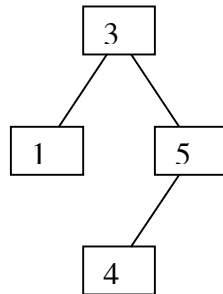


## COP4020 Spring 2011 Homework Assignment 3

1. Explain the difference between a *functional* and a *special form* in Scheme.
2. Why is Scheme called “*homoiconic*”?
3. Which Scheme construct(s) will cause a Scheme program to depart from a purely functional programming model, i.e. are not considered “pure”?
4. We can implement a binary tree data structure by using lists with three elements: (value left-tree right-tree). A leaf is an empty list ‘()’.
  - a. Given the tree:



What is the representation for this tree in Scheme written as a list? For this list also show the internal Scheme linked list node as a graph of nodes and edges.

- b. For this example, give the function calls to obtain the value “5” from the list representation of the tree (use `car` and `cdr` or shorthand combinations thereof if you prefer them).
5. Define a Scheme function “allpos” that takes a list of integers, applies a function that converts an integer to true if the integer is positive and to false otherwise, and reduces the resulting list to a single true/false by conjunction. To keep our code compact, use higher-order Scheme functions whenever possible. See lecture slide 27. The result should be: `(allpos '(1 2 3)) => #t` and `(allpos '(0 1 2)) => #f`