

COMS 4701 Artificial Intelligence

Homework 1 - Conceptual

Due date: Feb 2nd, 2021

Question 1: Search space formulation

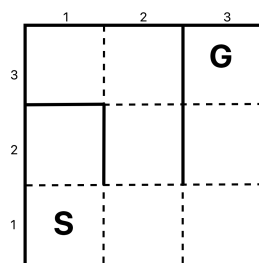
A 3-tower Hanoi puzzle consists of three pegs, and 3 disks of different sizes which can slide onto any peg. The objective of the puzzle is to move the entire stack to the right peg. You can only move one disk at a time. Each move consists of taking the upper disk from one of the pegs and placing it on top of another stack. No disk may be placed on top of a smaller disk.



1. Using a list (ordered set) or other, suggest a structure that represents each state.
2. What is the initial state?
3. How many possible states are there (valid or not). Give few examples.
4. What are the possible actions?
5. What is the transition model?
6. What is the Goal test?

Question 2: Search strategies

Given a grid maze below with the agent start state S and the goal state G. The agent can move up, right, down or left.

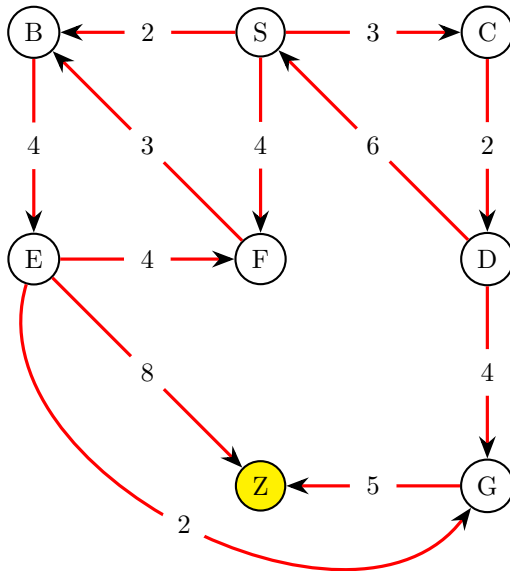


Use the following guidelines:

1. The agent can move through the dot lines only.
 2. Diagonal moves are not allowed.
 3. Moves are considered in the following order: Up, Right, Down, Left.
 4. No state is visited twice.
- (a) What is the order of visit obtained with BFS?
- (b) Depth-First search (DFS) What is the order of visit with DFS?

Question 3: Search strategies

Consider the following graph. Edges between nodes may only be traversed in the direction indicated by the arrow. We will search the graph with the algorithms we learned, keeping a full explored set as we go. Let S be the start and Z the goal. As usual, where an arbitrary choice has to be made, assume that nodes are visited in lexicographical order. The table provides the value of the heuristic function for each node:

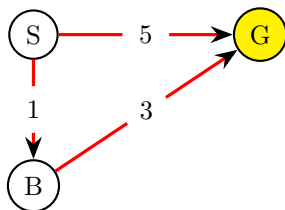


Node	Heuristic
S	8
B	7
C	6
D	5
E	4
F	5
G	2
Z	0

1. What is the order of visit and path obtained with UCS? Show the priority queue. If some keys change, show the change.
2. What is the order of visit and path obtained with A*? Show the priority queue. If some keys change, show the change.

Question 4: Heuristics

For the following question, consider the graph below (S is the start node and G is the goal node) and the four defined heuristic functions.



	$h(S)$	$h(B)$	$h(G)$
Heuristic 1:	4	2	0
Heuristic 2:	6	3	0
Heuristic 3:	3	2	0
Heuristic 4:	4	1	0

For each of the 4 heuristic functions, determine whether it is admissible and whether is it consistent. If the answer is yes to either question, please explain how the heuristic fits into the definition of admissible and/or consistent. Otherwise, please provide a counter-example.