Recursivitate – continuare

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Testarea daca e1 se afla inaintea lui e2 in lista l

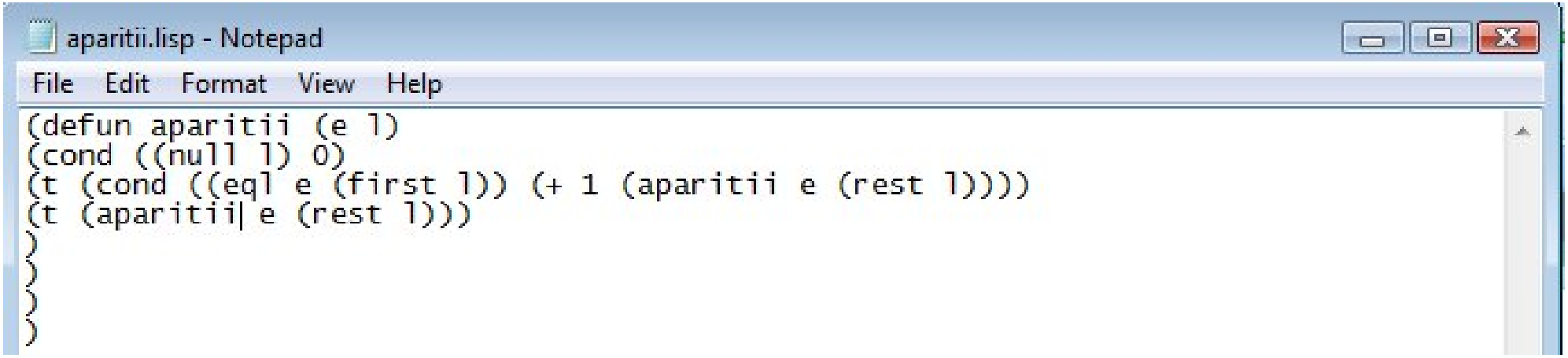
inainte.lisp - Notepad

File Edit Format View Help

```
(defun inainte (e1 e2 l)
(if (null l) nil (if (and (eql e1 (first l)) (member e2 l)) t (inainte e1 e2 (rest l))))
)
```

```
[145]> (inainte 'a 'b '(a c d e b f g))
T
[146]> (inainte 'a 'b '(d c b d a e f g))
NIL
[147]> (inainte 'a 'b '(d c a e f g))
NIL
```

Numarul aparitiilor unui element intr-o lista




```
[12]> (aparitii 'a '(a b c a d e a f))
3
```

Testarea egalitatii elementelor a doua liste

egale.lisp - Notepad

File Edit Format View Help

```
(defun egale (l1 l2)
(cond ((null l1) (null l2))
((null l2) nil)
((eql (first l1) (first l2)) (egale (rest l1) (rest l2)))
(t nil)
)
)
```

```
[15]> (egale '(a b c) '(a b c))
T
[16]> (egale '(a b c) '(a b c d))
NIL
[17]> (egale '(a b c d) '(a b c))
NIL
[18]> (egale '() '(a))
NIL
[19]> (egale '(a) '())
NIL
[20]> (egale '() '())
T
```

Elementul de pe pozitia *n* din lista *l*


```
[37]> (elemn 0 '(a b c))
NIL
[38]> (elemn 1 '(a b c))
A
[39]> (elemn 3 '(a b c))
C
[40]> (elemn 2 '(a b c))
B
```

