

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. The following function definition in LISP is given

```
(DEFUN F(N)
  (COND
    ((= N 1) 1)
    (> (F (- N 1)) 2) (- N 2))
    (> (F (- N 1)) 1) (F (- N 1)))
    (T (- (F (- N 1)) 1))
  )
)
```

Rewrite the definition in order to avoid the repeated call **(F (- N 1))**. Do NOT redefine the function. Do NOT use SET, SETQ, SETF. 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 $N=2 \Rightarrow [[1,3], [2,4]]$.

C. Given a nonlinear list, write a Lisp function to return the list with all even numerical atoms from an odd level removed. The superficial level is assumed 1. **A MAP function shall be used.**

Example **a)** if the list is (1 (2 A (4 A)) (6)) => (1 (2 A (A)) (6))

b) if the list is (1 (2 (C))) => (1 (2 (C)))