Functional and logic programming
- **written exam -**

Important:

1. Subjects are graded as follows: By default - 1p; A – 2p; B - 4p; C - 3p.
2. Prolog problems will be resolved using SWI Prolog. The following are required: (1) explanation of the code and of the reasoning behind it; (2) recursive model that solves the problem, for all the predicates used; (3) specification of every predicate (parameters and their meaning, flow model, type of the predicate - deterministic/non-deterministic).
3. Lisp problems will be resolved using Common Lisp. The following are required: (1) explanation of the code and of the reasoning behind it; (2) recursive model that solves the problem, for each function used; (3) specification of every function (parameters and their meaning).

A. Let L be a list of numbers and given the following PROLOG predicate definition with flow model (i, o):

```
f([],-1).
f([H|T],S):-f(T,S1),S1>0,!,S is S1+H.
f([_|T],S):-f(T,S1),S is S1.
```

Rewrite the definition in order to avoid the recursive call **f(T,S)** in both clauses. Do NOT redefine the predicate. Justify your answer.

B. Write a PROLOG program that generates the list of all subsets with N elements, using the elements of a list, such that the sum of elements from a subset is an even number. Write the mathematical models and flow models for the predicates used. For example, for the list L=[1, 3, 4, 2] and N=2 ⇒ [[1,3], [2,4]].

C. Given a nonlinear list, write a Lisp function to return the list with all atoms on the level **k** replaced by 0. The superficial level is assumed 1. **A MAP function shall be used.**
Example for the list (a (1 (2 b)) (c (d))) **a)** k=2 => (a (0 (2 b)) (0 (d)))
b) k=1 => (0 (1 (2 b)) (c (d))) **c)** k=4 => the list does not change