Obtinerea listei elementelor de dupa pozitia *n*

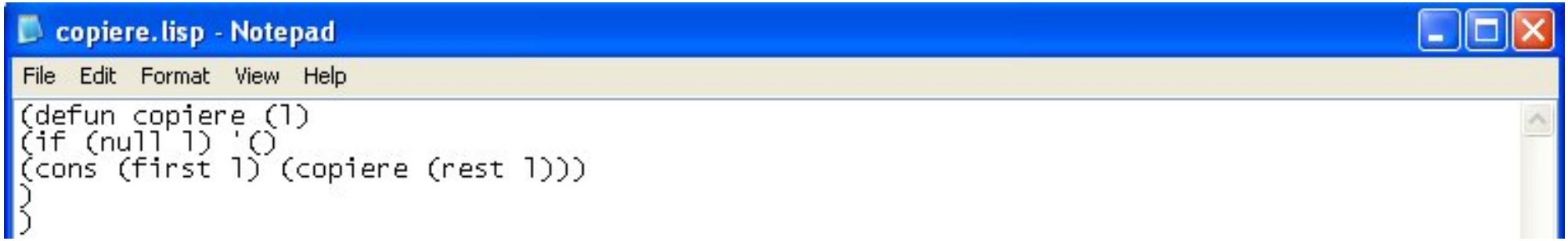
totifaran.lisp - Notepad

File Edit Format View Help

```
(defun totifaran (n l)
(cond ((= n 0) l)
(t (totifaran (- n 1) (rest l)))
)
)
```

```
[45]> (totifaran 0 '(a b c))
(A B C)
[46]> (totifaran 1 '(a b c))
(B C)
[47]> (totifaran 3 '(a b c))
NIL
[48]> (totifaran 0 '())
NIL
[49]> (totifaran 2 '())
NIL
```

Construirea copiei unei liste




```
[3]> (copiere '(1 2 3))
(1 2 3)
```

Concatenarea a doua liste

append.lisp - Notepad

File Edit Format View Help

```
(defun append (l1 l2)
(if (null l1) l2
(cons (first l1) (append (rest l1) l2))
)
)
```

```
[7]> (append '(a b c) '(c d))
(A B C C D)
```

Inversarea unei liste

inversa.lisp - Notepad

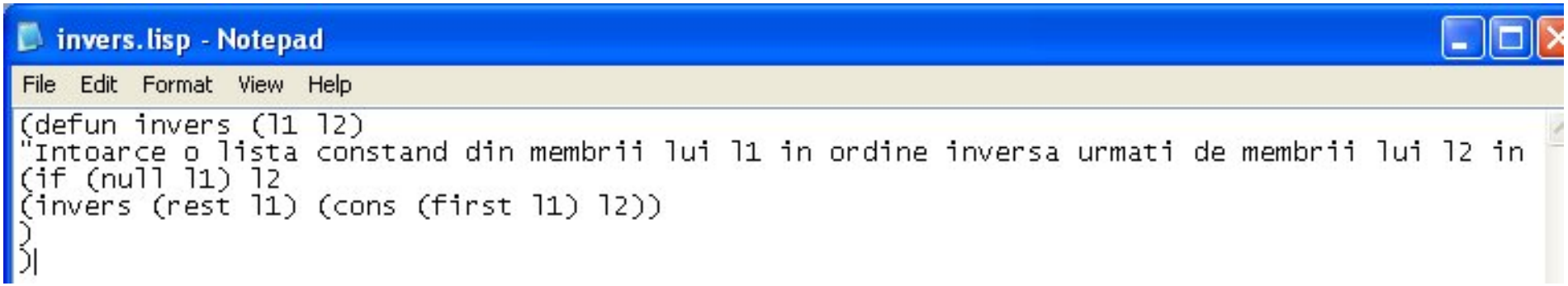
File Edit Format View Help

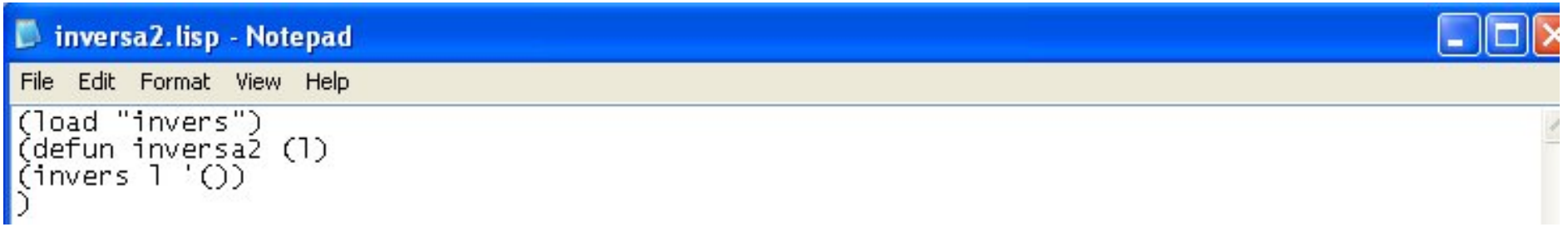
```
(load "append")
(defun inversa (l)
(if (null l) '()
(append (inversa (rest l)) (list (first l)))
)
)
```

Transforma un element simplu in lista ce contine acel element.

```
[11]> (inversa '(a b c d e))
(E D C B A)
```

