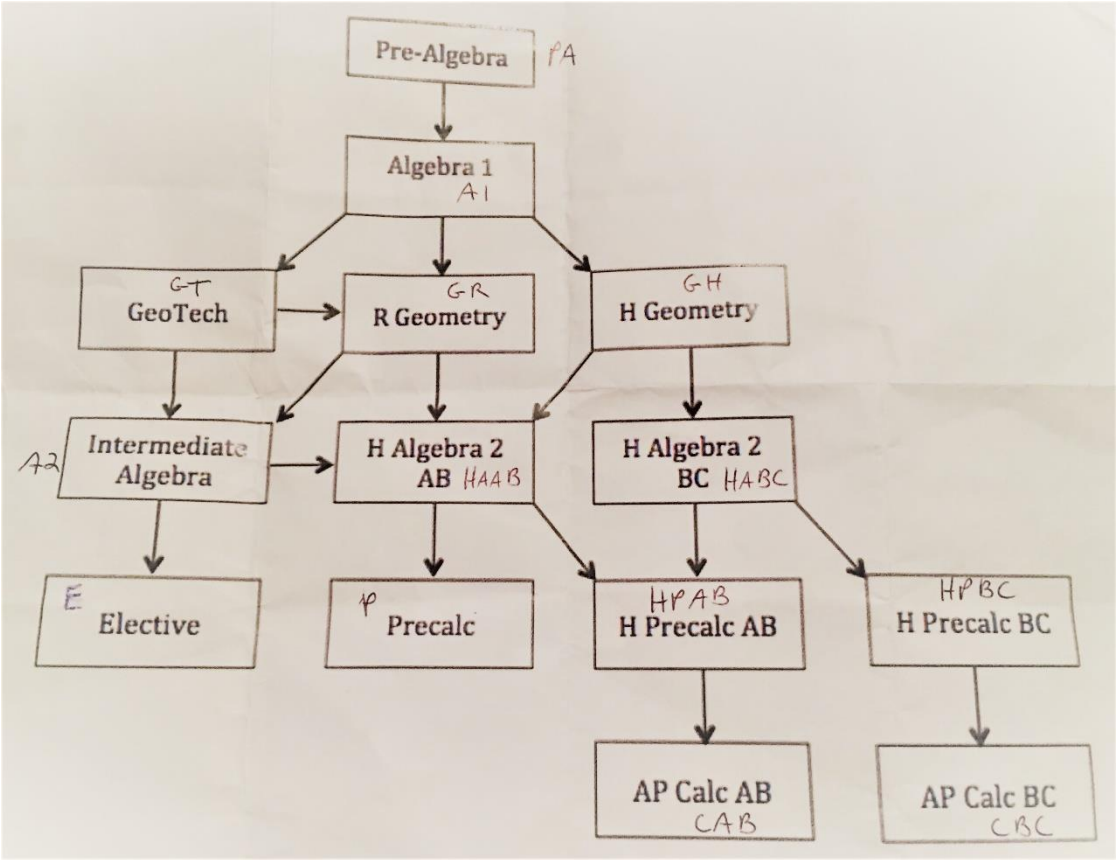
CS 4700: Foundations of Artificial Intelligence
Ungraded Homework

1. The following figure shows the prerequisite structure for math classes at Ithaca High School. For example, it shows that a student must have taken Pre-Algebra before taking Algebra 1. Two arrows coming into a course means *either* course can be taken as a prerequisite (as opposed to *both*).



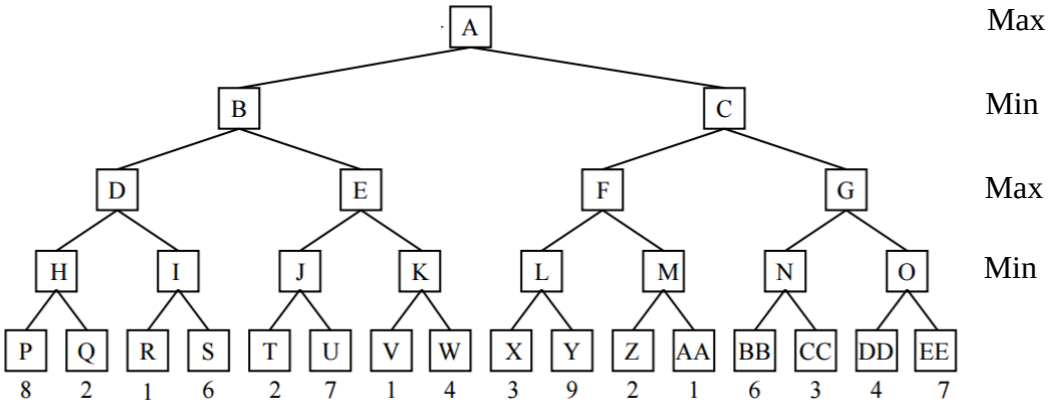
   a. Write down in propositional logic the set of rules that encode these prerequisites. Instead of writing out the full name of each course you can use the short labels written at the various nodes (PA, A1, etc.) as the propositional symbols in your encoding.

      Note that you will likely want to think about this in the reverse direction of the arrows: It is not that taking Pre-Algebra (PA) necessarily implies that you must have taken Algebra 1 (A1). Instead, if you have taken Algebra 1 you must have taken Pre-Algebra. (Alternatively but equivalently, you can read this as saying that if you haven't taken PA you can't have taken A1.)

   b. Convert these rules into CNF.

   c. Use resolution to show that if a student has taken AP Calc AB (CAB), the student must have taken Pre-Algebra (PA).

2. Consider the following game tree for a hypothetical game:



a. Which move should be made at the top level? What is its value?

b. How many of the leaves get evaluated if you use alpha-beta pruning when exploring successors of states going left-to-right at each state?

c. How does the answer to (b) change if successors are explored right-to-left?

d. Imagine that at each level the given player first flips a fair coin. If it is heads the player is allowed to choose from the options given in the tree for that node. If it is tails the player loses. (Treat a win as +10 and a loss as -10.) If the value of each node is calculated as its expected value as discussed in class, what move should be made at the top level? What is its value?

3. Textbook:

a. Exercise 5.9 (b) – (d)

b. Exercise 7.4 (f) – (i)

c. Exercise 7.10 (a) – (d); (f) – (g)

d. Exercise 7.17(a)