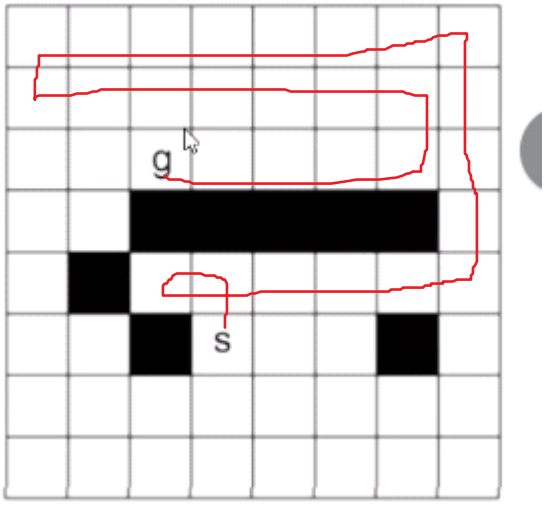
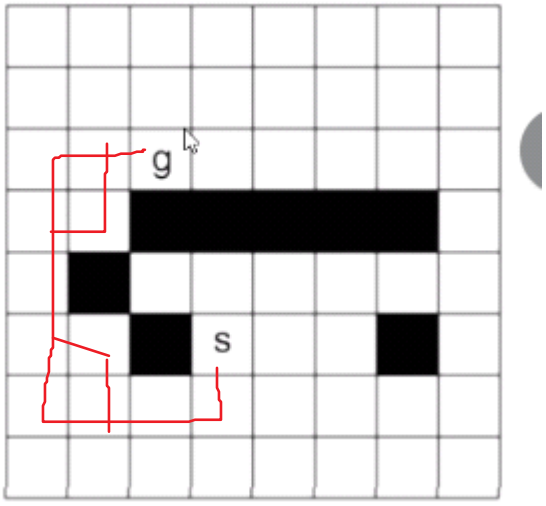
3.Search Questions

Monday, February 15, 2021 9:24 AM



Up-left-right-down

1. DFS: Answer above
2. Best-first



Manhattan distance distance in x-direction + distance in y-direction

- On the grid shown in figure, number the nodes expanded (in order) for a depth-first search from *s* to *g*, given that the order of the operators is up, left, right, then down. Assume there is a cycle check.
- For the same grid, number the nodes expanded, in order, for a best-first search from *s* to *g*. Manhattan distance should be used as the evaluation function. The Manhattan distance between two points is the distance in the *x*-direction plus the distance in the *y*-direction. It corresponds to the distance travelled along city streets arranged in a grid. Assume multiple-path pruning. What is the first path found?
- On the same grid, number the nodes expanded, in order, for a heuristic depth-first search from *s* to *g*, given Manhattan distance as the evaluation function. Assume a cycle check. What is the path found?
- Number the nodes in order for an A^* search, with multiple-path pruning, for the same graph. What is the path found? (1.5X4=6M)

Pacman and Ms. Pacman are lost in an NxN maze and would like to meet; they don't care where. In each time step, both simultaneously move in one of the following directions: NORTH, SOUTH, EAST, WEST, STOP.
They do not alternate turns. You must devise a plan which positions them together, somewhere, in as few time steps as possible. Passing each other does not count as meeting; they must occupy the same square at the same time.

a. Formally state this problem as a single-agent state-space search problem.

Answer: The set of pairs of positions for Pacman and Ms. Pacman:

$$\{((x_1, y_1), (x_2, y_2)) \mid x_1, x_2, y_1, y_2 \in \{1, 2, \ldots, N\}\}$$

Maximum state space:
- N*N for both pacmen, so N^4

Maximum branching factor:
- 5 for each pacman--> 25

Goal state:

Answer: $isGoal((x_1, y_1), (x_2, y_2)) := (x_1 = x_2) \wedge (y_1 = y_2)$

e. Give a non-trivial admissible heuristic for this problem.

Answer: Manhattan distance between Pacman and Ms. Pacman DIVIDED BY 2 (since both take a step simultaneously)

f. Circle all of the following graph search methods which are guaranteed to output optimal solutions to this problem:
(i) DFS
(ii) BFS
(iii) UCS

BFS, A* (with consistent and admissible heuristic & with a heuristic that returns zero), UCS