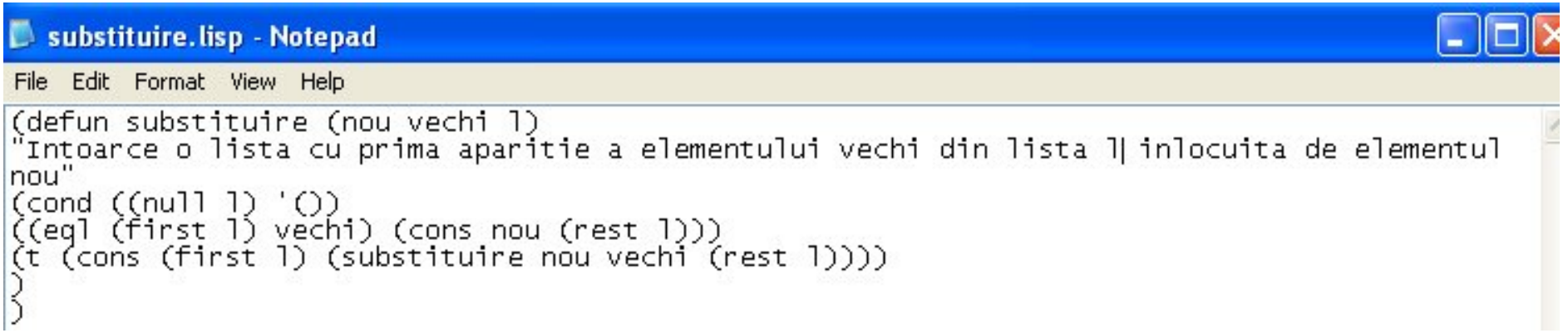
Inversa – alta solutie



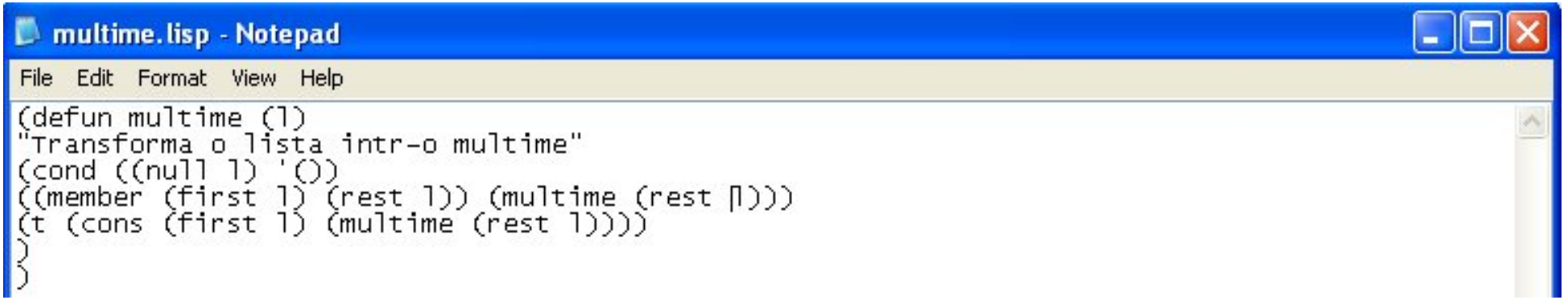



```
[15]> (inversa2 '(a b c d e))
(E D C B A)
```

Substituirea primei aparitii a unui element dintr-o lista cu un element nou

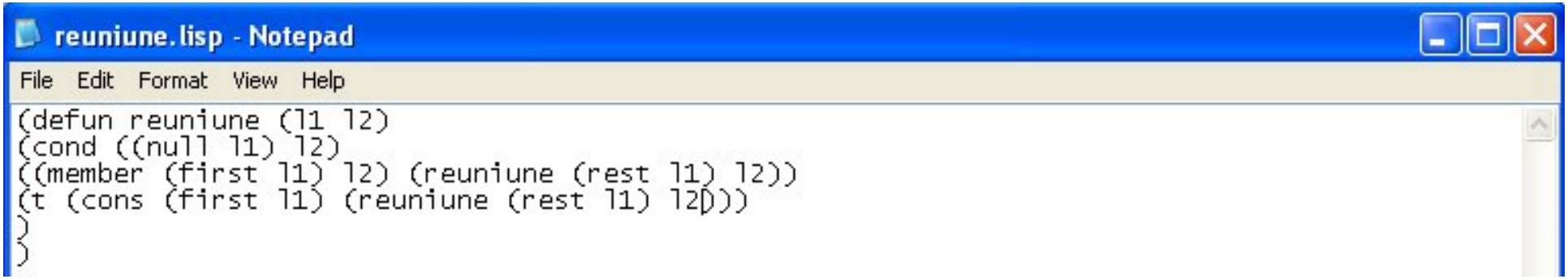


Transformarea din lista in multime




```
[27]> (multime '(a b c b a d e c))
(B A D E C)
```

