Regular Expressions

$underscore \rightarrow \_$
$letter \rightarrow A|B...|Z|a|b...|z$
$digit \rightarrow 0|1|2...|9$
$underscore\_tail \rightarrow underscore \ (letter|digit)^+$
$id \rightarrow letter \ (letter|digit)^* \ underscore\_tail^*$
$fraction \rightarrow . \ digit^+$
$optional\_exponent \rightarrow (E \ (+|-|\varepsilon) \ digit^+)|\varepsilon$
$integer \rightarrow \ digit^+$
$float \rightarrow digit^* \ fraction \ optional\_exponent$

DFA 過程

id

$\varepsilon - closure(\{0\}) = \{0\} \Longrightarrow A$

$move(A, letter) = \{1\}$
$\varepsilon - closure(\{1\}) = \{1, 2, 3, 4, 5, 6\} \Longrightarrow B$

$move(A, digit) = \phi$
$\varepsilon - closure(\phi) = \phi$

$move(A, underscore\_tail) = \phi$
$\varepsilon - closure(\phi) = \phi$

$move(B, letter) = \{1, 4\}$
$\varepsilon - closure(\{1, 4\}) = \{1, 2, 3, 4, 5, 6\} \Longrightarrow B$

$move(B, digit) = \{1, 4\}$
$\varepsilon - closure(\{1, 4\}) = \{1, 2, 3, 4, 5, 6\} \Longrightarrow B$

$move(B, underscore\_tail) = \{4, 6\}$
$\varepsilon - closure(\{4, 6\}) = \{4, 5, 6\} \Longrightarrow C$

$$move(C, letter) = \phi$$
$$\varepsilon - closure(\phi) = \phi$$

$$move(C, digit) = \phi$$
$$\varepsilon - closure(\phi) = \phi$$

$$move(C, underscore\_tail) = \{4, 6\}$$
$$\varepsilon - closure(\{4, 6\}) = \{4, 5, 6\} \Longrightarrow C$$

No	State	letter	digit	underscore_tail
0	A	B	-	-
1	B	B	B	C
2	C	-	-	C

fraction

$$\varepsilon - closure(\{0\}) = \{0\} \Longrightarrow A$$

$$move(A, \cdot) = \{1\}$$
$$\varepsilon - closure(\{1\}) = \{1, 2\} \Longrightarrow B$$

$$move(A, digit) = \phi$$
$$\varepsilon - closure(\phi) = \phi$$

$$move(B, \cdot) = \phi$$
$$\varepsilon - closure(\phi) = \phi$$

$$move(B, digit) = \{1, 3\}$$
$$\varepsilon - closure(\{1, 3\}) = \{1, 2, 3\} \Longrightarrow C$$

$$move(C, \cdot) = \phi$$
$$\varepsilon - closure(\phi) = \phi$$

$$move(C, digit) = \{1, 3\}$$
$$\varepsilon - closure(\{1, 3\}) = \{1, 2, 3\} \Longrightarrow C$$

No	State	·	digit
0	A	B	-

No	State	.	digit
1	B	-	C
2	C	-	C

optional_exponent

$$\varepsilon - closure(\{0\}) = \{0, 1, 2, 3\} \implies A$$

$$move(A, E) = \{4\}$$
$$\varepsilon - closure(\{4\}) = \{4, 5, 6, 7, 8, 9\} \implies B$$

$$move(A, +) = \phi$$
$$\varepsilon - closure(\phi) = \phi$$

$$move(A, -) = \phi$$
$$\varepsilon - closure(\phi) = \phi$$

$$move(A, digit) = \phi$$
$$\varepsilon - closure(\phi) = \phi$$

$$move(B, E) = \phi$$
$$\varepsilon - closure(\phi) = \phi$$

$$move(B, +) = \{8\}$$
$$\varepsilon - closure(\{8\}) = \{8, 9\} \implies C$$

$$move(B, -) = \{8\}$$
$$\varepsilon - closure(\{8\}) = \{8, 9\} \implies C$$

$$move(B, digit)\{3, 8\}$$
$$\varepsilon - closure(\{3, 8\}) = \{3, 8, 9\} \implies D$$

$$move(C, E) = \phi$$
$$\varepsilon - closure(\phi) = \phi$$

$$move(C, +) = \phi$$
$$\varepsilon - closure(\phi) = \phi$$

$$move(C, -) = \phi$$
$$\varepsilon - closure(\phi) = \phi$$

$move(C, digit)\{3, 8\}$
$\varepsilon - closure(\{3, 8\}) = \{3, 8, 9\} \Longrightarrow D$

$move(D, E) = \phi$
$\varepsilon - closure(\phi) = \phi$

$move(D, +) = \phi$
$\varepsilon - closure(\phi) = \phi$

$move(D, -) = \phi$
$\varepsilon - closure(\phi) = \phi$

$move(D, digit)\{3, 8\}$
$\varepsilon - closure(\{3, 8\}) = \{3, 8, 9\} \Longrightarrow D$

