

# Simple Calculator Grammar

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2015-03-13

## 1 Grammar

1.  $\text{goal} \mapsto \text{expr}$
2.  $\text{expr} \mapsto \text{term expr2}$
3.  $\text{expr2} \mapsto + \text{term expr2}$
4.  $\quad \quad \quad | \quad - \text{term expr2}$
5.  $\quad \quad \quad | \quad \epsilon$
6.  $\text{term} \mapsto \text{factor term2}$
7.  $\text{term2} \mapsto * \text{factor term2}$
8.  $\quad \quad \quad | \quad / \text{factor term2}$
9.  $\quad \quad \quad | \quad \epsilon$
10.  $\text{factor} \mapsto '0'..'9'$
11.  $\quad \quad \quad | \quad (\text{expr})$

## 2 Sets

### 2.1 FIRST

- $FIRST(\#1) = FIRST(expr) = FIRST(term) = FIRST(factor) = \{ 0..9, ( \}$
- $FIRST(\#2) = FIRST(term) = FIRST(factor) = \{ 0..9, ( \}$
- $FIRST(\#3) = \{ + \}$
- $FIRST(\#4) = \{ - \}$
- $FIRST(\#5) = \{ \epsilon \}$
- $FIRST(\#6) = FIRST(factor) = \{ 0..9, ( \}$
- $FIRST(\#7) = \{ * \}$
- $FIRST(\#8) = \{ / \}$
- $FIRST(\#9) = \{ \epsilon \}$
- $FIRST(\#10) = \{ 0..9 \}$
- $FIRST(\#11) = \{ ( \}$

### 2.2 FOLLOW

- $FOLLOW(goal) = \{ \$ \}$
- $FOLLOW(expr) = FOLLOW(goal) + \{ ) \} = \{ \$, ) \}$
- $FOLLOW(expr2) = FOLLOW(expr) = \{ \$, ) \}$
- $FOLLOW(term) = FOLLOW(expr2) = \{ +, -, \epsilon \} = \{ +, -, FOLLOW(expr) \} = \{ +, -, \$, ) \}$
- $FOLLOW(term2) = FOLLOW(term) = \{ +, -, \$, ) \}$
- $FOLLOW(factor) = FIRST(term2) = \{ *, /, \epsilon \} = \{ *, /, FOLLOW(term) \} = \{ *, /, +, -, \$, ) \}$

### 2.3 FIRST+

- $FIRST + (\#1) = \{ 0..9 , ( \}$
- $FIRST + (\#2) = \{ 0..9 , ( \}$
- $FIRST + (\#3) = \{ + \}$
- $FIRST + (\#4) = \{ - \}$
- $FIRST + (\#5) = \{ \epsilon \} = FOLLOW(expr2) = \{ \$ , ) \}$
- $FIRST + (\#6) = \{ 0..9 , ( \}$
- $FIRST + (\#7) = \{ * \}$
- $FIRST + (\#8) = \{ / \}$
- $FIRST + (\#9) = \{ \epsilon \} = FOLLOW(term2) = \{ + , - , \$ , ) \}$
- $FIRST + (\#10) = \{ 0..9 \}$
- $FIRST + (\#11) = \{ ( \}$

$$\bigcap_{i=1}^{11} FIRST + (i) = \emptyset \longrightarrow \text{Grammar is LL(1)}$$

### 3 Lookahed Table

E := Parse Error , #i := Rule No.i

	'0..9'	'+'	'-'	'*'	'/'	'('	')'	'\$'
goal	#1	E	E	E	E	#1	E	E
expr	#2	E	E	E	E	#2	E	E
expr2	E	#3	#4	E	E	E	#5	#5
term	#6	E	E	E	E	#6	E	E
term2	E	#9	#9	#7	#8	E	#9	#9
factor	#10	E	E	E	E	#11	E	E