Reuniunea a doua multimi




```
[30]> (reuniune '(a b c) '(d e c))
(A B D E C)
```

Lista cu primele *n* elemente din lista data ca argument

primelen.lisp - Notepad

File Edit Format View Help

```
(defun primelen (n l)
(if (= n 0) '()
(cons (first l) (primelen (- n 1) (rest l)))
)
)
```

```
[37]> (primelen 3 '(a b c))
(A B C)
[38]> (primelen 3 '(a b c d e))
(A B C)
```

Inserarea unui element intr-o multime

inserare.lisp - Notepad

File Edit Format View Help

```
(defun inserare (e l)
(if (member e l) l
(cons e l)
)
)
```

```
[66]> (inserare '3 '(1 2 4 5))
(3 1 2 4 5)
[67]> (inserare '3 '(1 2 3 4 5))
(1 2 3 4 5)
```

Intersectia a doua multimi

intersectie.lisp - Notepad

File Edit Format View Help

```
(defun intersectie (l1 l2)
(cond ((null l1) '())
((not (member (first l1) l2)) (intersectie (rest l1) l2))
(t (cons (first l1) (intersectie (rest l1) l2)))
)
)
```

```
[79]> (intersectie '(5 1 7 9 3) '(2 3 1 5 6 9))
(5 1 9 3)
[80]> (intersectie '(5 1 7 9 3) '(2 1 6))
(1)
[81]> (intersectie '(5 1 7 9 3) '(2 6))
NIL
```

Diferenta a doua multimi

diferenta.lisp - Notepad

File Edit Format View Help

```
(defun diferenta (l1 l2)
(cond ((null l1) '())
((member (first l1) l2) (diferenta (rest l1) l2))
(t (cons (first l1) (diferenta (rest l1) l2)))
)
)
```

```
[84]> (diferenta '(1 2 3) '(3 4 5))
(1 2)
[85]> (diferenta '(a b c) '(c a b))
NIL
```

Verificarea daca o multime e submultime a unei alte multimi

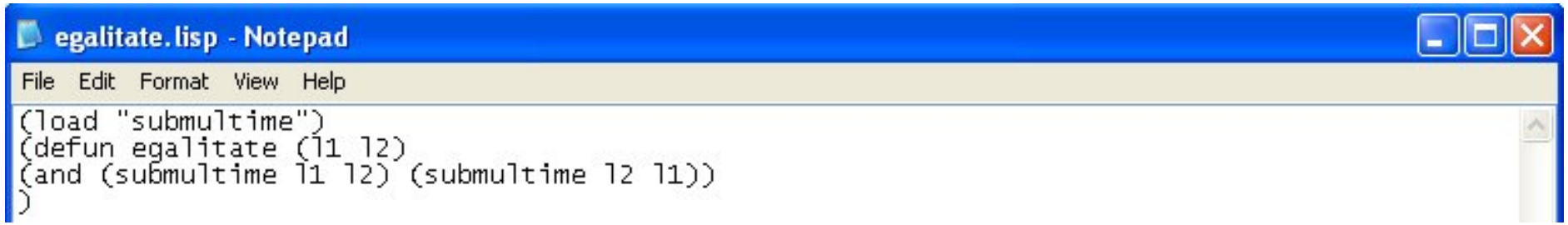
submultime.lisp - Notepad

File Edit Format View Help

```
(defun submultime (l1 l2)
"Intoarce true daca fiecare element al lui l1 apartine lui l2"
(cond ((null l1) t)
((member (first l1) l2) (submultime (rest l1) l2))
(t nil)
)
)
```

```
[89]> (submultime '(1 2) '(1 2 3))
T
[90]> (submultime '(1 2) '(1 3 4 2))
T
[91]> (submultime '(1 2) '(1 3 4))
NIL
[92]> (submultime '(1 2) '(2 3 4))
NIL
```

Egalitatea a doua multimi – fara a lua in considerare ordinea elementelor




```
[96]> (egalitate '(1 2) '(2 1))
T
[97]> (egalitate '(1 2) '(2 3))
NIL
[98]> (egalitate '(1 2) '(1 2 3))
NIL
```

Produsul cartezian a doua multimi

Vom defini o functie care cupleaza un element dat cu fiecare membru al unei liste, rezultand o lista a cuplurilor formate.

