CSC 384 Winter 2023 Test 1 Version A

January 30 and 31, 2023

Last Name: _____

First Name: _____

Email: _____

Q1 Definitions of AI (3 marks)

Q1.1 (1 mark)

What is/are the difference(s) between **Turing Test** and **Rational Agent** as two definitions of AI? Circle all the correct answers.

A. They differ in how we measure the performance of the system.
B. They differ in whether we care about modelling thoughts or behaviour.

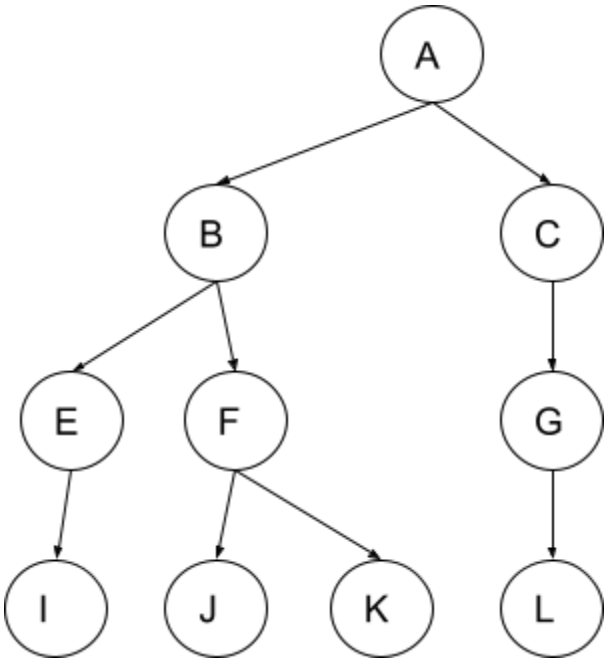
Q1.2 (2 marks)

Which arguments support choosing **Rational Agent** over **Turing Test** as the definition of AI? Circle all the correct answers.

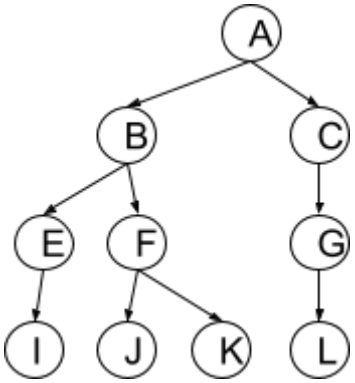
A. Human is one of the few examples of intelligence.
B. Modelling behaviour is more general than modelling thoughts.
C. Rationality can be well-defined mathematically.
D. Humans often behave irrationally.

Q2 Uninformed Search (10 marks)

Consider the search graph below. A is the initial state. There is no goal state.



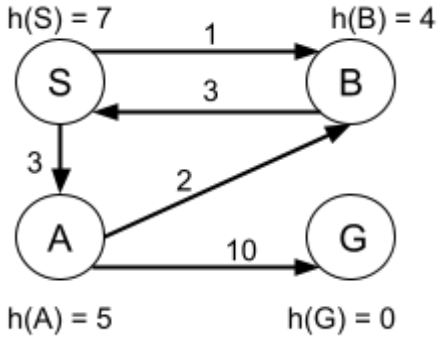
Execute the **Iterative-Deepening Search** on this search graph. **Add** states to the frontier in **alphabetical** order. Start with depth limit = 0. Fill in the steps in the table until you have completed the execution for depth limit = 2. Do not perform multiple-path pruning or cycle checking. We have filled in the first few steps for you as an example. If no states appear in a cell, write **None**. Use as many rows in the table as necessary.



Step	Depth limit	Node to remove	Node to add	Resulting frontier
1	0	None	A	A
2	0	A	None	None
3	1	None	A	A
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				

Q3 Properties of Search Algorithms (4 marks)

Consider the search graph below. S is the initial state, and G is the goal state.



Q3.1 (2 marks)

Suppose our goal is to find a solution to this problem.

Which of **Depth-First Search** and **Iterative-Deepening Search** is a better algorithm for solving this search problem?

Circle the best answer: Depth-First Search OR Iterative-Deepening Search

Justify your answer in one sentence:

_____

Q3.2 (2 marks)

Suppose our goal is to find the optimal solution by visiting the smallest number of states.

Which of **Uniform-Cost Search** and **A* Search** is a better search algorithm for solving this search problem?

