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(L)
        (COND
              ((NULL L) 0)
              ((> (F (CAR L)) 1) (F (CDR L)))
              (T (+ (F (CAR L)) (F (CDR L))))
        )
)
```

Rewrite the definition in order to avoid the double recursive call **(F (CAR L))**. 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 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 ⇒ [[1,2,3,4], [4,6]].

C. Given a nonlinear list, write a Lisp function to return the list with all occurrences of the element **e** replaced by the value **e1**. **A MAP function shall be used.**

Example **a)** if the list is (1 (2 A (3 A)) (A)), **e** is A and **e1** is B => (1 (2 B (3 B)) (B))

b) if the list is (1 (2 (3))) and **e** is A => (1 (2 (3)))