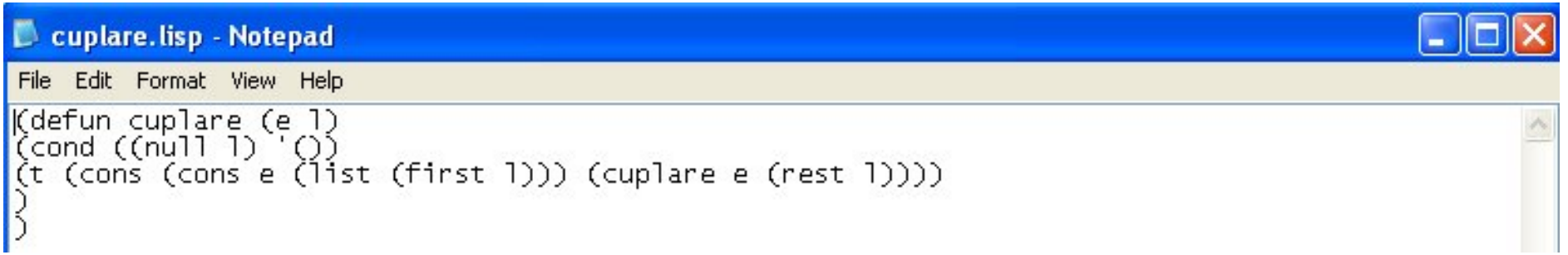
cartezian.lisp - Notepad

File Edit Format View Help

```
(load "cuplare")
(defun cartezian (l1 l2)
(cond ((null l1) '())
(t (append (cuplare (first l1) l2) (cartezian (rest l1) l2)))
)
)
```

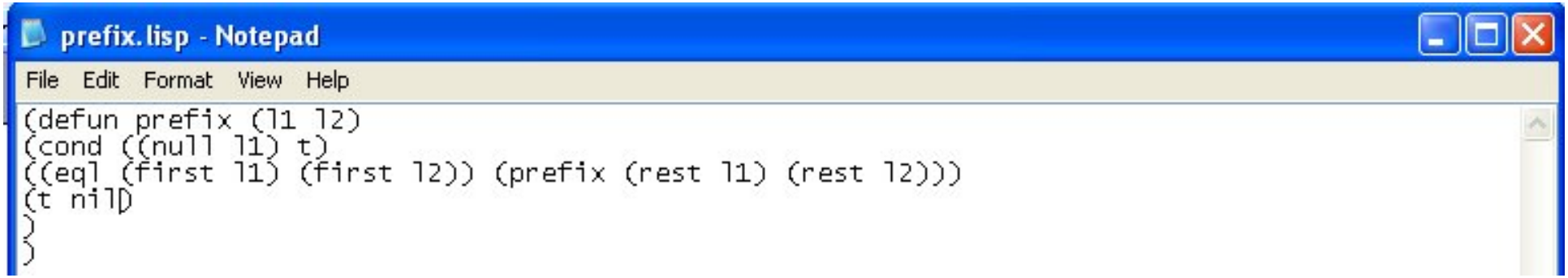
```
[4]> (cartezian '(a b) '(c d e))
((A C) (A D) (A E) (B C) (B D) (B E))
[5]> (cartezian '(a b c) '(x y z))
((A X) (A Y) (A Z) (B X) (B Y) (B Z) (C X) (C Y) (C Z))
```

