

Homework 1

Write Python functions to solve the following problems:

1. Calculate the number of lines in a matrix with the property that the elements are in ascending order.
2. Determine the columns of a matrix with the property that they have the smallest element equal to 5.
3. Implement the bubble sort algorithm to sort each line of an array.
4. Implement the insertion sort algorithm to sort each column of an array.
5. Write a recursive function for calculating the cmmdc between two non-zero natural numbers
6. Let A and B be two square matrices and n a non-zero natural number. Calculate A^T , $A+B$, $A*B$ și A^n .
7. Implement insertion sorting algorithm using list and vector.
8. Check the property of a permutation to be identical permutation
9. Let S be the set of binary vectors of length 7. Calculate using random generation, a matrix A with 20 lines - vectors from S and a vector V with 20 elements, each $V[i]$ representing the quality of line i from A, defined by the sum of bits from line (vector) i.
10. Use A and V from exercise 9. Arrange the lines of the matrix A so that the elements of V are in ascending order.
11. Implement the hill-climbing algorithm to calculate the maximum for function:
$$f: \{1,2, \dots, 2500\} \rightarrow \mathbb{R}, f(x) = (\sin(x - 2)) - x * \cos(x).$$
12. Let $f: \{1,2, \dots, 2500\} \rightarrow \mathbb{R}, f(x) = (\sin(x - 2))^2$ the objective function of a maximum problem. Each phenotype $x \in \{1,2, \dots, 2500\}$ corresponds to a binary string genotype obtained by the standard base 2 representation of x. Solve the maximum problem using a hill climbing algorithm.