COMS 4701 Artificial Intelligence

Homework 2 - Conceptual

Due date: October 14, 2021

Please review the **lectures and the required materials** before answering these questions.

1. **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 G 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:


   ```
   A: 5
   B: 1
   C: 3
   D: 9
   E: 4
   F: 0
   G: 0
   H: 7
   ```
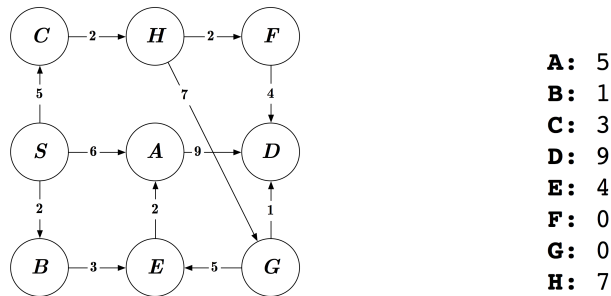
   1. What is the order of visit and path obtained with BFS? Show the queue.
   2. What is the order of visit and path obtained with DFS? Show the stack.
   3. What is the order of visit and path obtained with UCS? Show the priority queue. If some keys change, show the change.
   4. What is the order of visit and path obtained with A*? Show the priority queue. If some keys change, show the change.

2. Consider the following table summarizing a transaction dataset collected by a retail store.

	PC	$\overline{\textbf{PC}}$	$\sum$ **lines**
Mac	400	200	600
$\overline{\textbf{Mac}}$	350	50	400
$\sum$ **columns**	750	250	1000

   PC stands for the transactions containing Personal Computers, while $\overline{PC}$ stands for transactions that do not contain PCs. Mac stands for the transactions containing Apple Computers, while $\overline{Mac}$ stands for transactions that do not contain Apple Computers.

   1. For a MinSup=30% and a MinConf=60%, will the Apriori algorithm discover the rule below? Justify your answer.
   $$Mac \;\rightarrow\; Pc$$
   2. Are PC and Mac purchases independent of each other? What type of relationship exist between them?

3. **Constraint Satisfaction Problems**

   We are going to consider a simplified version of the sudoku puzzle:

4	A	B	C
D	E	F	4
G	2	H	I
J	K	3	L

The solution to this problem is to generally assign values between 1 and 4 to each of the letters while satisfying the condition; each number (1-4) must appear exactly once in each row, column, and 2x2 box, without changing the numerals that are already in the grid.

(a) What is the size of the state space for this CSP? You do not have to consider constraints.

(b) List all unary constraints

(c) If we choose to assign the first variable using the minimum remaining values (MRV) heuristic, which variable(s) would get chosen? List all such variables if there is a tie.

(d) Prior to assigning any variables, use both unary constraints and arc consistency due to binary constraints to reduce the domains of the problem.