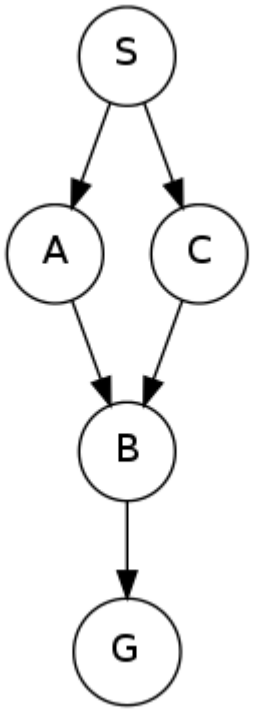
Q1 Search Trees

6 Points

How many nodes are in the complete search tree for the given state space graph? The start state is S. You may find it helpful to draw out the search tree on a piece of paper.



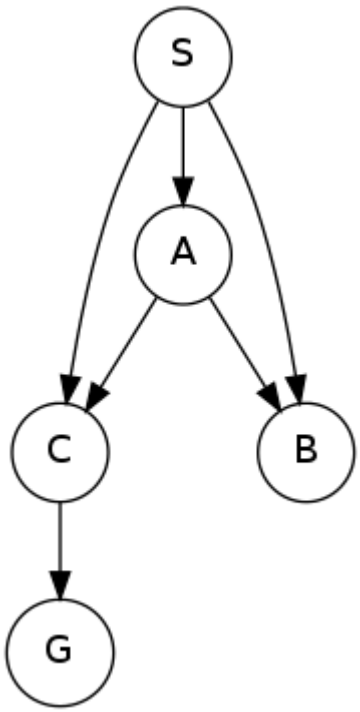
1

Q2 Depth-First Graph Search

6 Points

Consider a depth-first graph search on the graph below, where S is the start and G is the goal state. Assume that ties are broken alphabetically (so a partial plan S->X->A would be expanded before S->X->B and S->A->Z would be expanded before S->B->A). You may find it helpful to execute the search on scratch paper.

Please enter the final path returned by depth-first graph search in the box below. Your answer should be a string with S as your first character and G as your last character. Don't include arrows or spaces in your submission. For example, if you believe the path is S->X->G, please enter SXG in the box.

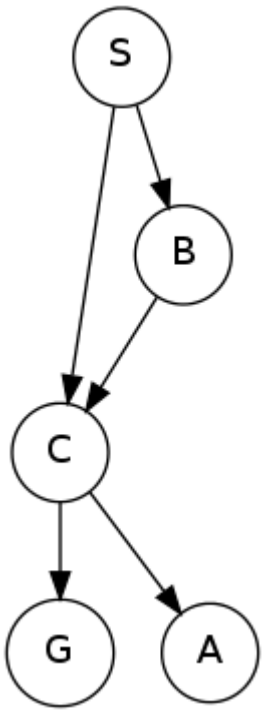


Q3 Breadth-First Graph Search

6 Points

Consider a breadth-first graph search on the graph below, where S is the start and G is the goal state. Assume that ties are broken alphabetically (so a partial plan S->X->A would be expanded before S->X->B and S->A->Z would be expanded before S->B->A). You may find it helpful to execute the search on scratch paper.

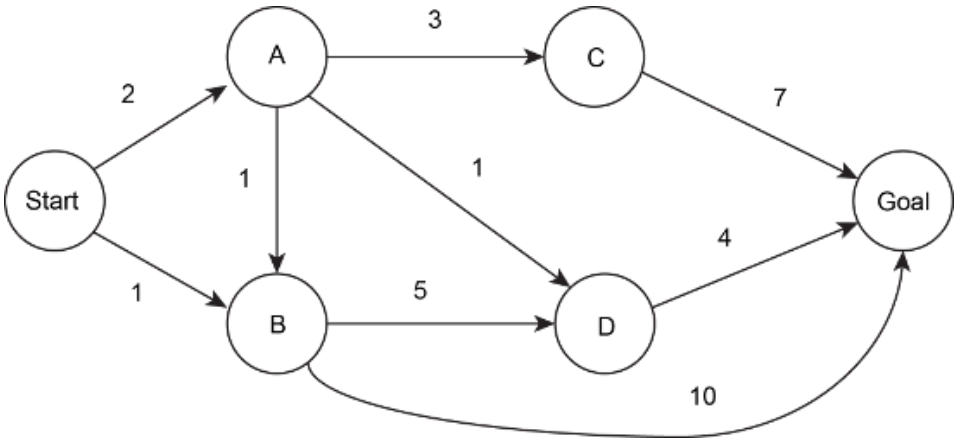
Please enter the final path returned by breadth-first graph search in the box below. Your answer should be a string with S as your first character and G as your last character. Don't include arrows or spaces in your submission. For example, if you believe the path is S->X->G, please enter SXG in the box.



Q4 Uniform-Cost Graph Search

7 Points

Consider the graph below. Arcs are labeled with their costs. Assume that ties are broken alphabetically (so a partial plan S->X->A would be expanded before S->X->B and S->A->Z would be expanded before S->B->A.



Q4.1

3 Points

In what order are states expanded by Uniform Cost Search? You may find it helpful to execute the search on scratch paper.

