

## 实验 2 语法分析器-算术表达式

语法分析器分两部分，第一部分为算术表达式，第二部分为布尔表达式和控制语句。时间安排为每次上机完成一个部分，第二部分完成后进行检查。

请按照消除左递归文法实现递归下降语法分析器(p74)。

消除左递归文法:

$expr \rightarrow term\ rest5$

$rest5 \rightarrow +term\ rest5 \mid -term\ rest5 \mid \epsilon$

$term \rightarrow unary\ rest6$

$rest6 \rightarrow *unary\ rest6 \mid /unary\ rest6 \mid \epsilon$

$unary \rightarrow factor$

$factor \rightarrow \mathbf{num}$

含左递归文法:

$expr \rightarrow expr + term \mid expr - term \mid term$

$term \rightarrow term * unary \mid term / unary \mid unary$

$unary \rightarrow factor$

$factor \rightarrow \mathbf{num}$

可将以上文法拆解为小的文法分步完成。

第一步: 包含乘、除的算术表达式

$term \rightarrow unary\ rest6$

$rest6 \rightarrow *unary\ rest6 \mid /unary\ rest6 \mid \epsilon$

$unary \rightarrow factor$

$factor \rightarrow \mathbf{num}$

输入:

5\*2/3

输出:

1) 按推导过程

$term \Rightarrow unary\ rest6$   
 $\Rightarrow factor\ rest6$   
 $\Rightarrow num\ rest6$   
 $\Rightarrow num * unary\ rest6$   
 $\Rightarrow num * factor\ rest6$   
 $\Rightarrow num * num\ rest6$   
 $\Rightarrow num * num / unary\ rest6$   
 $\Rightarrow num * num / factor\ rest6$   
 $\Rightarrow num * num / num\ rest6$   
 $\Rightarrow num * num / num$

2) 按使用产生式过程

$term \rightarrow unary\ rest6$

$unary \rightarrow factor$

$factor \rightarrow num$

$rest6 \rightarrow *unary\ rest6$

$unary \rightarrow factor$

$\text{factor} \rightarrow \text{num}$   
 $\text{rest6} \rightarrow / \text{unary rest6}$   
 $\text{unary} \rightarrow \text{factor}$   
 $\text{factor} \rightarrow \text{num}$   
 $\text{rest6} \rightarrow \epsilon$

## 第二步：加入加、减运算

$\text{expr} \rightarrow \text{term rest5}$   
 $\text{rest5} \rightarrow +\text{term rest5} \mid -\text{term rest5} \mid \epsilon$   
 $\text{term} \rightarrow \text{unary rest6}$   
 $\text{rest6} \rightarrow * \text{unary rest6} \mid / \text{unary rest6} \mid \epsilon$   
 $\text{unary} \rightarrow \text{factor}$   
 $\text{factor} \rightarrow \mathbf{num}$

输入：

9+5\*2/3-6

输出：

### 1) 按推导过程

$\text{expr} \Rightarrow \text{term rest5}$   
 $\Rightarrow \text{unary rest6 rest5}$   
 $\Rightarrow \text{factor rest6 rest5}$   
 $\Rightarrow \text{num rest6 rest5}$   
 $\Rightarrow \text{num rest5}$   
 $\Rightarrow \text{num} + \text{term rest5}$   
 $\Rightarrow \text{num} + \text{unary rest6 rest5}$   
 $\Rightarrow \text{num} + \text{factor rest6 rest5}$   
 $\Rightarrow \text{num} + \text{num rest6 rest5}$   
 $\Rightarrow \text{num} + \text{num} * \text{unary rest6 rest5}$   
 $\Rightarrow \text{num} + \text{num} * \text{factor rest6 rest5}$   
 $\Rightarrow \text{num} + \text{num} * \text{num rest6 rest5}$   
 $\Rightarrow \text{num} + \text{num} * \text{num} / \text{unary rest6 rest5}$   
 $\Rightarrow \text{num} + \text{num} * \text{num} / \text{factor rest6 rest5}$   
 $\Rightarrow \text{num} + \text{num} * \text{num} / \text{num rest6 rest5}$   
 $\Rightarrow \text{num} + \text{num} * \text{num} / \text{num rest5}$   
 $\Rightarrow \text{num} + \text{num} * \text{num} / \text{num} - \text{term rest5}$   
 $\Rightarrow \text{num} + \text{num} * \text{num} / \text{num} - \text{unary rest6 rest5}$   
 $\Rightarrow \text{num} + \text{num} * \text{num} / \text{num} - \text{factor rest6 rest5}$   
 $\Rightarrow \text{num} + \text{num} * \text{num} / \text{num} - \text{num rest6 rest5}$   
 $\Rightarrow \text{num} + \text{num} * \text{num} / \text{num} - \text{num rest5}$   
 $\Rightarrow \text{num} + \text{num} * \text{num} / \text{num} - \text{num}$

### 2) 按使用产生式过程

$\text{expr} \rightarrow \text{term rest5}$   
 $\text{term} \rightarrow \text{unary rest6}$   
 $\text{unary} \rightarrow \text{factor}$

factor  $\rightarrow$  num  
rest6  $\rightarrow \epsilon$   
rest5  $\rightarrow$  +term rest5  
term  $\rightarrow$  unary rest6  
unary  $\rightarrow$  factor  
factor  $\rightarrow$  num  
rest6  $\rightarrow$  \* unary rest6  
unary  $\rightarrow$  factor  
factor  $\rightarrow$  num  
rest6  $\rightarrow$  / unary rest6  
unary  $\rightarrow$  factor  
factor  $\rightarrow$  num  
rest6  $\rightarrow \epsilon$   
rest5  $\rightarrow$  -term rest5  
term  $\rightarrow$  unary rest6  
unary  $\rightarrow$  factor  
factor  $\rightarrow$  num  
rest6  $\rightarrow \epsilon$   
rest5  $\rightarrow \epsilon$