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 L be a list of numbers and given the following PROLOG predicate definition with flow model (i, o):

```
f([],0).
f([H|T],S):-f(T,S1),S1>=2,!,S is S1+H.
f([_|T],S):-f(T,S1),S is S1+1.
```

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. Given a nonlinear list that contains numerical and non-numerical atoms, write a LISP program that replaces each even numerical atom on odd levels with the sum of its digits. The superficial level is odd. For example, for the list (A 2 (B 31 F (D 102 5 T (66) E) (D 10 (E R 51)) 99)) the result will be (A 2 (B 31 F (D 3 5 T (66) E) (D 1 (E R 51)) 99)).

C. Write a PROLOG program that generates the list of all subsets of k elements (all elements being odd numbers) in arithmetic progression. Write the mathematical models and flow models for the predicates used. For example, for L=[1,5,2,9,3] and k=3 $\Rightarrow$ [[1,5,9],[1,3,5]] (not necessarily in this order).

D. Given a nonlinear list, write a Lisp function to return the list with all the numerical atoms that are multiple of 3 removed. **A MAP function shall be used.**

Example   **a)** if the list is (1 (2 A (3 A)) (6)) => (1 (2 A (A)) NIL)
b) if the list is (1 (2 (C))) => (1 (2 (C)))