Module 11 — Lists: Activities

1. Define a list with five elements “air”, “water”, “fire”, “earth”, “ether” in this order. Then sort the list using sorted and sort. One will change the list in place, the other will create a new list. Then print out the first, second, last, and pen-ultimate elements of the sorted list.

2. Create a list of the first 100 numbers 1 … 100. Create a list of the numbers 501 … 600. Then create a list combining those numbers.

3. Given a list of numbers, calculate the arithmetic mean, the geometric mean, and the harmonic mean. Recall that the arithmetic mean of numbers $x_1, x_2, \ldots, x_n$ is $(x_1 + x_2 + \ldots + x_n)/n$, the geometric mean is $(x_1 \times x_2 \times \ldots \times x_n)^{1/n}$ and the harmonic mean is $\frac{1}{x_1} + \frac{1}{x_2} + \ldots + \frac{1}{x_n}$. On the right is code for the calculation of the arithmetic mean. An alternative is the use of the \texttt{sum( )} function.

4. When we process a list, we often create an empty list \texttt{(result = [ ])}, walk through the list using a for-statement, and decide what we append to the result-list. Here is a program that finds all elements that appear at least twice in the list. We walk through the list, looking at all its elements. We place an element in a list \texttt{once} unless this element is already in the list \texttt{once}. In this case, we add it to a list \texttt{multiple} of elements seen at least twice, unless of course it is already in the list. There are other ways to solve this problem, we can for example use the list method \texttt{index}. Note that we are using the test: if element in list to test whether an element is in the list.

(a) Define a function \texttt{elements(lista)} that gives a list of all elements in \texttt{lista}, which each elements appearing exactly once. For example, the result of \texttt{elements([1, 2, 3, 2, 3, 4, 3, 4, 5])} is [1, 2, 3, 4, 5].

(b) Define a function \texttt{minus(list1, list2)} that returns a list of all elements in \texttt{list1} that are not in \texttt{list2}.

(c) Define a function \texttt{intersection(list1, list2)} that returns a list of all elements that are both in \texttt{list1} and \texttt{list2}, but without repeating elements.

```python
def arithmetic_mean(lista):
    suma = 0
    for elemento in lista:
        suma += elemento
    return suma/len(lista)

def find_multiples(lista):
    once = []
    multiple = []
    for element in lista:
        if element in once:
            if element not in multiple:
                multiple.append(element)
        else:
            once.append(element)
    return multiple
```