AI Assignment-1 Report

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1 Approach

The basic approach we used for the A.I assignment is to use the concept of graphs & vertices and applied BFS{Breadth First Search} , DFS {Depth First Search} and DFID {Depth First Iterative Deepening Search}.

Along with applying the above algorithms for the PacMan , we have also set the preference order for adding the neighbor nodes which are:

$$DOWN > UP > RIGHT > LEFT$$

If the input number $\in \{0, 1, 2\}$, then the program executes the algorithms BFS , DFS and DFID respectively .

After visiting the neighbors in the maze graph, We can easily find out the length of the path and the number of states for the maze.

2 Variables used in Python Program

- **dfs_stop** : tells when dfs to stop.
- **goaldfs** : target state to achieve for DFS.
- **goaldfid** : target state to achieve for DFID.
- **statesdfs** : No. of states explored during DFS traversal .
- **statesdfid** : No. of states explored during DFID traversal .
- **DFIDstop** : to break out of recursion .
- **visited** : Variable created to store the set of visited vertices .
- **parent** : Tuple to store the parent of each node . It is used for finding path .
- **graph_input** : This stores the input given in as a list of lists .
- **m** : No. of rows in the Maze .
- **n** : No. of columns in the Maze .
- **states** : Variable to store no. of states explored .
- **pathlength** : Variable to store length of the path .

3 Functions created in Python Program

- **goal_state(i,j,graph_input)** : This function determines whether the coordinate (i,j) is the end goal for the PacMan or not .
- **move_gen(i,j,graph_input)** : This function's task is returning all possible moves available to the PacMan , if the adjecent block has a space (' ') or astrik('*') , funtion returns its coordinates .
- **DFSUtil(v, visited,parent,graph_input,open_list)** : This is the recursive DFS Utility function .
- **DFS(graph_input,v=(0,0))** : The function to do DFS traversal. It uses recursive DFSUtil()- dfs utility function .
- **DFID(graph_input, depth,v=(0,0))** : The function to do DFID traversal. It uses recursive DFSUtil()- DFS Utility Function.
- **DFIDUtil(v, visited,parent,graph_input, depth)** : This is recursive DFID- utility function .
- **dfid(graph_input,v=(0,0))** : This is the Main DFID function- which calls DFID- which is dfs version for DFID . The extra thing is the depth here.
- **bfs(graph_input,s=(0,0))** : This function is used to perform BFS .
- **searchmethod(bdd,graph_input)** : Simple function to deal with the case wise operation to perform BFS, DFS or DFID as per the requirement

4 Pseudo Code

The main pseudo code used in our assignment is as follows :

move_gen function

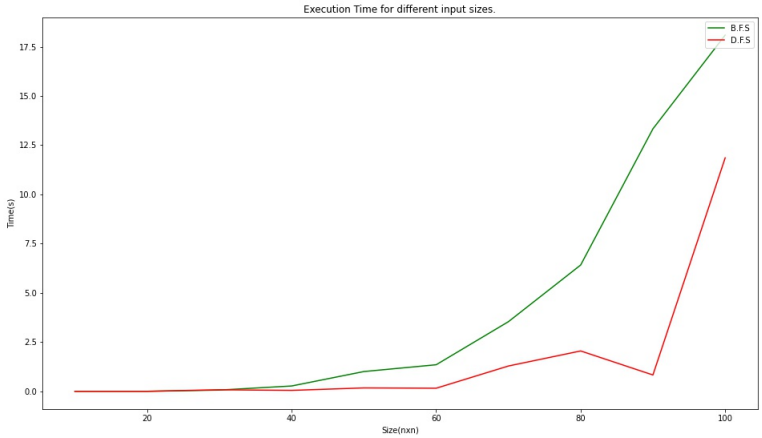
```
def move_gen(i,j,graph_input):
    global open_list
    templist=[]
    if(i<n-1):
       if((graph_input[i+1][j]==' ' or '*') and ((i+1 , j) not in open_list)):
          templist.append((i+1 , j))
     if(i>0):
       if(graph_input[i-1][j]==' ' or '*') and ((i-1 , j) not in open_list):
       templist.append((i-1,j))
     if(j<n-1):
       if(graph_input[i][j+1]==' ' or '*') and ((i , j+1) not in open_list):
          templist.append((i,j+1))
     if(j>0):
       if(graph_input[i][j-1]==' ' or '*') and ((i+1 , j) not in open_list):
          templist.append((i,j-1))
    return templist
```

goal_state function

```
def goal_state(i,j,graph_input):
    if(graph_input[i][j]=='*')
       return True
    else :
       return True
```

5 Graphical Analysis

Based on observation , we have plotted the following time vs size of maze graph for BFS and DFS .



