

Formal Language and Compilers

Laboratory n° 5

1 Exercise

Write, by means of JFLEX and CUP, a parser which simulates the behavior of a pocket calculator furnished with memory.

The calculator handles:

- real scalars (eventually with exponent); i.e. 34, -678, 4.677E5, -0.004e-10
- vectors with two elements in the form $[a,b]$, where a and b are real scalars or scalar variables or expressions
- 26 scalar variables corresponding to the 26 lowercase letters of the alphabet; each one can contains the value of a real scalars
- vector variables corresponding to the 26 uppercase letters of the alphabet; each one can contain the value of a vector

The following operations are available:

- between real scalars: sum (+), subtraction (-), multiplication (*), division (/), exponentiation in the form a^b
- between vectors: sum (+), subtraction (-), scalar product (.)
- product and division of one scalar by a vector; i.e. $2 * [3, 2]$, $10/[5 + 3, a/10]$
- assignment of an expression to a variable; i.e. $a = 5$, $b = 5 * (4/2)$, $c = -a * 2 + (b * 2)$, $D = [3, a] + [5.5, 2.2 + 3].[c, 1.2]$

Forbidden operations:

- it is not possible to sum or subtract a scalar from a vector (and viceversa)
- it is not possible to assign a vector, or an expression that returns as result a vector, to a scalar variable; i.e. $a = 3 * [2, 1]$
- it is not possible to assign a scalar, or an expression that returns as result a scalar, to a vector variable; i.e. $M = 3 * a - 1$

Each line introduced is terminated by a semi colon. The session ends with the symbol ?.

The operators precedence is: $^*/. + -$

The lexer must recognize: numerical constants, vectors, arithmetical operators and variables identifiers.

The parser must execute the assignments returning the assigned value, it must compute the value of the expressions printing the scalar or vector result.

1.1 Input file example

```
a = -2.5;
a * 3;
M = 5 * [a,5];
[2,5] + M;
[4,5] . [6,a]*2;
?
```

1.2 Output example

```
assignment: -2.5  
scalar expression: -7.5  
assignment: [-12.5,25]  
vector expression: [-10.5,30]  
scalar expression: 23
```