Functional and logic programming
- written exam -

Important:
1. Subjects are graded as follows: of - 1p; A – 1.5p; B - 2.5p; C - 2.5p; D - 2.5p.
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 **G** be LISP function and given the following definition
```
(DEFUN F(L)
      (COND
            ((NULL L) 0)
            (> (G L) 2) (+(G L) (F (CDR L))))
            (T (G L))
      )
)
```

Rewrite the definition in order to avoid the repeated call **(G L)**. Do NOT redefine the function. Do NOT use SET, SETQ, SETF.Justify your answer.

B. Given a numerical linear list, write a SWI-Prolog program that returns (in a list of pairs) all possible partitions of the initial list in two sublists, such that all elements of the sublists are relatively prime numbers (all elements of the first sublist are relatively prime and all elements of the second list are relatively prime). To avoid generating the same partition twice (ex: [A, B] and [B, A]), the first sublist will contain at most the same number of elements as the second sublist. For example, for the list [3, 5, 7, 9], the result will be (not necessarily in this order): [[[5, 3], [9, 7]], [[7, 3], [9, 5]], [[3], [9, 7, 5]], [[9, 5], [7, 3]], [[9, 7], [5, 3]], [[9], [7, 5, 3]]].

C. Given a list composed of integer numbers, generate in PROLOG the list of arrangements of N elements ending with an odd value and have the sum S given. Write the mathematical models and flow models for the predicates used. For example, for the list L=[2,7,4,5,3], N=2 and S=7 ⇒ [[2,5], [4,3]] (not necessarily in this order).

D. An n-ary tree is represented in Lisp as (node subtree1 subtree2 ...). Write a Lisp function to determine the path from the root to a given node. **A MAP function shall be used.**
Example for the tree (a (b (g)) (c (d (e)) (f)))
(a) nod=e => (a c d e)   **(b)** nod=v => ()