Cuplarea unui element cu fiecare membru al unei liste



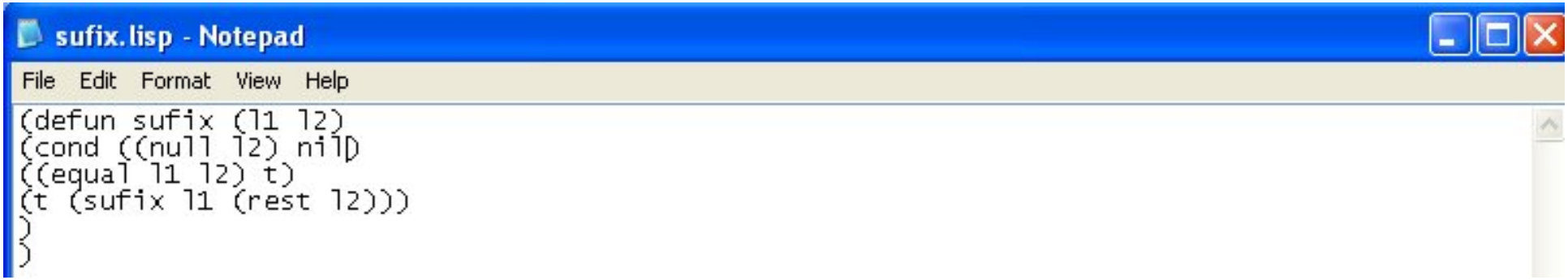

```
[8]> (cuplare 'a '(x y z))
((A X) (A Y) (A Z))
```

Prefixul unei liste




```
[20]> (prefix '(a b) '(a b c))
T
[21]> (prefix '(a b) '(a c b))
NIL
```

Sufixul unei liste




```
[3]> (sufix '(a b) '(c a b))
T
[4]> (sufix '(a b) '(c b a))
NIL
```

Schimbul intre 2 elemente dintr-o lista

schimb.lisp - Notepad

File Edit Format View Help

```
(defun schimbaElem (l p1 p2)
(cond ((null l) '())
((eql (first l) p1) (cons p2 (schimbaElem (rest l) p1 p2)))
((eql (first l) p2) (cons p1 (schimbaElem (rest l) p1 p2)))
(t (cons (first l) (schimbaElem (rest l) p1 p2)))
)
)
```

```
[1]> (compile-file "schimb.lisp")

Compiling file C:\Documents and Settings\Student\Desktop\clisp-2.30\schimb.lisp
...

Wrote file C:\Documents and Settings\Student\Desktop\clisp-2.30\schimb.fas
0 errors, 0 warnings
#P"C:\\Documents and Settings\\Student\\Desktop\\clisp-2.30\\schimb.fas" ;
NIL ;
NIL
[2]> (load "schimb")
;; Loading file C:\Documents and Settings\Student\Desktop\clisp-2.30\schimb.fas
...
;; Loaded file C:\Documents and Settings\Student\Desktop\clisp-2.30\schimb.fas
T
[3]> (schimbaElem '(1 2 3 4 5) 2 4)
(1 4 3 2 5)
```

Pozitia unui element intr-o lista

pozitia.lisp - Notepad

File Edit Format View Help

```
(defun pozitia (l el p)
(if (eql el (first l)) p (pozitia (rest l) el (+ p 1))
)
)
```

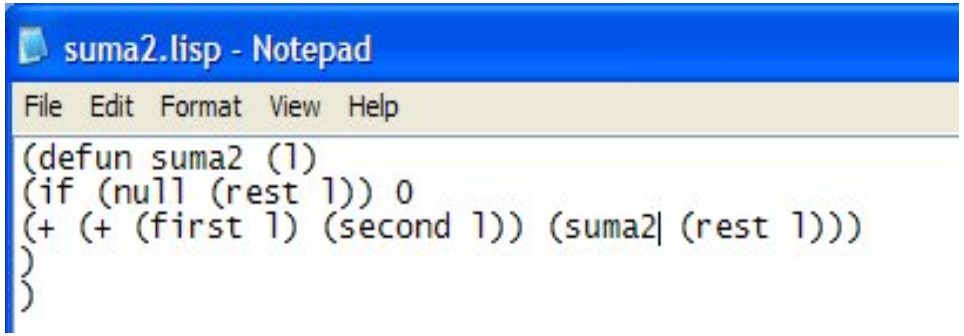
La apelare, contorul se initializeaza cu valoarea 1.

```
[13]> (compile-file "pozitia.lisp")

Compiling file C:\Documents and Settings\Student\Desktop\clisp-2.30\pozitia.lisp
 ...

Wrote file C:\Documents and Settings\Student\Desktop\clisp-2.30\pozitia.fas
0 errors, 0 warnings
#P"C:\\Documents and Settings\\Student\\Desktop\\clisp-2.30\\pozitia.fas" ;
NIL ;
NIL
[14]> (load "pozitia")
;; Loading file C:\Documents and Settings\Student\Desktop\clisp-2.30\pozitia.fas
 ...
;; Loaded file C:\Documents and Settings\Student\Desktop\clisp-2.30\pozitia.fas
T
[15]> (pozitia '(a b c d e) 'd 1)
4
```