- Start, A, B, C, D, Goal
- Start, A, C, Goal
- Start, B, A, D, C, Goal
- Start, A, D, Goal
- Start, A, B, Goal
- Start, B, A, D, B, C, Goal

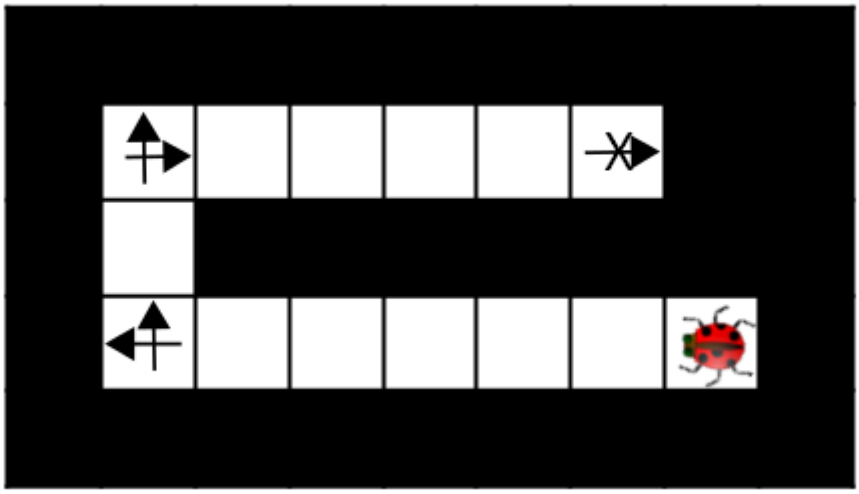
Q4.2
4 Points

What path does uniform cost search return?

- Start-A-C-Goal
- Start-B-Goal
- Start-A-D-Goal
- Start-A-B-Goal
- Start-A-B-D-Goal

Q5 Hive Minds: Jumping Bug
6 Points

There is a ladybug in a rectangular maze-like environment with dimensions $M \times N$. The insect has super legs that can take it as far as you want in a straight line in each time step. However, it takes the insect a time step to change the direction it is facing. Moving v squares requires that all intermediate squares passed through, as well as the vth square, currently be empty. The cost of a multi-square move is still 1 time unit, as is a turning move. As an example, the arrows in the maze below indicate where the insect will be and which direction it is facing after each time step in the optimal (fewest time steps) plan (cost 5):



Q5.1
3 Points

Which of the following is a minimal state representation?

- A tuple (x, y) giving the position of the insect.
- A tuple (x, y) giving the position of the insect, plus the direction the insect is facing.
- A tuple (x, y) giving the position of the insect, plus an integer representing the number of direction changes necessary on the optimal path from the insect to the goal.
- A tuple (x, y) giving the position of the insect, plus an integer t representing the number of time steps that have passed.

Q5.2
3 Points

What is the size of the state space?

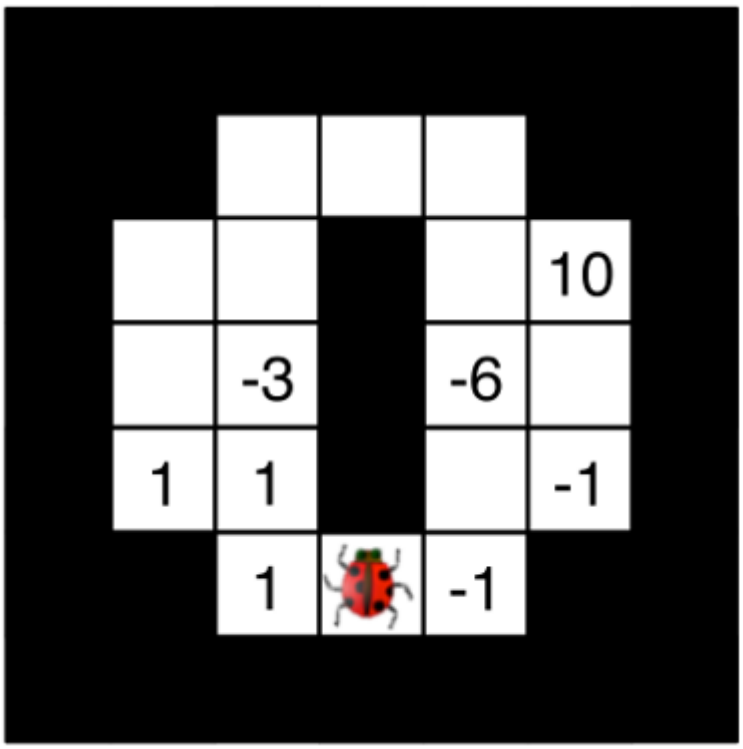
- MN
- $\max(M, N)$
- $\min(M, N)$
- $4MN$
- $(MN)^2$
- $(MN)^4$
- 4^{MN}

Q6 Hive Minds: Time Limit

7 Points

In this problem, the ladybug lives for only a fixed number of timesteps. At each timestep, the ladybug must move to an adjacent square that it has not already visited. The ladybug gains or loses points according to the number written in the square.

Your goal in this problem is to find the optimal score (higher is better) for a given timestep limit.



Q6.1

1 Point

What is the optimal score for a timestep of 2?:

Q6.2
2 Points

What is the optimal score for a timestep of 5?:

Q6.3
2 Points

What is the optimal score for a timestep of 8?:

Q6.4
2 Points

What is the optimal score for a timestep of 11?:

Homework 1 (Electronic)

● UNGRADED

STUDENT
Qingjing Zhang

TOTAL POINTS
- / 38 pts

QUESTION 1

Search Trees 6 pts

QUESTION 2

Depth-First Graph Search 6 pts

QUESTION 3

Breadth-First Graph Search 6 pts

QUESTION 4

Uniform-Cost Graph Search 7 pts

4.1 (no title) 3 pts

4.2 (no title) 4 pts

QUESTION 5

Hive Minds: Jumping Bug 6 pts

5.1 (no title) 3 pts

5.2 (no title) 3 pts

QUESTION 6

Hive Minds: Time Limit 7 pts

6.1 (no title) 1 pt

6.2 (no title) 2 pts

6.3 (no title) 2 pts

6.4 (no title) 2 pts