

- 1) $\text{exp} \rightarrow \text{num}$
- 2) | exp op exp
- 3) | (exp)

4) op $\rightarrow +$

5) | -

6) | **

7) num -> digit

8) | digit num

8) digit -> 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9

exp

$$\text{first}(\#1) = \{ \text{first}(\text{num}) \} = \{ \text{first}(\text{digit}) \} = \{ 0, 1, 2, \dots, 9 \}$$
$$\text{first}(\#2) = \{ \text{first}(\text{exp}) \} = \{ \text{first}(\#1) \} = \{ 0, 1, 2, \dots, 9 \}$$
$$\text{first}(\#3) = \{ '(' \}$$

op

$$\text{first}(\#4) = \{ '+' \}$$

first (#5) = { '-' }

$$\text{first}(\#6) = \{ '**' \}$$

num

$$\text{first}(\#7) = \{ \text{first}(\text{digit}) \} = \{ 0, 1, 2, \dots, 9 \}$$
$$\text{first}(\#8) = \{ \text{first}(\text{digit}) \} = \{ 0, 1, 2, \dots, 9 \}$$

exp

$$\text{first}+(\#1) = \{ '0, 1, 2, .., 9 ' \}$$
$$\text{first}+(\#2) = \{ '0, 1, 2, .., 9 ' \}$$
$$\text{first}+(\#3) = \{ '(' \}$$

O 1o, 2o, 3o kanonanas anaferontai se 1 tematiko ara sugkrinoume ta first+ tous

h tomh tou first+ (#1) tomh first+(#2) tomh first+(#3) me ta epimerous den einai to keno sunolo ara den einai LL(1)

LL(1) !

- 1) $\text{exp} \rightarrow \text{term exp2}$
- 2) $\text{exp2} \rightarrow \text{addop term exp2}$
- 3) $\quad \quad \quad | \text{e}$
- 4) $\text{term} \rightarrow \text{factor term2}$
- 5) $\text{term2} \rightarrow \text{powop factor term2}$
- 6) $\quad \quad \quad | \text{e}$
- 7) $\text{factor} \rightarrow \text{num}$
- 8) $\quad \quad \quad | (\text{exp})$
- 9) $\text{addop} \rightarrow +$
- 10) $\quad \quad \quad | -$
- 11) $\text{powop} \rightarrow **$
- 12) $\text{num} \rightarrow \text{digit rest}$
- 13) $\text{rest} \rightarrow \text{digit rest}$
- 14) $\quad \quad \quad | \text{e}$
- 15) $\text{digit} \rightarrow 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9$

FIRST(.)

$\text{first}(\#1) = \{ 0, \dots, 9, ' (' \}$

$\text{first}(\#2) = \{ '+', '- ' \}$

$\text{first}(\#3) = \{ \text{e} \}$

$\text{first}(\#4) = \{ 0, \dots, 9, ' (' \}$

$\text{first}(\#5) = \{ ** \}$

$\text{first}(\#6) = \{ \text{e} \}$

$\text{first}(\#7) = \{ 0, \dots, 9 \}$

$\text{first}(\#8) = \{ ' (' \}$

$\text{first}(\#9) = \{ + \}$

$\text{first}(\#10) = \{ - \}$

$\text{first}(\#11) = \{ ** \}$

$\text{first}(\#12) = \{ 0, \dots, 9 \}$

$\text{first}(\#13) = \{ 0, \dots, 9 \}$

$\text{first}(\#14) = \{ e \}$

$\text{first}(\#15) = \{ 0, \dots, 9 \}$

Follow(.)

Goal \rightarrow **exp**

1) $\text{exp} \rightarrow \text{term exp2}$

2) $\text{exp2} \rightarrow \text{addop term exp2}$

3) $\quad \quad \quad | e$

4) $\text{term} \rightarrow \text{factor term2}$

5) $\text{term2} \rightarrow \text{powop factor term2}$

6) $\quad \quad \quad | e$

7) $\text{factor} \rightarrow \text{num}$

8) $\quad \quad \quad | (\text{exp})$

9) $\text{addop} \rightarrow +$

10) $\quad \quad \quad | -$

11) $\text{powop} \rightarrow **$

12) $\text{num} \rightarrow \text{digit rest}$

13) $\text{rest} \rightarrow \text{digit rest}$

14) $\quad \quad \quad | e$

15) $\text{digit} \rightarrow 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9$

