CMPT 310 Midterm 1, Summer 2019

Last name *exactly as it appears on student card*									
First name *exactly as it appears on student card*									
SFU Student #									
SFU email *ends with* `sfu.ca`									

This is a **closed book exam**: notes, books, computers, calculators, electronic devices, etc. are **not permitted**. Do not speak to any other students during their exam or look at their work. If you have a question, please remain seated and raise your hand and a proctor will come to you.

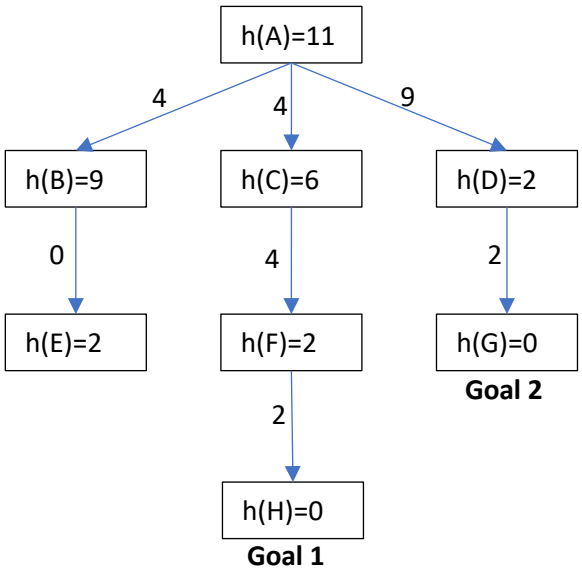
	Out of	***Your Mark***
Agent Architecture	10	
Search	10	
Constraint Satisfaction	10	
Short Answer	10	
Total	40	

Agent Architecture

a) (5 marks) Give the definition of a **rational agent**.

b) (5 marks) What is a **table-driven agent**, and how does it work? What is one **good** thing about such an agent? What are two different **bad** things about it?

Searching



In the tree on the left, the starting node A is the root. The capital letter in each node is the node's name, and the number is the node's h-value. Altogether, the h-values define a heuristic function h.

Each edge of the tree is labelled with its cost, and the two goal nodes, H and G, are marked.

For example, node G has an h-value of 0, and the cost of going from node D to node G is 2.

In the first few questions, a node is **visited** when it is removed from the frontier. **If there is a tie** about what node to visit next, always choose the node that comes first alphabetically.

a) (2 marks) If you start at node A, in what order will the nodes be visited by **uniform-cost search**?

b) (2 marks) If you start at node A, in what order will the nodes be visited by **greedy best-first search**?

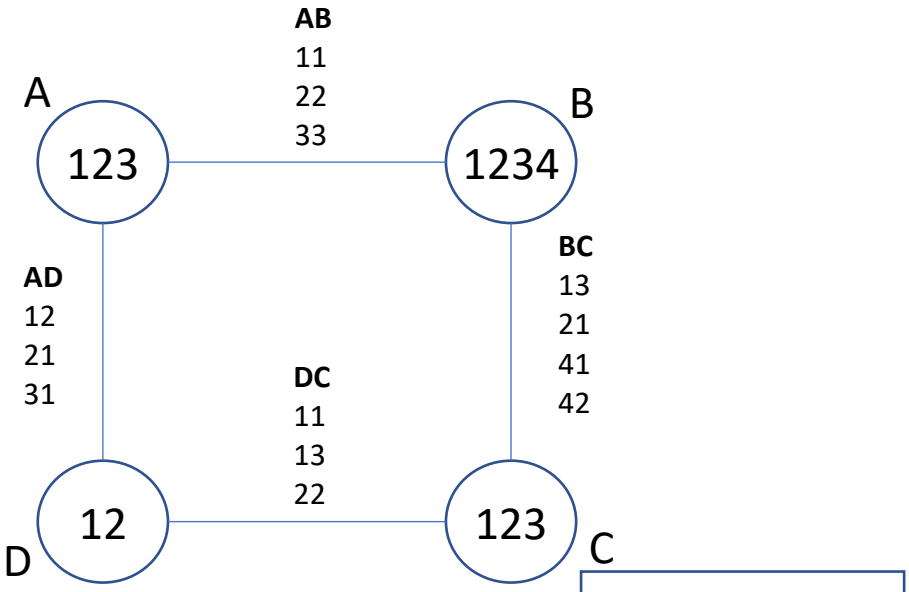
c) (2 marks) Is the heuristic function h **admissible**? If not, why not?

d) (2 marks) If you start at node A, in what order will the nodes be visited by **A* search**?

e) (2 marks) If you start at node A, what nodes (and in what order) will basic **hill-climbing** visit? The value of a node n is f(n)=11-h(n), and the higher the value of f the better.

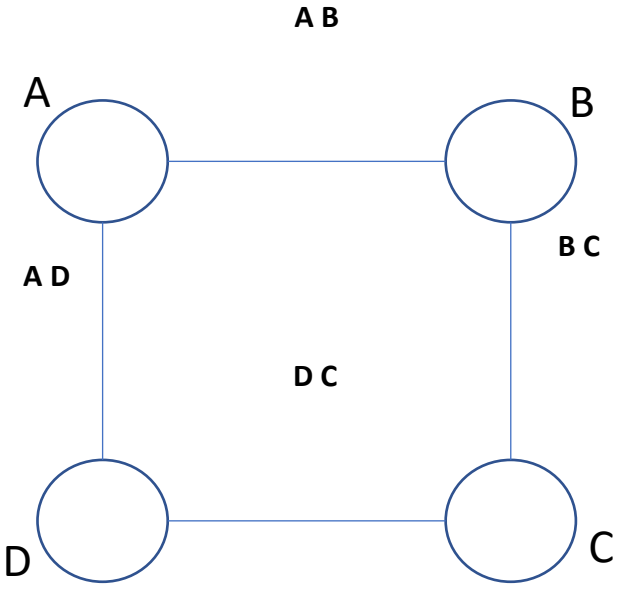
Constraint Satisfaction

(8 marks) Consider the following CSP, where the constraints are all represented as "good lists":



a) (1 mark) What is the size of the search space of the above CSP?

b) (8 marks) Create an **arc consistent** version of the above CSP. Fill in the domains (in the circles) and constraints (under the corresponding letter pairs) here:



c) (1 mark) What is the size of the search space of the arc consistent CSP in b)?

Short Answer

a) (1 mark) What is the name of the main algorithm that most of the best traditional chess-playing programs used?	
b) (1 mark) What is the name of the search algorithm used by the AlphaZero chess playing program?	
c) (1 mark) *True* or *False*: AlphaZero learned to play chess by playing games against itself.	
d) (1 mark) *True* or *False*: in practice, the major problem with A*-search when solving is that it runs out of memory.	
e) (1 mark) *True* or *False*: A*-search with an **inadmissible** heuristic on a finite graph sometimes may not find a goal node even though one exists.	
f) (1 mark) *True* or *False*: If you run the AC3 algorithm on an arc consistent CSP, then the CSP will not be changed.	
g) (1 mark) *True* or *False*: In CSP backtracking search, the **minimum remaining values** (**MRV**) heuristic says that you should choose to next assign the node whose domain is the smallest.	
h) (1 mark) *True* or *False*: When solving CSPs, **forward checking** is **not** useful with backtracking search, but **is** useful when making a CSP arc consistent.	
i) (1 mark) *True* or *False*: The **min-conflicts** algorithm for solving CSPs is both incomplete and non-optimal.	
j) (1 mark) *True* or *False*: An agent can't be truly intelligent unless it is conscious.	