A short example: "Little garden"

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1 Braga Gardener

A gardener of this city makes proposals to supply plants (trees and shrubs) to build, or to rebuild, public or particular gardens. In this context it is intended to develop a simple language processor to implement some operations associated to the management of the Gardener enterprise.
Analyze the following context free grammar, that is a simplified version of the real one. Initial symbol is `Flores` and Terminal Symbols are written in lowercase (pseudo-terminals), or in uppercase (reserved-words), or between apostrophes (punctuation marks). Null string is denoted by `&`, and `$` represents end-of-file (input text).

```
p1:  Flores    -->  FsExt  FsInt
p2:  FsExt     -->  FEXTERIOR  Fs
p3:  FsInt     -->  &
p4:               |  FINTERIOR
p5:  Fs        -->  Flor  MaisFs
p6:  MaisFs    -->  &
p7:               |  ","  Fs
p8:  Flor      -->  Cod  NomVulgar  Preco
p9:  NomVulgar-->  str
p10: Preco     -->  num
p11: Cod       -->  pal
```

In this context, the exercise that should be done is to compute LL(1) parsing table.

Resolution

Let us start building LL(1) Decision Table , what implies to compute the lookahead of each one of the productions in P[1]. For this we will consider that they are *anulables* only the symbols FsInt and MaisFs.

- p1

$$\begin{aligned} lookahead(Flores \rightarrow FsExt\ FsInt) &= First(FsExt) \\ &= First(FEXTERIOR) \\ &= \{FEXTERIOR\} \end{aligned}$$

[1]Remember formulas in the document with the formal definitions — `www.di.uminho.pt/~gepl/LP/docs/AlgorithmLL1.pdf`

- p2

$$\begin{aligned} lookahead(FsExt \rightarrow FEXTERIOR\ Fs) &= First(FEXTERIOR) \\ &= \{FEXTERIOR\} \end{aligned}$$

- p3

$$\begin{aligned} lookahead(FsInt \rightarrow \epsilon) &= First(\epsilon) \bigcup Follow(FsInt) \\ &= \emptyset \bigcup Follow(FsInt) \\ &= First(\epsilon) \bigcup Follow(Flores) \\ &= \{\$\} \end{aligned}$$

- p4

$$\begin{aligned} lookahead(FsInt \rightarrow FINTERIOR) &= First(FINTERIOR) \\ &= \{FINTERIOR\} \end{aligned}$$

- p5

$$\begin{aligned} lookahead(Fs \rightarrow FlorMaisFs) &= First(Flor) \\ &= First(Cod) \\ &= \{pal\} \end{aligned}$$

- p6

$$\begin{aligned} lookahead(\text{MaisFs} \rightarrow \epsilon) &= First(\epsilon) \bigcup Follow(MaisFs) \\ &= \emptyset \bigcup Follow(Fs) \\ &= Follow(FsExt) \bigcup Follow(MaisFs) \\ &= First(FsInt) \bigcup Follow(Flores) \\ &= \{FINTERIOR, \$\} \end{aligned}$$

- p7

$$\begin{aligned} lookahead(MaisFs \rightarrow \text{","} \text{ Fs}) &= First(\text{","}) \\ &= \{\text{","}\} \end{aligned}$$

- p8

$$\begin{aligned} lookahead(Flor \rightarrow Cod\ NomVulgar\ Preco) &= First(Cod) \\ &= \{pal\} \end{aligned}$$

- p9

$$\begin{aligned} lookahead(NomVulgar \rightarrow str) &= First(str) \\ &= \{str\} \end{aligned}$$

- p10

$$\begin{aligned} lookahead(Cod \rightarrow pal) &= First(pal) \\ &= \{pal\} \end{aligned}$$

- p11

$$\begin{aligned} lookahead(Preco \rightarrow \text{num}) &= First(num) \\ &= \{num\} \end{aligned}$$

From the results obtained above we can pass, then, to the construction of the LL(1) table.
It is obtained, thus, the following table:

	FEXTERIOR	FINTERIOR	","	str	pal	num	$
Flores	p1						
FsExt	p2						
FsInt		p4					p3
Fs					p5		
MaisFs		p6	p7				p6
Flor					p8		
NomVulgar				p9			
Cod					p10		
Preco						p11	

We can, finally, conclud that **it is a grammar LL(1)**, once:

$$\forall_{A\rightarrow\alpha_1, A\rightarrow\alpha_2} : lookahead(A \rightarrow \alpha_1) \bigcap lookahead(A \rightarrow \alpha_2) = \emptyset$$

This conclusion, that comes out immediately from the computation of the lookahead, is also clear in the table, once that this does not show any conflict in some of its entrances.