Lab Report -1

Question 1

In this question I had to implement the depth first search algorithm . I had used a recursive implementation for the DFS. There were basically three states possible in the DFS namely :

(1) Goal state
(2) already visited and not a goal state
(3) not a goalstate as well as not visited node

For the TinyMaze – Total Cost =8 , Number of Nodes expanded =15
For the MediumMaze – Total Cost=246 , Number of Nodes expanded =269
For the BigMaze – Total Cost=210 , Number of Nodes Expaned =466

The cost for MediumMaze for my code is 246 as I store the successors in reverse order. Secondly, DFS will not give us the optimal solution always . As in case both branch of a node lead to the goal state then but the one that is on top of the stack will be popped irrespective which gives the shortest path.

Question 2

In this question I was asked to implement BFS and BFS works correctly as it gives the most optimal path in other words since the shallowest goal node will explored first . Hence for the MediumMaze it yields the the path with cost =68 that is the most optimal.

Question 3

In this question I was asked to implement UCS (Uniform Cost Search) using priority queues . UCS also returns the most optimal path thatis 68 in case of the mediumMaze as it explores the node with minimum cost from the root node .

Yes, we get very less cost (1) with the eastSearch and very large cost (68719479864) with westSearch.

Question 4

In case of the BigMaze the astar search expands 549 nodes while ucs expands 620 nodes.

In case of open Maze the Following Results were Observed

Search technique	Number of Nodes expanded	Total Cost

A star search	535	54
DFS	683	390
BFS	682	54
UCS	682	54

Question 5

In this corner problem I changed the state of the problem along with co-ordinates I also have the list of the corners that are remaining . Hence the goal state is reached when the list becomes empty . And a corner from the list is removed if any of the successors is the corner state in the maze.

Hence for implementing this I need to make no changes in my bfs code .
For the tinyMaze it takes 28 steps as mentioned it should.

For mediumCorners the cost is 106.

Question 6

In question 6 I tried the following Heuristics as mentioned below and following results were obtained :

1) If I use the minimum distance from the remaining corners then Total number of nodes expanded is 1475. As the difference between most optimal heuristic and this is very large . If the list is empty it returns 0 so, it is consistent for the goal state as it is 0. For calculating distances I have manhattan distance.

2) If I use sum of manhattan distances for the remaining corners as the heuristics , It becomes inadmissible (if the distance is very less since we are summing up its value can be greater than the most optimal heuristic)

3) The heuristic that I have sumbitted is from the current state going to the closest corner , then this corner becomes the current node and then repeating the process untill all the corners have been visited. For distances I have used manhattan distance.
This heuristic expands 692 nodes. It is consistent as if for goal state it returns 0. Also is non negative as it is manhattan distance and also admissble as the manhattan distance is alwaysa relaxed version of the problem.

Question 7

The heuristics that I tried and results observed are as follows :

1) minimum Mazedistance among all the foods present . It expanded 12370 nodes.

2) when I used teh average of the Maze Distance from the foods it expanded 8384.

3) When I used teh max of all the Maze Distances , this heuristics was closest to the optimal heuristics and explored just 4110 nodes.

Question 8

For Implementing this part I just had to invoke the bfs function from the Closestfoodsearch fucntion and in defining the check goal state function if at the position of the state the food grid is true then we have reached the goal state.
And returns true.

Problem that I faced :

The heuristic I found in the Question 6 I am unable to get why it doesn't work for Question 7 as they are almost similar and only corner has been replaced by the food.

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