

CSEN 1002

Task 1: Regular Expression to Non Deterministic Finite Automata using Thompson's Construction

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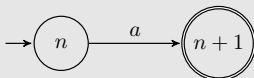
1 Thompson's Construction

2 Postfix Notation

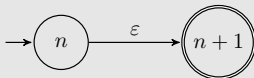
3 Example

Symbol Expression

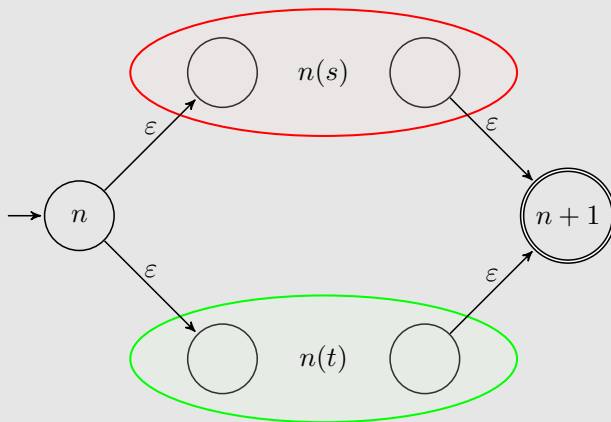
$a \in \Sigma$



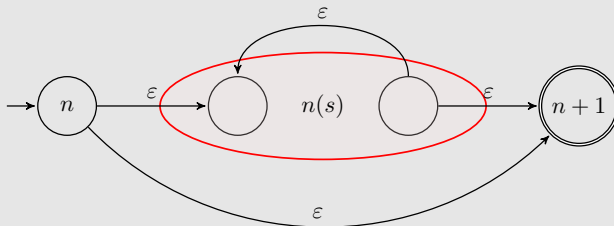
ε



Union Expression

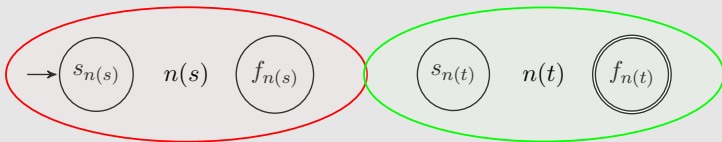
 $n(s) \cup n(t)$ 

Kleene Star Expression

 $n(s)^*$ 

Concatenation Expression

$$n(s) \circ n(t)$$



$$n(s) \circ n(t)$$

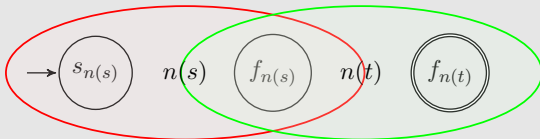


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Postfix Notation

$((2 + 3) - 1) * 7$

↓

2 3 + 1 - 7 *

Stack



Postfix Notation

$((2 + 3) - 1) * 7$

↓

2 3 + 1 - 7 *

Stack

2

Postfix Notation

$((2 + 3) - 1) * 7$

2 3 + 1 - 7 *

↓

Stack

2

Postfix Notation

$((2 + 3) - 1) * 7$

2 3 + 1 - 7 *

↓

Stack

3
2

Postfix Notation

$((2 + 3) - 1) * 7$

2 3 \downarrow + 1 - 7 *

Stack

3
2

Postfix Notation

 $((2 + 3) - 1) * 7$

$2 \quad 3 \quad \downarrow \quad + \quad 1 \quad - \quad 7 \quad *$

Stack

5
3
2

Postfix Notation

 $((2 + 3) - 1) * 7$

2 3 + 1 - 7 *

↓

Stack

5
3
2

Postfix Notation

 $((2 + 3) - 1) * 7$

2 3 + ↓ 1 - 7 *

Stack

1
5
3
2

Postfix Notation

$((2 + 3) - 1) * 7$

2 3 + 1 ↓ - 7 *

Stack

1
5
3
2

Postfix Notation

$$(((2 + 3) - 1) * 7)$$

2 3 + 1 ↓ - 7 *

Stack

4
1
3
3
2

Postfix Notation

 $((2 + 3) - 1) * 7$

2 3 + 1 - 7 *

↓

Stack

4
1
3
3
2

Postfix Notation

 $((2 + 3) - 1) * 7$

2 3 + 1 - 7 *

↓

Stack

7
4
1
3
3
2

Postfix Notation

 $(((2 + 3) - 1) * 7)$

2 3 + 1 - 7 *

↓

Stack

7
4
1
5
3
2

Postfix Notation

 $((2 + 3) - 1) * 7$

2 3 + 1 - 7 *

↓

Stack

28
7
4
1
3
3
2

Postfix Notation

 $((2 + 3) - 1) * 7$

2 3 + 1 - 7 *



Stack

28
7
4
1
5
3
2

Postfix Notation

 $(((2 + 3) - 1) * 7)$

2 3 + 1 - 7 *



Stack

28
7
4
1
5
3
2

Table of Contents

1 Thompson's Construction

2 Postfix Notation

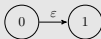
3 Example

Example

$$eab^*| .a.* = ((\varepsilon \circ (a \cup (b^*))) \circ a)^*$$

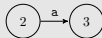
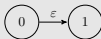
Example