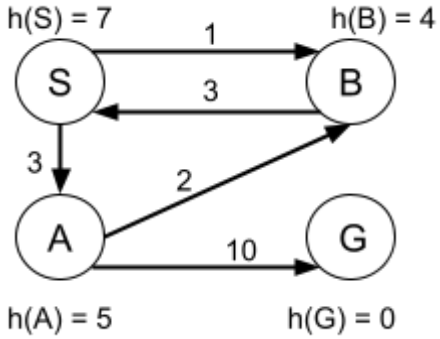
Circle the best answer: Uniform-Cost Search OR A* Search

Justify your answer in one sentence:

_____

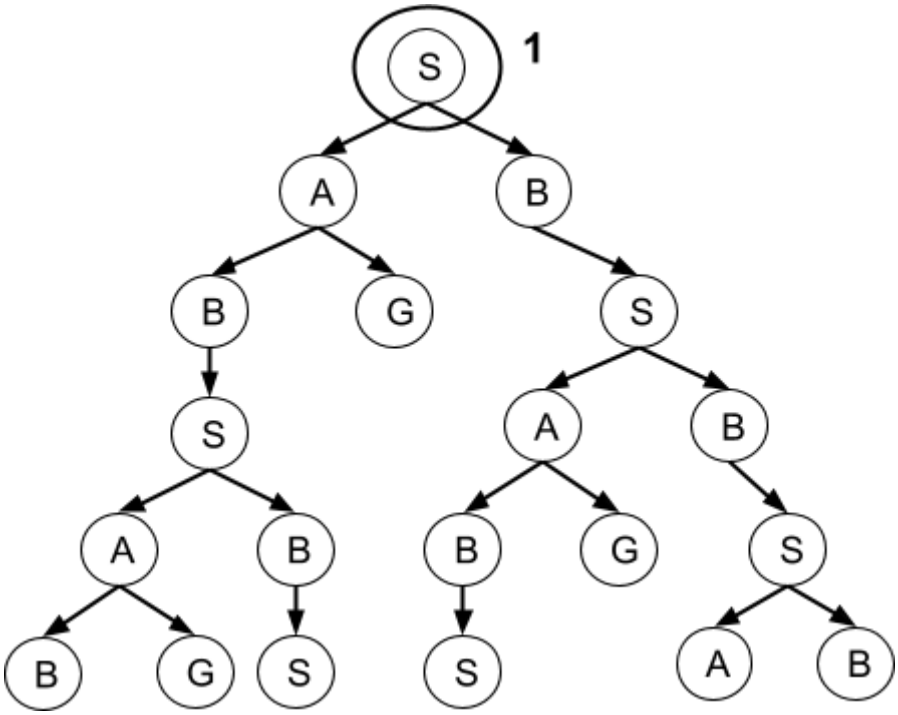
Q4 Heuristic Search (8 marks)

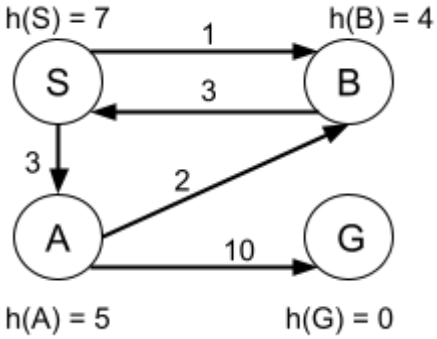
Consider the search graph from Q3 again (copied on the right). S is the initial state, and G is the goal state.



Q4.1 (6 marks)

Execute **A* Search** on the search graph above. In the search tree below, circle the **first seven nodes removed from the frontier** and label them in order of removal. If multiple states have the same f value, **break ties** by removing the **oldest** state (the one **added first**). Do not perform multiple-path pruning or cycle checking. We have circled and labelled the first node as an example.





This graph is the same as the one in Q3 and Q4.1. We have reproduced the same graph here for your convenience.

Q4.2 (1 mark)

Is the heuristic function **admissible**?

Circle the best answer: YES OR NO

If your answer is NO, explain in one sentence:

_____

Q4.3 (1 mark)

Is the heuristic function **consistent**?

Circle the best answer: YES OR NO

If your answer is NO, explain in one sentence:

_____

Q5 Constructing Heuristics (3 marks)

Consider a problem X. Suppose h_1 and h_2 are both **admissible** heuristic functions and h_3 is an **inadmissible** heuristic function for problem X. Which of the following statements is true? Circle all the correct answers.

A. $h_1(s) + h_2(s)$ is guaranteed to be admissible for problem X.

B. $\min(h_1(s), h_2(s))$ is guaranteed to be admissible for problem X.

C. $\min(h_1(s), h_3(s))$ is guaranteed to be admissible for problem X.