CS 4470: Artificial Intelligence
HW1

Points: Please see the points for each problem.
Instruction: Please submit on canvas

1. It is a training day for a swarm of robotic miners in a hazardous environment. Each of the *k* miners starts in its own assigned start location *si* in a large maze of size $M \times N$, meaning M columns and N rows. Each miner's goal is to return to its own dumpsite stationed at location *gi*. Along the way the miners must gather all chucks of Strontium 90 (think Pacman dots) in the maze.

   At each time step, all *k* miners move one unit to any open adjacent square. The only legal actions are Up, Down, Left, or Right. It is illegal for a miner to wait in a square, attempt to move into a wall, or attempt to occupy the same square as another miner. To set a record, the miners must find an optimal collective solution.

   a) (3 pts) Define a minimal state space **representation** for this problem.

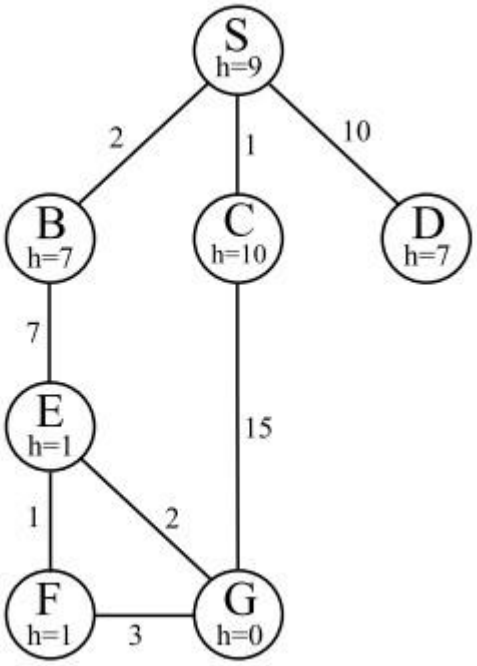
      Location of Miner

      Location of Strontium

   b) (3 pts) How large is the state space?

      The size of the state space depends on where the location of the closest Strontium is and if there is another robot adjacent to your current location.

2. Consider the search graph shown below. S is the start state and G is the goal state. All edges are bidirectional.



For each of the following search strategies, give the path that would be returned, or write none if no path will be returned. If there are any ties, assume alphabetical tiebreaking (i.e., nodes for states earlier in the alphabet are expanded first in the case of ties).

(a) (3 pt) Depth-first graph search

S – B – E – F – G

(b) (3 pt) Breadth-first graph search

S – C – G

(c) (3 pt) Uniform cost graph search

S – B – E – F – G

(d) (3 pt) Greedy graph search

S – C – G

(e) (3 pt) A* graph search

S – B – E – F – G