Degree in Software Engineering – Computing Basics

Unit 2.7 Exercises: Structured Data Types (I)

This document includes a collection of exercises from the first part of Unit 2.7: Structured Data Types. It is recommended that you try doing the exercises without looking at the solutions first, and then you check your answers.

Exercise 1

Write a function that takes a list of integers as input parameter and returns the number of even natural numbers in it. Assume the function always receives valid input parameters. Do you want an additional challenge? Then define the function so that it allows lists containing data of any type.

Write a main program that defines an example list and shows the number of elements that meet the above condition on screen.

Example for list [-2, 6, -6, 7, 1, 0, 4, 12]:

```
The list contains 3 even natural numbers
After calling the function, the list is [-2, 6, -6, 7, 1, 0, 4, 12]
```

Exercise 2

Modify the above exercise so that the defined function not only returns the number of even naturals in the list, but also replaces all these values in the original list by their corresponding negative values. Therefore, the list passed as a parameter to the function may be modified.

Example for list [-2, 6, -6, 7, 1, 0, 4, 12]:

```
The list contained 3 even natural numbers
After calling the function, the list is [-2, -6, -6, 7, 1, 0, -4, -12]
```

Exercise 3

Modify the above exercise so that the function still replaces even naturals in the list by their corresponding negative values, but it returns a new list containing the original values being replaced, only and exclusively.

Example for list [-2, 6, -6, 7, 1, 0, 4, 12]:

```
3 elements were replaced, and they were [6, 4, 12]
After calling the function, the list is [-2, -6, -6, 7, 1, 0, -4, -12]
```

Exercise 4

Write a function that takes a natural number n as input parameter and returns a list with the n first numbers of the Fibonacci series. Assume the function always receives valid input parameters. Remember that the Fibonacci series is defined as follows:

$$f_0 = 0 \qquad f_1 = 1 \qquad f_n = f_{n-1} + f_{n-2}$$

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Write a main program that takes the number of elements of the Fibonacci series to print from the user, then obtains the corresponding list from the function, and finally prints the corresponding values.

Example:
| ```
Input number of Fibonacci numbers to show: 8
0 1 1 2 3 5 8 13
``` |

Exercise 5

Write a function that takes two lists as parameters and returns a new list containing the elements that are present in both lists. The resulting list must not contain duplicates. Assume the function always receives valid input parameters.

Given the above function, write a main program that shows its correct behavior with any two lists.

Example for lists [1, 6, 6, 5, 2, 8] and [2, 8, 8, 6]:
| ```
The elements present in both lists are [6, 2, 8]
``` |

Exercise 6

Write a function that takes a numeric list as parameter and returns both its arithmetic mean and standard deviation. Assume the function always receives valid input parameters. Remember these values are calculated as follows:

$$\mu = \frac{\sum_{i=1}^{N} x_i}{N}$$

$$\sigma = \sqrt{\frac{\sum_{i=1}^{N}(x_i - \mu)^2}{N}}$$

where N is the population size (number of elements in the list), μ is the average, and σ is the standard deviation of the population.

Write a main program that asks the user how many numbers they want to input, and then requests each value one by one until the list is filled. Once the list is ready, the program must show the corresponding mean and standard deviation on screen using two decimal digits.

Example:
| ```
Input population size: 5
Input value #1: 1.7
Input value #2: 2
Input value #3: 7.21
Input value #4: 4
Input value #5: -6
The average is 1.78 and the standard deviation is 4.36
``` |