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. Given the following PROLOG predicate definition **f(integer, integer),** with the flow model (i, o):

```
f(100, 1):-!.
f(K,X):-K1 is K+1, f(K1,Y), Y>1, !, K2 is K1-1, X is K2+Y.
f(K,X):-K1 is K+1, f(K1,Y), Y>0.5, !, X is Y.
f(K,X):-K1 is K+1, f(K1,Y), X is Y-K1.
```

Rewrite the definition in order to avoid the recursive call **f(J,V)** in all clauses. Do NOT redefine the predicate. Justify your answer.

B. Given a list made of integer numbers, generate in PROLOG the list of all subsets with even number of elements. Write the mathematical models and flow models for the predicates used. For example, for the list L=[2,3,4] $\Rightarrow$ [[],[2,3],[2,4],[3,4]] (not necessarily in this order).

C. Given a nonlinear list, write a Lisp function to replace all even numerical values with their natural successor. **A MAP function shall be used.**
Example for the list (1 s 4 (2 f (7))) the result is (1 s 5 (3 f (7))).