No	State	E	+	-	digit
0	A	B	-	-	-
1	B	-	C	C	D
2	C	-	-	-	D
3	D	-	-	-	D

float

$\varepsilon - closure(\{0\}) = \{0, 1, 2\} \Longrightarrow A$

$move(A, digit) = \{0, 2\}$
$\varepsilon - closure(\{0, 2\}) = \{0, 1, 2\} \Longrightarrow A$

$move(A, fraction) = \{3\}$
$\varepsilon - closure(\{3\}) = \{3\} \Longrightarrow B$

$move(A, optional\_exponent) = \phi$
$\varepsilon - closure(\phi) = \phi$

$move(B, digit) = \phi$
$\varepsilon - closure(\phi) = \phi$

$move(B, fraction) = \phi$
$\varepsilon - closure(\phi) = \phi$

$move(B, optional\_exponent) = \{4\}$
$\varepsilon - closure(\{4\}) = \{4\} \Longrightarrow C$

$move(C, digit) = \phi$
$\varepsilon - closure(\phi) = \phi$

$move(C, fraction) = \phi$
$\varepsilon - closure(\phi) = \phi$

$move(C, optional\_exponent) = \phi$
$\varepsilon - closure(\phi) = \phi$

No	State	digit	fraction	optional_exponent
0	A	A	B	-
1	B	-	-	C
2	C	-	-	-

underscore

$\varepsilon - closure(\{0\}) = \{0\} \Longrightarrow A$

$move(A, \_) = \{1\}$
$\varepsilon - closure(\{1\}) = \{1\} \Longrightarrow B$

$move(B, \_) = \phi$
$\varepsilon - closure(\phi) = \phi$

No	State	_
0	A	B
1	B	-

letter

$\varepsilon - closure(\{0\}) = \{0\} \Longrightarrow A$

$move(A, [A - Za - z]) = \{1\}$
$\varepsilon - closure(\{1\}) = \{1\} \Longrightarrow B$

$$move(B, [A - Za - z]) = \phi$$
$$\varepsilon - closure(\phi) = \phi$$

No	State	[A-Za-z]
0	A	B
1	B	-

digit

$$\varepsilon - closure(\{0\}) = \{0\} \implies A$$

$$move(A, [0 - 9]) = \{1\}$$
$$\varepsilon - closure(\{1\}) = \{1\} \implies B$$

$$move(B, [0 - 9]) = \phi$$
$$\varepsilon - closure(\phi) = \phi$$

No	State	[0-9]
0	A	B
1	B	-

underscore_tail

$$\varepsilon - closure(\{0\}) = \{0\} \implies A$$

$$move(A, underscore) = \{1\}$$
$$\varepsilon - closure(\{1\}) = \{1, 2, 3\} \implies B$$

$$move(A, letter) = \phi$$
$$\varepsilon - closure(\phi) = \phi$$

$$move(A, digit) = \phi$$
$$\varepsilon - closure(\phi) = \phi$$

$$move(B, underscore) = \phi$$
$$\varepsilon - closure(\phi) = \phi$$

$move(B, letter) = \{1, 4\}$
$\varepsilon - closure(\{1, 4\}) = \{1, 2, 3, 4\} \Longrightarrow C$

$move(B, digit) = \{1, 4\}$
$\varepsilon - closure(\{1, 4\}) = \{1, 2, 3, 4\} \Longrightarrow C$

$move(C, underscore) = \phi$
$\varepsilon - closure(\phi) = \phi$

$move(C, letter) = \{1, 4\}$
$\varepsilon - closure(\{1, 4\}) = \{1, 2, 3, 4\} \Longrightarrow C$

$move(C, digit) = \{1, 4\}$
$\varepsilon - closure(\{1, 4\}) = \{1, 2, 3, 4\} \Longrightarrow C$

No	State	underscore	letter	digit
0	A	B	-	-
1	B	-	C	C
2	C	-	C	C

integer

$\varepsilon - closure(\{0\}) = \{0, 1\} \Longrightarrow A$

$move(A, digit) = \{0, 2\}$
$\varepsilon - closure(\{0, 2\}) = \{0, 1, 2\} \Longrightarrow B$

$move(B, digit) = \{0, 2\}$
$\varepsilon - closure(\{0, 2\}) = \{0, 1, 2\} \Longrightarrow B$

No	State	digit
0	A	B
1	B	B

ID Plus

$\varepsilon - closure(\{0\}) = \{0\} \Longrightarrow A$

$move(A, letter) = \{1\}$
$\varepsilon - closure(\{1\}) = \{1, 2, 4\} \Longrightarrow B$

