Programming Paradigms Exercise 7 - Haskell 3

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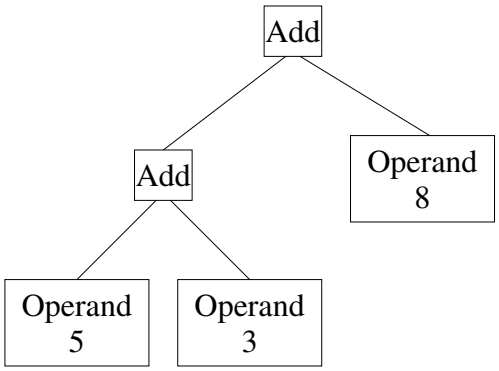
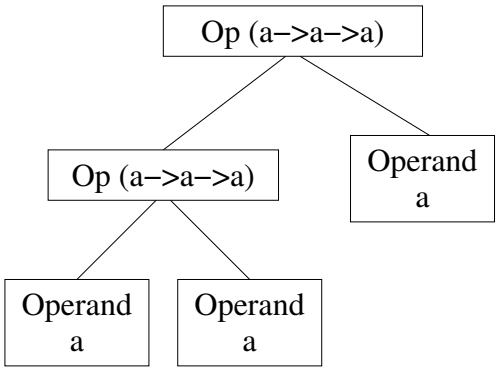
1. Write a function `insertPos` that takes an element `x` and a list `y` as input parameters. It will insert the element `x` into all possible positions of `y`. The result should be a list containing all the lists with `x` inserted into different positions. For example, the input `2` and `[3,5]` should return `[[2,3,5],[3,2,5],[3,5,2]]`.

2. Define a user-defined type for operator trees. An operator tree contains operands of type integer that are connected via the binary operation addition (+). The smallest possible operator tree is one that only contains one operand. The following diagram shows an example:



   Write a function `evaluate` that gets an integer operator tree and evaluates it, i.e., it traverses the tree and adds up all the operands.

3. Now rewrite your user-defined type from the previous exercise to make it an operator tree that contains operands of any type `a` and any binary operation `a->a->a` defined on type `a`. Again write a function `evaluate` that gets an operator tree and evaluates it.



4. Write a Haskell program that reads a list of numbers (entered by a user). The input is terminated by entering a 0. The program should then compute the sum and the product of the list of numbers. Try to compile your program as a stand-alone executable.

   Hints:

   - Use the function `read` to convert an input into a number (e.g. an `Int`). The function is used like this:

     ```
     number <- getLine
     let intNumber = (read number)::Int
     ```

   - To convert a number back into a string (for output), you can use the function `show`

5. Change your implementations of the sieve of Eratesthenes (exercise 6.2) so that you can compile your programs as stand-alone executable. The program must get the required argument from the command line:

   ```
   > ./sieve 10
   [2,3,5,7]
   ```