# CS 571 Homework 6

## 1 Draw the Search Tree — 5 points

Draw the complete search tree for the goal `?- clos(a, g).` based on the following Prolog facts and rules.

```
% Facts
rel(a, b).
rel(a, c).
rel(b, f).
rel(f, g).

% Rules
clos(A, B) :- rel(A, B).
clos(A, B) :- rel(A, Z), clos(Z, B).
```

## 2 Prolog Unification — 5 points

For each pair of Prolog terms below, determine whether the unification succeeds and describe its output.

```
p(X, Y) = p(Y, X).
q(X, X) = q(1, 2).
m(f(X), Y) = m(f(a), b).
k(X, Y) = k(a).
[A, B | X] = [1, 2].
```

## 3 Peano Arithmetic — 5 points

In this question, you will write a Prolog predicate to perform exponentiation using a formalization of Peano arithmetic. Your predicate – exp(X,Y,Z) – should be true if and only if X raised to the power of Y is equal to Z. You should use the Peano arithmetic formalization in `peano/peano.pl` and write your solution in the same file.

## 4 Binary Search Trees — 5 points

The file `binary/binary.pl` contains a formalization of a binary search tree in Prolog. Your task in this question is to write predicates rotateLeft(In,Out) and rotateRight(In,Out) that respectively perform a left or right binary search tree rotation[1] on the input binary search tree In to produce the output binary search tree Out. You should write your predicate in `binary/binary.pl`, which also has examples of the expected output.

[1] `https://en.wikipedia.org/wiki/Tree_rotation`