MASSACHUSETTS INSTITUTE OF TECHNOLOGY
Department of Electrical Engineering and Computer Science
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Tree Problems

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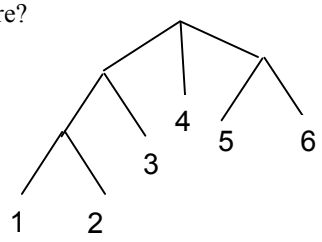
Trees as Nested Lists

A conventional representation of trees is achieved using a nested list structure. Each node in the tree is represented as a list of the children of that node, where a child may be either another tree or a leaf node. A child node that is a tree is called a subtree. A leaf node is anything that is not a pair (e.g., a symbol or a self-evaluating value).

1. Draw a box-and-pointer structure for the following tree using this convention. How does the interpreter print this structure?



Printed representation:

Box-and-pointer diagram:

2. Draw the interpretation of this list as a tree structure: (((1 2) 3) (4 (5 6)) 7 (8 9 10))

Draw the box-and-pointer diagram:

3. Fill in the procedure for double-tree that returns a new tree (in the list representation) with double the value of all leaf nodes. Recall that you check for a leaf node with this procedure:

```
(define (leaf? x)
  (not (pair? x)))

(define (double-tree tree)
   (cond  ((null?  tree)  '())
          ((leaf?  tree)


           ))
          (else




           ))
```

4. An advantage of representing trees as lists is that we can use list procedures. Write the double-tree procedure using the map procedure.

```
(define (double-tree tree)
   (if (leaf? tree)




      ))
```

5. Recall the tree-map procedure, which will perform some operation on all the leaf nodes of a tree,
e.g. (tree-map double mytree).

```
(define (tree-map proc tree)
  (if (leaf? tree)
     (proc tree)
     (map (lambda (tree) (tree-map proc tree)) tree)))
```

Why can't we just use the procedure tree-map as the second argument to map? .