$move(A, digit) = \phi$
$\varepsilon - closure(\phi) = \phi$

$move(A, underscore) = \phi$
$\varepsilon - closure(\phi) = \phi$

$move(B, letter) = \{1, 4\}$
$\varepsilon - closure(\{1, 4\}) = \{1, 2, 4\} \Longrightarrow B$

$move(B, digit) = \{1, 4\}$
$\varepsilon - closure(\{1, 4\}) = \{1, 2, 4\} \Longrightarrow B$

$move(B, underscore) = \{3\}$
$\varepsilon - closure(\{3\}) = \{3\} \Longrightarrow C$

$move(C, letter) = \{4\}$
$\varepsilon - closure(\{4\}) = \{2, 4\} \Longrightarrow D$

$move(C, digit) = \{4\}$
$\varepsilon - closure(\{4\}) = \{2, 4\} \Longrightarrow D$

$move(C, underscore) = \phi$
$\varepsilon - closure(\phi) = \phi$

$move(D, letter) = \{4\}$
$\varepsilon - closure(\{4\}) = \{2, 4\} \Longrightarrow D$

$move(D, digit) = \{4\}$
$\varepsilon - closure(\{4\}) = \{2, 4\} \Longrightarrow D$

$move(D, underscore) = \{3\}$
$\varepsilon - closure(\{3\}) = \{3\} \Longrightarrow C$

No	State	letter	digit	underscore
0	A	B	-	-
1	B	B	B	C
2	C	D	D	-

No	State	letter	digit	underscore
3	D	D	D	C

float plus

$$\varepsilon - closure(\{0\}) = \{0,1\} \Longrightarrow A$$

$$move(A, digit) = \{0\}$$
$$\varepsilon - closure(\{0\}) = \{0,1\} \Longrightarrow A$$

$$move(A, \cdot) = \{2\}$$
$$\varepsilon - closure(\{2\}) = \{2\} \Longrightarrow B$$

$$move(A, E) = \phi$$
$$\varepsilon - closure(\phi) = \phi$$

$$move(A, +) = \phi$$
$$\varepsilon - closure(\phi) = \phi$$

$$move(A, -) = \phi$$
$$\varepsilon - closure(\phi) = \phi$$

$$move(B, digit) = \{3\}$$
$$\varepsilon - closure(\{3\}) = \{3,4\} \Longrightarrow C$$

$$move(B, \cdot) = \phi$$
$$\varepsilon - closure(\phi) = \phi$$

$$move(B, E) = \phi$$
$$\varepsilon - closure(\phi) = \phi$$

$$move(B, +) = \phi$$
$$\varepsilon - closure(\phi) = \phi$$

$$move(B, -) = \phi$$
$$\varepsilon - closure(\phi) = \phi$$

$$move(C, digit) = \{3\}$$
$$\varepsilon - closure(\{3\}) = \{3,4\} \Longrightarrow C$$

$move(C, \cdot) = \phi$
$\varepsilon - closure(\phi) = \phi$

$move(C, E) = \{5\}$
$\varepsilon - closure(\{5\}) = \{5\} \Longrightarrow D$

$move(C, +) = \phi$
$\varepsilon - closure(\phi) = \phi$

$move(C, -) = \phi$
$\varepsilon - closure(\phi) = \phi$

$move(D, digit) = \{7\}$
$\varepsilon - closure(\{7\}) = \{7\} \Longrightarrow E$

$move(D, \cdot) = \phi$
$\varepsilon - closure(\phi) = \phi$

$move(D, E) = \phi$
$\varepsilon - closure(\phi) = \phi$

$move(D, +) = \{6\}$
$\varepsilon - closure(\{6\}) = \{6\} \Longrightarrow F$

$move(D, -) = \{6\}$
$\varepsilon - closure(\{6\}) = \{6\} \Longrightarrow F$

$move(E, digit) = \{7\}$
$\varepsilon - closure(\{7\}) = \{7\} \Longrightarrow E$

$move(E, \cdot) = \phi$
$\varepsilon - closure(\phi) = \phi$

$move(E, E) = \phi$
$\varepsilon - closure(\phi) = \phi$

$move(E, +) = \phi$
$\varepsilon - closure(\phi) = \phi$

$move(E, -) = \phi$
$\varepsilon - closure(\phi) = \phi$

$move(F, digit) = \{7\}$

$\varepsilon - closure(\{7\}) = \{7\} \implies E$

$move(F, \cdot) = \phi$

$\varepsilon - closure(\phi) = \phi$

$move(F, E) = \phi$

$\varepsilon - closure(\phi) = \phi$

$move(F, +) = \phi$

$\varepsilon - closure(\phi) = \phi$

$move(F, -) = \phi$

$\varepsilon - closure(\phi) = \phi$

No	State	·	digit	E	+	-
0	A	B	A	-	-	-
1	B	-	C	-	-	-
2	C	-	C	D	-	-
3	D	-	E	-	F	F
4	E	-	E	-	-	-
5	F	-	E	-	-	-