L1: Recursive Programming in List (1)

1. (a) Given a list and an atom insert the atom in the list after the 2nd, 4th, 6th, and so on, elements
   (b) Define a function that extracts a list of all atoms of a multi level list in reverse order. E.g., (((A B) C) (D E)) → (E D C B A)
   (c) Define a function that computes the largest common denominator of the elements of a list
   (d) Define a function that determines the number of appearances of an atom in a list

2. (a) Define a function that selects the n-th element of a list or nil if it does not exist.
   (b) Define a function that checks if an atom is a member of a lists, not necessarily linear.
   (c) Build a list of all lublists of a list. By a sublist we understand the list itself and all elements of the list on any level that are also lists. E.g. (1 2 (3 (4 5) (6 7)) 8 (9 10)) → ((1 2 (3 (4 5) (6 7)) 8 (9 10)) (3 (4 5) (6 7)) (4 5) (6 7) (9 10)).
   (d) Define a function that transforms a linear list into a set.

3. (a) Define a function that computes the elementwise product of two vectors.
   (b) Define a function that computes the depth of a list.
   (c) Define a function that sorts a list without with no duplicates.
   (d) Define a function that finds the intersection of two sets.

4. (a) Define a function that computes the sum of two vectors.
   (b) Define a function that builds the ist of atoms of another list of any depth in the same order. E.g., (((A B) C) (D E)) → (A B C D E)
   (c) Define a function that takes a list as an argument and reverses only contiguous sequences of atoms. E.g., (a b c (d (e f) g h i)) → (c b a (d (f e) i h g))
   (d) Define a function that returns the maximum of the numeric atoms of a list at top level.

5. (a) Define a function that interleaves two sorted lists while maintaining duplicates.
   (b) Define a function that substitutes and element E with the elements of a list L1 in a list L at all levels.
   (c) Define a function that computes the sum of two numbers represented as lists.
   (d) Define a function that returns the largest common denominator of the numbers in a list.

6. (a) Duplicate the n-th element of a list. E.g., (1 2 3 4), n=3 → (1 2 3 3 4)
   (b) Create associations of the elements of two slits. E.g., (A B C) (X Y Z) → (A.X B.Y C.Z)
   (c) Count all sublists of a list including the list itself. E.g., (1 2 (3 (4 5) (6 7)) 8 (9 10)) → 5
   (d) Count the number of atoms at of a list.

7. (a) Determine if a list has no sublists.
   (b) Define a funstion that replaces the first appearance of a value with another value.
   (c) Replace all sublists with its last element at any level. E.g., (a (b c) (d ((e) f))) → (a c ((e) f)) → (a c f)
   (d) Merge two lists without duplicates.

8. (a) Delete the n-th element of a list.
   (b) Define a function that returns the successor of a number represented as a list. E.g., (1 9 3 5 9 9) → (1 9 3 6 0 0)
   (c) Find the set of atoms of a list and its sublist. E.g., (1 (2 (1 3 (2 4) 3) 1) (1 4)) → (1 2 3 4)
   (d) Define a function that checks if a list is a set.

9. (a) Define a function that returns the difference of two sets.

   (b) Define a function that reverses a list including all its sublists.

   (c) Given a list compute the list of all first elements of all top level sublists E.g., (1 2 (3 (4 5) (6 7)) 8 (9 10 11)) → (1 3 9)

   (d) Define a function that sums all numeric atoms of a list at top level.

10. (a) Define a function that find the product of all numeric atoms of a list at top level.

    (b) Find all ordered pairs of a list.

    (c) Define a function that computes an arithmetic expression in preorder. E.g., (+ * 2 4 - 5 * 2 2) → 9 ((2 * 4) + (5 - (2 * 2)))

    (d) Define a function that given a list returns a list of paris with each unique element of the list and their count. E.g., (A B A B A C A) → ((A 4) (B 2) (C 1))

11. (a) Find the lowest common multiple of the numbers in a list.

    (b) Check if a list of numbers is mountain shaped.

    (c) Delete all occurancesof the maximum value of a list.

    (d) Find the product of all even numbers in a list at any level.

12. (a) Compute the inner product of two vectors.

    (b) Find the maximum numerical atomic value in a list at any level.

    (c) Compute the ist of permutations of a list.

    (d) Determine if a list has an even number of element at the top level without explicitly counting them.

13. (a) Inser a value at the n-th index of a list

    (b) Compute the sum of all numeric atomic values at any level of a list.

    (c) Compute the list of all sublists of a list.

    (d) Check if two sets are equal without doing a set difference.

14. (a) Delete the values at at position n and all multiples of n.

    (b) Check if a list is valey shaped.

    (c) Find the minimum numeric atomic value at any level of a list.

    (d) Define a function that deletes all occurances of the minimum value of a list.

15. (a) Compute the union of two sets.

    (b) Find the product of all numeric values of a list at any level.

    (c) Sort a list while keeping duplicates.

    (d) Define a function that returns a list of all indices of the minimum value of a list