LABORATORY 10

REQUIREMENT

You will be assigned with a problem from the list below and you are required to solve the problem using the BACKTRACKING programming method, using both an ITERATIVE and a RECURSIVE backtracking implementation.

PROBLEM STATEMENTS

1) A number of **n** coins are given, with values of a_1, ..., a_n and a value **s**. Display all payment modalities for the sum **s**. If no payment modality exists print a message.

2) Consider a positive number **n**. Determine all its decompositions as sums of prime numbers.

3) The sequence **a** = a_1, ..., a_n with integer elements is given. Determine all strictly increasing subsequences of sequence **a** (conserve the order of elements in the original sequence).

4) A player at PRONOSPORT wants to choose score options for four games. The options may be 1, X, 2. Generate all possible alternatives, knowing that:
- The last score option may not be x;
- There should be no more than two score options of 1.

5) The sequence **a** = a_1, ..., a_n with distinct integer numbers is given. Determine all subsets of elements having the sum divisible by a given **n**.

6) Generate all sequences of **n** parentheses that close correctly. Example: for **n**=4 there are two solutions: (()) and ()().

7) Generate all subsequences of length 2n+1, formed only by 0, -1 or 1, such that a_1 = 0, ..., a_{2n+1}= 0 and $|a_{i+1} - a_i|$ = 1 or 2, for any 1 ≤ i ≤ 2n.

8) Consider n points in a plane, given by their coordinates. Determine all subsets with at least three elements formed by collinear points. If the problem has no solution, give a message.

9) The sequence **a** = a_1, ..., a_n with distinct integer elements is given. Determine all subsets of at least two elements with the property:
- The elements in the subset are in increasing order;
- Any two consecutive elements in the subsequence have at least one common digit.

10) A group of **n** (n<=10) persons, numbered from 1 to n are placed on a row of chairs, but between every two neighbor persons some conflicts appeared. Display all the possible modalities to replace the persons, such that between any two persons in conflict stay one or at most two other persons.

11) Two natural numbers **m** and **n** are given. Display in all possible modalities the numbers from 1 to n, such that between any two numbers on consecutive positions, the difference in absolute value is at least m. If there is no solution, display a message.

12) Consider the natural number **n** (n<=10) and the natural numbers a_1, ..., a_n. Determine all the possibilities to insert between all numbers a_1, ..., a_n the operators + and – such that by evaluating the expression the result is positive.

13) The sequence a_1, ..., a_n of distinct integer numbers is given. Display all subsets with a mountain aspect. A set has a mountain aspect if the elements increase up to a point and then they decrease. E.g. 10, 16, 27, 18, 14, 7.

14) Generate all numbers of n digits with the property that no number has two identical neighboring subsequences. For example, for n=6, 121312 is correct, and 121313 and 132132 are not correct.