Work in groups to find the solutions for the following problems.
This is not GRADED but is related to your weekly assignment.

Template for the first two problems.

Your solution should include the answers for the following questions.

1. What would be the initial state for the solving agent?
2. What would be the goal state/test for the solving agent?
3. Pseudocode
4. Which algorithm did your agent used to find the solution and why?

1. Where's the Trap?

Given a maze in the form of a matrix, filled with either W, T, or O, where O represents an open cell, W represents a Wall, and T represents Traps in the maze, find the shortest distance of every open cell in the maze from its nearest Trap.

Only allowed actions that the agent can take are UP, DOWN, LEFT and RIGHT. We can assume cells with the Trap have distance 0. Also, walls have distance -1.

For example,

Input: 4 x 5 Matrix filled with O (Open cell), T (Traps) and W (Wall).

O O T O O
O W O T O
W T O O W
O O O O O

Output:

2 1 0 1 2
3 -1 1 0 1
-1 0 1 1 -1
2 1 2 2 3

1. Initial State: Can start from any state that has a "T"
2. Goal State: Reach the state that has a "O"
3. Pseudocode:
4. Algorithm: BFS

2. Word Search

Given an R × C matrix of characters, find all occurrences of a given string in the matrix. We are allowed to search the string in all eight possible directions, i.e., UP, DOWN, LEFT, RIGHT and all the four diagonal directions.

For example,

Input:

4 x 5 matrix

'A' 'D' 'E' 'B' 'C'
'O' 'O' 'C' 'A' 'X'
'S' 'C' 'D' 'K' 'C'
'O' 'D' 'E' 'H' 'L'

Search: "CODE"

Output:

C(1,2), O(1,1), D(0,1), E(0,2)

C(1,2), O(1,1), D(2,2), E(3,2)

C(2,1), O(1,1), D(0,1), E(0,2)

C(2,1), O(1,1), D(2,2), E(3,2)

C(2,1), O(1,0), D(0,1), E(0,2)

C(2,1), O(3,0), D(3,1), E(3,2)

1. Initial state: THe first letter of the word
2. Goal state: The last letter of the word
3. Pseudocode:
4. Algorithm: DFS - because we are looking for something specific, in this case it is the word "CODE"

3. 8 Puzzle Problem (A*)

Given a 3 x 3 matrix, with 8 cells labeled from 1 through 8 and a blank cell. Goal is to rearrange the cells so that they are in order. The blank cell can be at any position in the grid. Below shows one of the states that the matrix can be in. You can move the cells UP, DOWN, LEFT or RIGHT into the blank cell to reach the goal state.

Input:
3 x 3 matrix, with cells from 1 through 8 and a blank cell represented by 0.

8 1 6
3 2 0
5 7 4

Output:
1 2 3
4 5 6
7 8 0

Answer the following:
1. Define heuristic for this problem i.e. *h(n)*:
   a.
2. Define cost i.e. *g(n)*:
   a.
3. Pseudocode

Hint:
- Heuristic is the estimated distance from the current state to the goal state.
- Cost of g(n) is the cost of reaching the current state from the initial state.