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
            ((ATOM L) -1)
            ((> (F (CAR L)) 0) (+ (CAR L) (F (CAR L)) (F (CDR L))))
            (T (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 permutations with the property the absolute value of difference between two consecutive values from each permutation is <=3. Write the mathematical models and flow models for the predicates used. For example, for L=[2,7,5] ⇒ [[2,5,7], [7,5,2]] (not necessarily in this order).

C. Given a nonlinear list, write a Lisp function to replace all the odd values from even levels with their natural successor. The superficial level is assumed 1. **A MAP function shall be used.**
Example for the list (1 s 4 (3 f (7))) the result is (1 s 4 (4 f (7))).