CISC 3410 - Midterm Exam

Name:____________

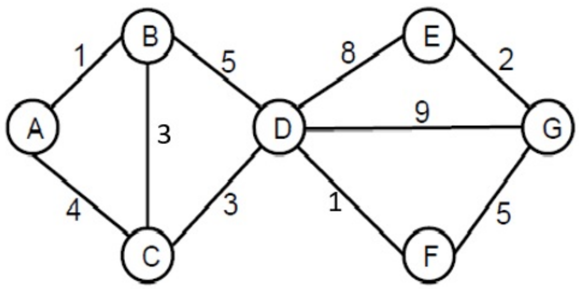
Q1

Circle (O) the true statements, and cross (X) the false statements.

1. Breadth-first search is a special form of uniform-cost search where the cost g(n) is the number of steps from the initial state to state n.
2. Depth-first tree search is complete if the state space is finite.
3. Backtracking search is a variant of depth-first search which generates only one successor at a time rather than all successors.
4. A heuristic function h(n) is said to be admissible if it never exceeds the real optimal cost from n to any goal state. Therefore, $h(n) = 0$ is always admissible.
5. Uniform-cost search is a special form of A* search.

Q2

This question refers to the undirected weighted graph below:



A is the start state and G is the goal state. The costs are given as weights on the graph. Apply each of the following algorithms until **5** expansions are made or a solution is found, and show what are in **frontier** and what are in **explored**. It is assumed that the children of each node are ordered alphabetically, and backtracking search generates nodes according to the order.

1. Breadth-first graph search.
2. Backtracking graph search.
3. A* graph search with the following heuristic function:

n	A	B	C	D	E	F	G
h(n)	9	9	8	7	1	4	0

Q3

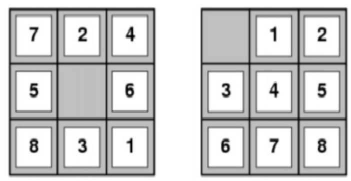
Consider the *pigeonhole* problem. Given n pigeons and m holes, each of which can hold k pigeons, the goal of the problem is to put the pigeons into the holes such that every pigeon is assigned a hole and no more than k pigeons are put into any hole. Obviously, according to the pigeon-hole principle, if $n > m \times k$, then the problem is unsatisfiable.

1. Model the problem as a CSP.
2. The original problem permits symmetric solutions. Introduce symmetry-breaking constraints into your model so that some of the symmetries are eliminated.
3. (Extra 5 points) Implement your model in a programming language of your choice.

Q4

Consider the relaxed 8-puzzle in which a tile can move from any square to the empty square.

- Formulate the problem as a state-space search problem by giving a state representation, a goal test, a set of actions, and a heuristic function.
- (Extra 5 points) Implement your model in a programming language of your choice for the following problem instance:



Start State Goal State