14BHD COMPUTER SCIENCES, 2020/2021

Laboratory 8

Goals

- Define lists and tables
- Manipulate and perform calculations on lists and tables

Technical contents

- Definition of list and operations on elements
- Definition of tables and manipulation of its elements

To be solved in the laboratory

~~Exercise 1~~. Write a function def merge(a, b) that merges two lists, alternating elements from both lists. If one list is shorter than the other, then alternate as long as you can and then append the remaining elements from the longer list. For example, if a is 1 4 9 16 and b is 9 7 4 9 11 then merge returns a new list containing the values 1 9 4 7 9 4 16 9 11 [P6.30]

~~Exercise 2~~. Write a function def neighborAverage(values, row, column) that computes the average of the neighbors of a table element in the eight directions shown in Figure below. However, if the element is located at the boundary of the table, only include the neighbors that are in the table. For example, if row and column are both 0, there are only three neighbors. [P6.23]

[i -1] [j - 1]	[i - 1] [j]	[i - 1] [j + 1]
[i] [j - 1]	[i] [j]	[i] [j + 1]
[i + 1] [j - 1]	[i + 1] [j]	[i + 1] [j + 1]

~~Exercise 3~~. *Magic squares*. An *n* × *n* matrix that is filled with the numbers 1, 2, 3, ..., *n*2 is a magic square if the sum of the elements in each row, in each column, and in the two diagonals is the same value. For instance, this is a magic square with size 4:

16	3	2	13
5	10	11	8
9	6	7	12
4	15	14	1

Write a program that reads in 16 values from the keyboard and tests whether they form a magic square when put into a 4 × 4 table. You need to test two features:

1. Does each of the numbers 1, 2, …, 16 occur in the user input?
2. When the numbers are put into a square, are the sums of the rows, columns, and diagonals equal to each other?

[P6.21]

To do at home

Exercise 4. Write a function def mergeSorted(a, b) that merges two *sorted* lists, (assume that they are already ordered) producing a new sorted list. Keep an index into each list, indicating how much of it has been processed already. Each time, append the smallest unprocessed element from either list, then advance the index.
The starting lists must not be modified. For example, if a is 1 4 9 16 and b is 4 7 9 9 11, then mergeSorted returns a new list containing the values 1 4 4 7 9 9 9 11 16. Do **not** use the sort method or the sort function. [P6.31]

Exercise 5. Write a program that plays tic-tac-toe. The tic-tac-toe game is played on a 3 × 3 grid as in the figure below. The game is played by two players, who take turns. The first player marks moves with a circle, the second with a cross. The player who has formed a horizontal, vertical, or diagonal sequence of three marks wins. Your program should draw the game board, ask the user for the coordinates of the next mark, change the players after every successful move, and pronounce the winner.

X		O
	X	O
O	O	X

[P6.28]