By far , we have observed that DFID is the slowest initially but potentially more better for bigger mazes .

Here is the following table depicting the dependence of no. of states and path length on priority order [U : Up, D : Down , R : Right, L :Left].

Dependency of no. of states with priority order

Input File	U>D>R>L	R>L>D>U	U>R>L>D	L>D>U>R	D>U>R>L
input1.txt (BFS)	42, 24	42, 24	42, 24	43, 24	42, 24
input1.txt (DFS)	31, 24	33, 26	33, 26	41, 24	24, 24
input1.txt(DFID)	426, 24	506, 26	508, 26	444, 24	442, 24
input2.txt(BFS)	61, 33	59, 33	61, 33	59, 33	59, 33
input2.txt(DFS)	47, 35	37, 37	73, 37	42, 35	41, 33
input2.txt(DFID)	904, 35	954, 37	964, 37	955, 35	911, 33

6 Results

The following conclusions have been made after evaluation of my program :

1. The Output for the first test case :

```
states= 42, path length= 24
0--+--+--+--+
00 |0000 |  |
+0 +0 +0 +  +
|0000 |0    |
+--+--+0 +--+
|       |0000 |
+  +  +--+0 +
|  |     000
+--+--+--+--+
```

2. The Output for the second test case :

```
states= 24, path length= 24
0--+--+--+--+
00 |0000 |  |
+0 +0 +0 +  +
|0000 |0    |
+--+--+0 +--+
|       |0000 |
+  +  +--+0 +
|  |     000
+--+--+--+--+
```

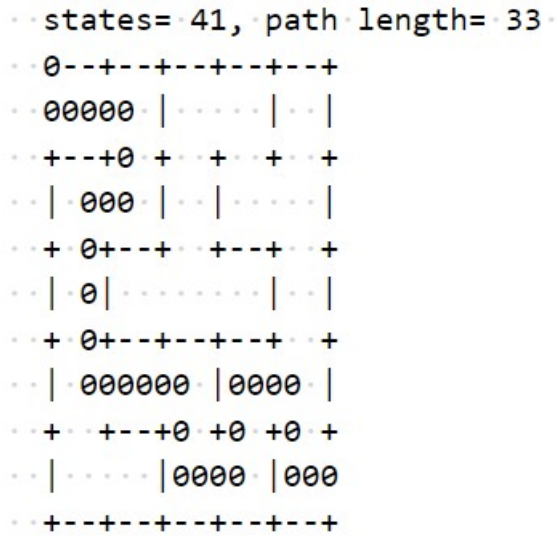
3. The Output for the third test case :

```
states= 419, path length= 24
0--+--+--+--+
00 |0000 |  |
+0 +0 +0 +  +
|0000 |0    |
+--+--+0 +--+
|     |0000 |
+  +  +--+0 +
|  |     000
+--+--+--+--+
```

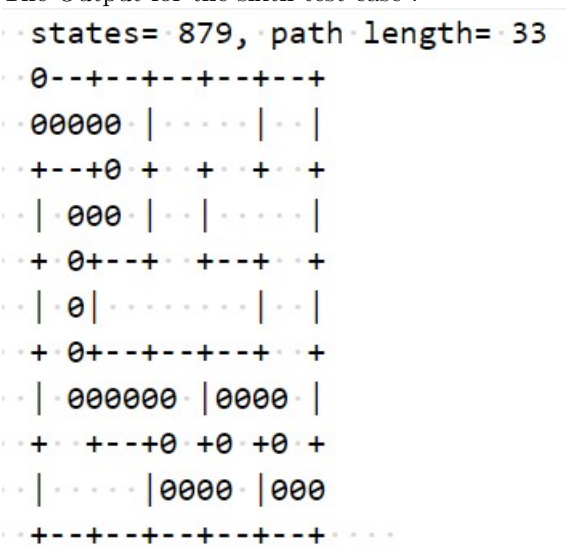
4. The Output for the fourth test case :

```
states= 59, path length= 33
0--+--+--+--+--+
00000 |     |  |
+--+0 +  +  +  +
| 000 |  |     |
+ 0+--+  +--+  +
| 0|        |  |
+ 0+--+--+--+  +
| 000000 |0000 |
+  +--+0 +0 +0 +
|     |0000 |000
+--+--+--+--+--+
```

5. The Output for the fifth test case :



6. The Output for the sixth test case :



Conclusion

Thus , BFS, DFS and DFID algorithms which are uninformed search methods always gives the solution to the problem , but it might not be optimal in every case .

7 References

- http://geeksforgeeks.com
- https://wikipedia.org
- https://stackoverflow.com
- http://www.delorie.com/game-room/mazes/genmaze.cgi