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Q1) A problem which must be solved using an AI agent is "Rat in a Maze" problem. In this problem, a given maze of size "N×N" exists. The source and destination locations are top-left and bottom-right cells respectively. Some cells are valid to move and some cells are blocked. If one rat starts moving from the start when to the destination we, we have to find that there is any way to complete the path, if it is possible then mark the correct path for the rat.

The maze is given using a binary matrix, wherein it is marked with 1, it is a valid path, otherwise a for a blocked cell.

Initial State :- The initial state of the rat in a maze problem is at whatever location the rat is placed (usually (0,0)) in a square matrix m[][] of order n.

Final State :- The final state of problem is to reach the destination at (n-1, n-1). The task is to find a sorted array of strings denoting all possible directions that the rat can take to reach destination at (n-1, n-1);

Transition Model :- The transition model consists of all the destination node the rat reaches through direction in order to reach its final destination. The directions in which the rat can move are U(up), D(down), L(left), R(Right).

Path Cost :- It will turn out to be minimum when the shortest path to destination will be taken. Since here, heuristic values are taken, there is no path cost.

PEAS

~~① Performance Measure.~~

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This will be regarded as the minimum number of moves in which the rat on reach the final destination in matrix (image) from the initial state.

② Environment :-

The environment will be N×N matrix where the rat is supposed to move in various directional steps to reach a situation

③ Actuators :-

The actuators for these problems will be the keyboard direction devices on a laptop or our finger for a touch phone where we can give directions to the rat so it gets into motion

④ Sensors :-

As you type, the processor in the keyboard analyzes the key matrix and determines what characters to send to the computer.

Q2) Search Technique Used :-

In this case, the Brute Force approach was used, whereas the simple backtracking approach without any extra space.

Backtracking :- It is an algorithmic technique for solving problems recursively by trying to build a solution incrementally. Solving one pile at a time and removing those solutions that fail to satisfy the constraints of the problem at any point of time

Q3) To use a more efficient approach (to optimize the solution), we can modify the given matrix to treat it as a visited matrix

(Implementation shown in Github link)

This approach, even though, makes the time complexity stay the same i.e. $O(3^{(N^2)})$; it reduces the space complexity from $O(3^{(N^2)})$ to $O(1)$, since we do not use any visited matrix again.