Scheme Tutorial Exercises

Fall 2003

Problem Set 2: Lists and Trees

11. Develop the function check-range, which consumes a list of temperature measurements and checks whether all measurements are between 5°C and 95°C inclusively. (HtDP Exercise 9.5.4)

   Generalize the function to check-range, which consumes a list of temperature measurements and a legal interval and checks whether all measurements are within the legal interval.

12. Develop the function convert. It consumes a list of digits and produces the corresponding number. The first digit is the least significant, and so on. (HtDP Exercise 9.5.5) For example:

   (convert (cons 1 (cons 2 (cons 3 empty))))
   > 321

13. Define the function average-price. It consumes a list of toy prices and computes the average price of a toy. The average is the total of all prices divided by the number of toys. (HtDP Exercise 9.5.7)

14. Develop convertFC. The function converts a list of Fahrenheit measurements to a list of Celsius measurements. (HtDP Exercise 10.1.3)

15. Develop the function eliminate-exp to eliminate expensive toys. The function consumes a number, called ua, and a list of toy prices, called loip, and produces a list of all those prices in loip that are below or equal to ua. (HtDP Exercise 10.1.5) For example:

   (eliminate-exp 1.0 (cons 2.95 (cons .95 (cons 1.0 (cons 5 empty))))))
   ; expected value:
   (cons .95 (cons 1.0 empty))

16. Define the function suffixes, which consumes a list l, and produces a list of all suffixes of l. For example:

   (suffixes '(a b c d))
   > ((a b c d) (b c d) (c d) (d) ())
17. Define a datatype for a family tree. A family tree is either:
   - Unknown
   
or
   - A person, which has five fields:
     - name, which is a string
     - birthyear, which is a number
     - eyecolor, which is a symbol
     - father, which is family tree
     - mother, which is family tree

For example, a small family tree looks like:

(person "Dave" 1977 'brown
   (person "Ken" 1945 'brown
     (unknown)
     (unknown))
   (person "Mary Ellen" 1946 'brown
     (unknown)
     (unknown)))

18. Develop count-persons. The function consumes a family tree node and produces
the number of people in the corresponding family tree. (HtDP Exercise 14.1.3)

19. Develop the function average-age. It consumes a family tree node and the current year. It produces the average age of all people in the family tree. (HtDP Exercise 14.1.4)

20. Develop the function eye-colors, which consumes a family tree node and produces a list of all eye colors in the tree. An eye color may occur more than once in the list. (HtDP Exercise 14.1.5)

   **Hint:** Use the Scheme operation append, which consumes two lists and produces
   the concatenation of the two lists. For example:

   (append (list 'a 'b 'c) (list 'd 'e)) = (list 'a 'b 'c 'd 'e)