Adunarea succesiva a cate doua elemente dintr-o lista



$$\sum_{i=1}^{n-1} \square x[i] \square\, x[i \square 1] \square$$

```
[16]> (compile-file "suma2.lisp")

Compiling file C:\Documents and Settings\Student\Desktop\clisp-2.30\suma2.lisp .
..

Wrote file C:\Documents and Settings\Student\Desktop\clisp-2.30\suma2.fas
0 errors, 0 warnings
#P"C:\\Documents and Settings\\Student\\Desktop\\clisp-2.30\\suma2.fas" ;
NIL ;
NIL
[17]> (load "suma2")
;; Loading file C:\Documents and Settings\Student\Desktop\clisp-2.30\suma2.fas .
..
;; Loaded file C:\Documents and Settings\Student\Desktop\clisp-2.30\suma2.fas
T
[18]> (suma2 '(1 2 3 4))
15
```

Impartirea unei liste in doua liste: prima cu elemente pare, cea de-a doua cu impare

listapi.lisp - Notepad

File Edit Format View Help

```
(defun pare (l)
(cond ((null l) '())
((= (mod (first l) 2) 0) (cons (first l) (pare (rest l))))
(t (pare (rest l)))
)
)

(defun impare (l)
(cond ((null l) '())
((/= (mod (first l) 2) 0) (cons (first l) (impare (rest l))))
(t (impare (rest l)))
)
)

(defun pareimpare (l)
(cons (pare l) (cons (impare l) '()))
)
```

```
[58]> (compile-file "listapi.lisp")

Compiling file C:\Documents and Settings\Student\Desktop\clisp-2.30\listapi.lisp
 ...

Wrote file C:\Documents and Settings\Student\Desktop\clisp-2.30\listapi.fas
0 errors, 0 warnings
#P"C:\\Documents and Settings\\Student\\Desktop\\clisp-2.30\\listapi.fas" ;
NIL ;
NIL
[59]> (load "listapi")
;; Loading file C:\Documents and Settings\Student\Desktop\clisp-2.30\listapi.fas
 ...
;; Loaded file C:\Documents and Settings\Student\Desktop\clisp-2.30\listapi.fas
T
[60]> (pareimpare '(1 2 3 4))
((2 4) (1 3))
```

Impartirea unei liste in doua liste: prima cu elementele de pe pozitiile pare, cea de-a doua cu cele de pe pozitiile impare

listapozpi - Notepad

File Edit Format View Help

```
(defun pozimpare(l)
(if (null l) '() (cons (first l) (pozimpare (rest (rest l))))
))
(defun pozpare(l)
(if (null (rest l)) '() (cons (second l) (pozpare (rest (rest l))))
))
(defun pozpareimpare(l)
(cons (pozpare l) (cons (pozimpare l) '()))
)
```

```
[97]> (compile-file "listapozpi.lisp")

Compiling file C:\Documents and Settings\Student\Desktop\clisp-2.30\listapozpi.l
isp ...

Wrote file C:\Documents and Settings\Student\Desktop\clisp-2.30\listapozpi.fas
0 errors, 0 warnings
#P"C:\\Documents and Settings\\Student\\Desktop\\clisp-2.30\\listapozpi.fas" ;
NIL ;
NIL
[98]> (load "listapozpi")
;; Loading file C:\Documents and Settings\Student\Desktop\clisp-2.30\listapozpi.
fas ...
;; Loaded file C:\Documents and Settings\Student\Desktop\clisp-2.30\listapozpi.f
as
T
[99]> (pozpareimpare '(a b c d e))
((B D) (A C E))
```

Determinarea tuturor numerelor pana la un numar n dat, care sunt divizibile cu un numar k

dv - Notepad

File Edit Format View Help

```
(defun div (k n)
(cond ((= n 0) '())
((= (mod n k) 0) (cons n (div k (- n 1))))
(t (div k (- n 1)))
)
)
```

```
[1]> (compile-file "dv.lisp")

Compiling file D:\Predare\Clisp\clisp-2.30\dv.lisp ...

Wrote file D:\Predare\Clisp\clisp-2.30\dv.fas
0 errors, 0 warnings
#P"D:\\Predare\\Clisp\\clisp-2.30\\dv.fas" ;
NIL ;
NIL
[2]> (load "dv")
;; Loading file D:\Predare\Clisp\clisp-2.30\dv.fas ...
;; Loaded file D:\Predare\Clisp\clisp-2.30\dv.fas
T
[3]> (div 3 19)
(18 15 12 9 6 3)
```