$$eab^*|.a.* = ((\varepsilon \circ (a \cup (b^*))) \circ a)^*$$



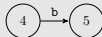
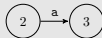
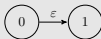
Example

$$eab^* | .a.^* = ((\varepsilon \circ (a \cup (b^*))) \circ a)^*$$



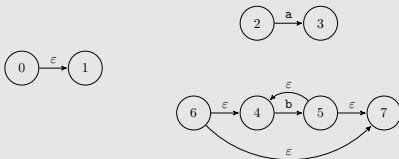
Example

$$eab^* | .a.* = ((\varepsilon \circ (a \cup (b^*))) \circ a)^*$$



Example

$$eab^*| . a . * = ((\varepsilon \circ (a \cup (b^*))) \circ a)^*$$

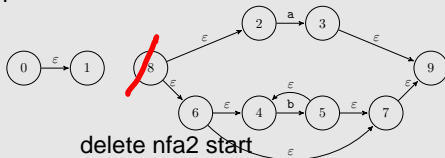


Example

$$eab^* | .a.* = ((\varepsilon \circ (a \cup (b^*))) \circ a)^*$$

start : nfa1

end: nfa2

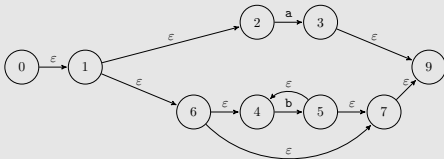


delete nfa2 start

convert its transitions to nfa1 end

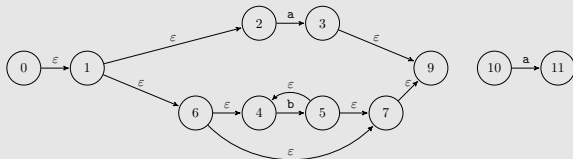
Example

$$eab^* | .a.* = ((\varepsilon \circ (a \cup (b^*))) \circ a)^*$$



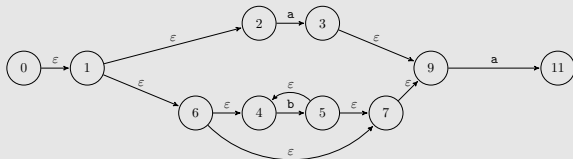
Example

$$eab^* | .a.* = ((\varepsilon \circ (a \cup (b^*))) \circ a)^*$$



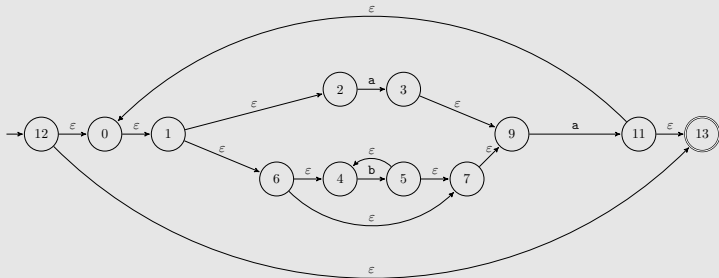
Example

$$eab^* | .a.* = ((\varepsilon \circ (a \cup (b^*))) \circ a)^*$$



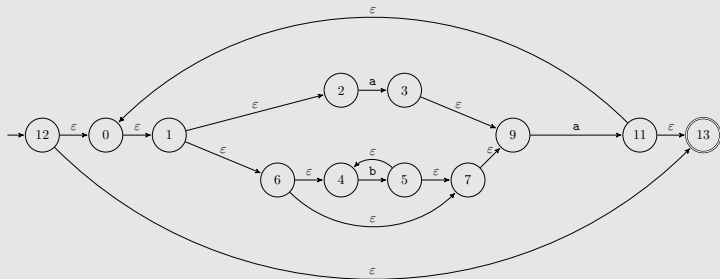
Example

$$eab^* | .a.* = ((\varepsilon \circ (a \cup (b^*))) \circ a)^*$$



Example

$$eab^* \mid .a.* = ((\varepsilon \circ (a \cup (b^*))) \circ a)^*$$



String Representation

```
0;1;2;3;4;5;6;7;9;11;12;13#a;b#0,e,1;1,e,2;1,e,6;2,a,3;
3,e,9;4,b,5;5,e,4;5,e,7;6,e,4;6,e,7;7,e,9;9,a,11;11,e,0;
11,e,13;12,e,0;12,e,13#12#13
```