CISC 3410 Artificial Intelligence - Test 1

Name:_____

Q1

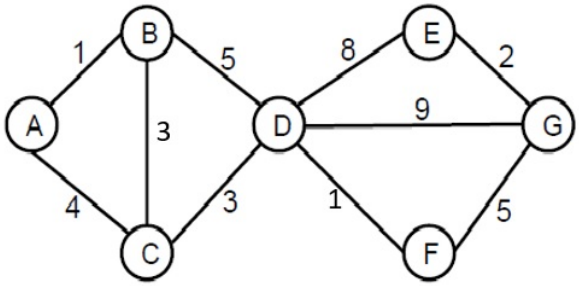
Formulate each of the following as a state-space search problem.

1. *K-knights problem*: Place K knights on an NxN chessboard such that no two knights attack each other ($K < N^2$).

2. *Deadfish problem*: Deadfish is a simple programming language that has a single accumulator to store data, and four instructions that modify the accumulator. The accumulator always starts with 0. The four instructions that modify the accumulator are: i (increment), d (decrement), s (square), and o (output). The Deadfish problem is to find a sequence of instructions that produces a given non-negative number.

Q2

This question refers to the undirected weighted graph given 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 on the graph until a solution is found. It is assumed that graph search is used, and the same state is never expanded more than once. It is also assumed that the children of each node are ordered alphabetically.

1. Breadth-first search. Is the solution found optimal?
2. Depth-first search. Is the solution found optimal?
3. A* with the following heuristic function:

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

Is the solution found optimal?

Q3

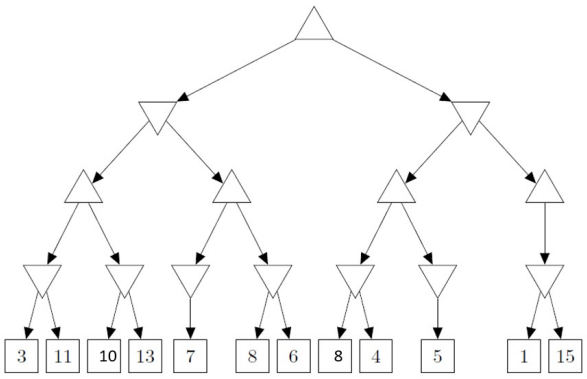
Write a program in a constraint programming language for each of the following problems:

1. The criptarithmetic puzzle $TWO+TWO = FOUR$: Assign a unique digit to each of the digits in {F,O,R,T,U,W} such that the equation TWO+TWO = FOUR holds. No leading digits in TWO and FOUR are zero.

2. The *K-knights problem* as defined above.

Q4

This question refers to the following game tree:



1. Mark the minmax value of each of the nodes in the game tree. Which action should the player represented by the root take?
2. Apply the alpha-beta algorithm to find the best value for the root, and circle all the nodes that can be pruned?