Maximul unei liste – Metoda 1

max1 - Notepad

File Edit Format View Help

```
(defun max1 (l)
(maxim l (first l))
)

(defun maxim (l m)
(cond ((null l) m)
((> (first l) m) (maxim (rest l) (first l)))
(t (maxim (rest l) m))
)
)
```

```
[15]> (compile-file "max1.lisp")

Compiling file D:\Predare\Clisp\clisp-2.30\max1.lisp ...

Wrote file D:\Predare\Clisp\clisp-2.30\max1.fas
0 errors, 0 warnings
#P"D:\\Predare\\Clisp\\clisp-2.30\\max1.fas" ;
NIL ;
NIL
[16]> (load "max1")
;; Loading file D:\Predare\Clisp\clisp-2.30\max1.fas ...
;; Loaded file D:\Predare\Clisp\clisp-2.30\max1.fas
T
[17]> (max1 '(1 4 3 2))
4
```

Maximul unei liste – Metoda 2

max2 - Notepad

File Edit Format View Help

```
(defun max2 (l)
(cond ((null (rest l)) (first l))
((> (first l) (second l)) (max2 (cons (first l) (rest (rest l)))))
(t (max2 (rest l)))
)
)
```

```
[27]> (compile-file "max2.lisp")

Compiling file D:\Predare\Clisp\clisp-2.30\max2.lisp ...

Wrote file D:\Predare\Clisp\clisp-2.30\max2.fas
0 errors, 0 warnings
#P"D:\\Predare\\Clisp\\clisp-2.30\\max2.fas" ;
NIL ;
NIL
[28]> (load "max2")
;; Loading file D:\Predare\Clisp\clisp-2.30\max2.fas ...
WARNING:
DEFUN/DEFMACRO: redefining MAX2; it was traced!
;; Loaded file D:\Predare\Clisp\clisp-2.30\max2.fas
T
[29]> (max2 '(1 4 3 2))
4
```

Maximul unei liste – Metoda 3

max3 - Notepad

File Edit Format View Help

```
(defun max3 (l)
(cond ((null (rest l)) (first l))
((> (first l) (max3 (rest l))) (first l))
(t (max3 (rest l)))
)
)
```

```
[33]> (compile-file "max3.lisp")

Compiling file D:\Predare\Clisp\clisp-2.30\max3.lisp ...

Wrote file D:\Predare\Clisp\clisp-2.30\max3.fas
0 errors, 0 warnings
#P"D:\\Predare\\Clisp\\clisp-2.30\\max3.fas" ;
NIL ;
NIL
[34]> (load "max3")
;; Loading file D:\Predare\Clisp\clisp-2.30\max3.fas ...
;; Loaded file D:\Predare\Clisp\clisp-2.30\max3.fas
T
[35]> (max3 '(1 4 3 2))
4
```

Quicksort – sortarea unei liste

quicksort - Notepad

File Edit Format View Help

```
(defun sortez (l)
(if (null l) '()
(append (sortez (selectMici (first l) (rest l))) (list (first l)) (sortez (selectMari (first l) (rest l))))
)
)

(defun selectMari (el l)
(cond ((null l) '())
((< el (first l)) (cons (first l) (selectMari el (rest l))))
(t (selectMari el (rest l)))
)
)

(defun selectMici (el l)
(cond ((null l) '())
((> el (first l)) (cons (first l) (selectMici el (rest l))))
(t (selectMici el (rest l)))
)
)
```

```
[56]> (compile-file "quicksort.lisp")

Compiling file D:\Predare\Clisp\clisp-2.30\quicksort.lisp ...

Wrote file D:\Predare\Clisp\clisp-2.30\quicksort.fas
0 errors, 0 warnings
#P"D:\\Predare\\Clisp\\clisp-2.30\\quicksort.fas" ;
NIL ;
NIL
[57]> (load "quicksort")
;; Loading file D:\Predare\Clisp\clisp-2.30\quicksort.fas ...
;; Loaded file D:\Predare\Clisp\clisp-2.30\quicksort.fas
T
[58]> (sortez '(4 3 5 2))
(2 3 4 5)
```

Pe saptamana viitoare…