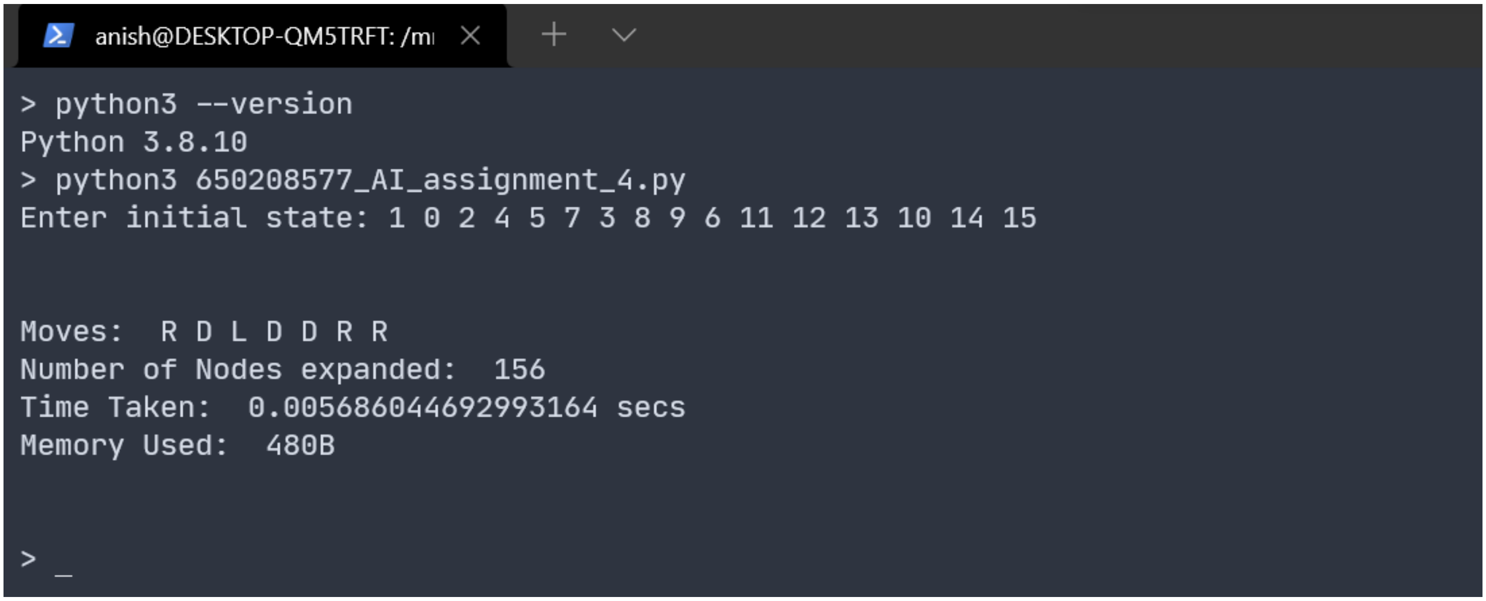
We also print the total time taken for the algorithm to run and the number of nodes expanded and memory usage for the latest depth limit in which either a solution is found or a failure is returned.

Instructions to run the code:

This code is compiled and executed on python3 with **Python 3.8.10** version.

The program can be run with the command **python3 650208577_AI_assignment_4.py** from the command line and the user will be prompted to enter the initial state input and upon entering a square matrix, the program results in the actions taken, number of nodes expanded, time and memory usage for the execution.

Sample run:



```
> python3 --version
Python 3.8.10
> python3 650208577_AI_assignment_4.py
Enter initial state: 1 0 2 4 5 7 3 8 9 6 11 12 13 10 14 15


Moves:  R D L D D R R
Number of Nodes expanded:  156
Time Taken:  0.005686044692993164 secs
Memory Used:  480B


> _
```