

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 **f(list, integer)**, with the flow model (i, o):

f([], 0).

f([H|T],S):-**f(T,S1)**,S1<H,!,S is 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 of sum **S** given, using the elements of a list, such that the number of even elements from each subset is even. Write the mathematical models and flow models for the predicates used. For example for the list [1, 2, 3, 4, 5, 6, 10] and $S=10 \Rightarrow [[1,2,3,4], [4,6]]$.

C. An n-ary tree is represented in Lisp as (node subtree1 subtree2 ...). Write a Lisp function to return the list of nodes on the given level **k**. The root level is assumed zero. **A MAP function shall be used.** ***Example*** for the tree (a (b (g)) (c (d (e)) (f)))

a) k=2 => (g d) **b)** k=5 => ()