$\text{follow}(\text{exp}) = \{ ') , \$ \}$

$\text{follow}(\text{exp2}) = \{ \text{follow}(\text{exp}) \} = \{ ') , \$ \}$

$\text{follow}(\text{term}) = \{ \text{first}(\text{exp2}), \text{follow}(\text{exp2}) \} = \{ ') , \$, '+', '- ' \}$

$\text{follow}(\text{term2}) = \{ \text{follow}(\text{term}) \} = \{ ') , \$, '+', '- ' \}$

$\text{follow}(\text{factor}) = \{ \text{first}(\text{exp2}), \text{follow}(\text{exp2}), \text{first}(\text{term2}), \text{follow}(\text{term2}), \} = \{ '+', '-', ')', \$, ** \}$

follow(addop) = { first(term) } =	{ 0, ..,9 , '(' }
follow(powop) = { first(factor) } =	{ 0, ..,9 , '(' }
follow(num) = { follow(factor) } =	{ '+', '-', ')', '\$, ** }
follow(rest) = { follow(num) } =	{ '+', '-', ')', '\$, ** }

First+(.)

- 1) $\text{exp} \rightarrow \text{term exp2}$
- 2) $\text{exp2} \rightarrow \text{addop term exp2}$
- 3) $\quad \quad \quad | \text{e}$
- 4) $\text{term} \rightarrow \text{factor term2}$
- 5) $\text{term2} \rightarrow \text{powop factor term2}$
- 6) $\quad \quad \quad | \text{e}$
- 7) $\text{factor} \rightarrow \text{num}$
- 8) $\quad \quad \quad | (\text{exp})$
- 9) $\text{addop} \rightarrow +$
- 10) $\quad \quad \quad | -$
- 11) $\text{powop} \rightarrow **$
- 12) $\text{num} \rightarrow \text{digit rest}$
- 13) $\text{rest} \rightarrow \text{digit rest}$
- 14) $\quad \quad \quad | \text{e}$
- 15) $\text{digit} \rightarrow 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9$

first+(#1) = { first(term) } =	{ '0', .., '9', '(' }
first+(#2) = { first(addop) } =	{ '+', '-' }
first+(#3) = { follow(exp2) } =	{ ')' }
first+(#4) = { first(factor) } =	{ '0', .., '9', '(' }
first+(#5) = { first(powop) } =	{ '**' }

first+ (#6) = { follow(term2) } =	{ '}', \$, '+', '-' }
first+ (#7) = { first(num) }	{ 0, .., 9 }
first+ (#8) =	{ '(' }
first+ (#9) =	{ '+' }
first+ (#10) =	{ '-' }
first+ (#11) =	{ '**' }
first+ (#12) = { first(digit) } =	{ '0', .., '9' }
first+ (#13) = { first(digit) } =	{ 0, .., 9 }
first+ (#14) = { follow(rest) } =	{ '+', '-', ')', \$, ** }
first+ (#15) =	{ 0, .., 9 }

Goal \rightarrow exp

- 1) exp \rightarrow term exp2
- 2) exp2 \rightarrow addop term exp2
- 3) | e
- 4) term \rightarrow factor term2
- 5) term2 \rightarrow powop factor term2
- 6) | e
- 7) factor \rightarrow num
- 8) | (exp)
- 9) addop \rightarrow +
- 10) | -
- 11) powop \rightarrow **
- 12) num \rightarrow digit rest
- 13) rest \rightarrow digit rest
- 14) | e
- 15) digit \rightarrow 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9

Table

///////// /////////	{0 ,..., 9} number	+	-	**	()	\$
exp	#1	Error	Error	Error	#1	Error	Error
exp2	Error	#2	#2	Error	Error	#3	Error
term	#4	Error	Error	Error	#4	Error	Error
term2	Error	#6	#6	#5	Error	#6	#6
factor	#7	Error	Error	Error	#8	Error	Error
addop	Error	#9	#10	Error	Error	Error	Error
powop	Error	Error	Error	#11	Error	Error	Error
num	#12	Error	Error	Error	Error	Error	Error
rest	#13	#14	#14	#14	#Error	#14	#14

digit	#15	Error	Error	Error	Error	Error	Error
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