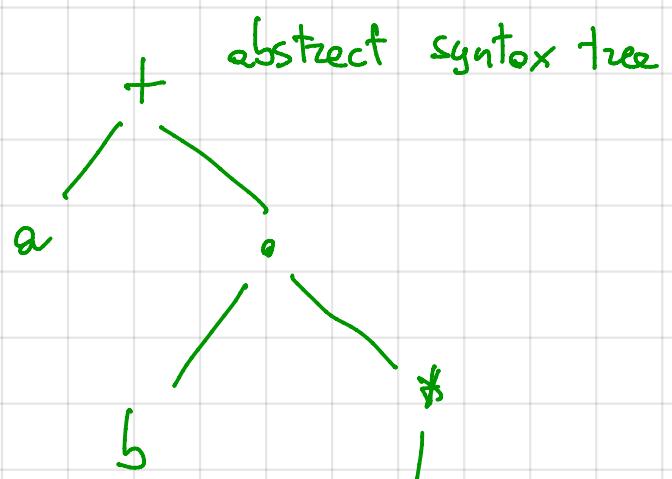


$$a + [b[c^*]]$$



$$\boxed{[a[b]c] + c} + d$$

$$\{a\} \odot \{b\} = \{ab\}$$

$$\{ab\} = \{a\} \cup \{b\}$$

$\mathcal{L}($

```

graph TD
    Plus1["+"] --- Plus2["+"]
    Plus1 --- d[d]
    Plus2 --- a[a]
    Plus2 --- b[b]
    a --- c[c]
    b --- c[c]
    c --- d[d]
  
```

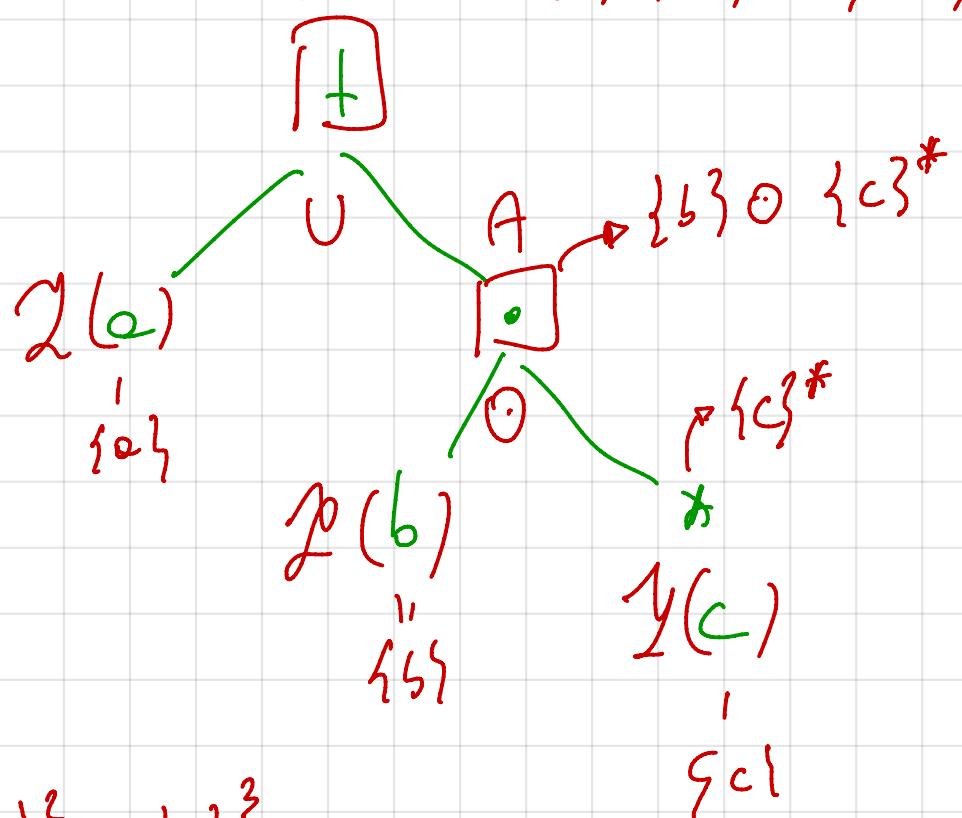
$\mathcal{L}(abc + c + d) = \{abc, c, d\}$

$$\boxed{[a[b][c+d]]} + e$$

```

graph TD
    Plus["+"] --- Dot[•]
    Plus --- Plus2["+"]
    Plus --- e[e]
    Dot --- a[a]
    Dot --- b[b]
    Plus2 --- c[c]
    Plus2 --- d[d]
  
```

$$2(\{a + bc^*\}) = \{a\} \cup A = \{a, b, bc, bcc, bccc, \dots\}$$



$$\{c\}^* = \bigcup_{i \geq 0} \{c\}^i =$$

$$= \{c\}^0 \cup \{c\}^1 \cup \{c\}^2 \cup \{c\}^3 \dots$$

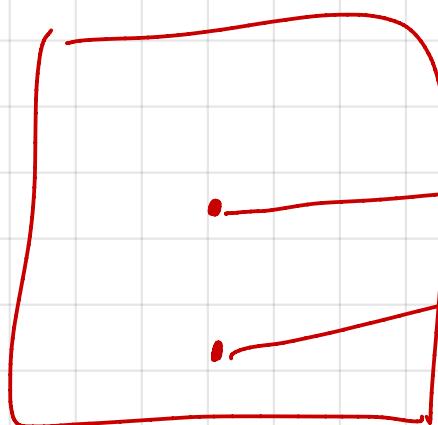
$$= \{\epsilon\} \cup \{c\} \cup \{cc\} \cup \{ccc\} \cup \{cccc\} \cup \dots$$

$$= \{\epsilon, c, cc, ccc, cccc, \dots\}$$

$$\{b\} \odot \{c\}^* = \{b\} \odot \{\epsilon, c, cc, ccc, cccc, \dots\} =$$

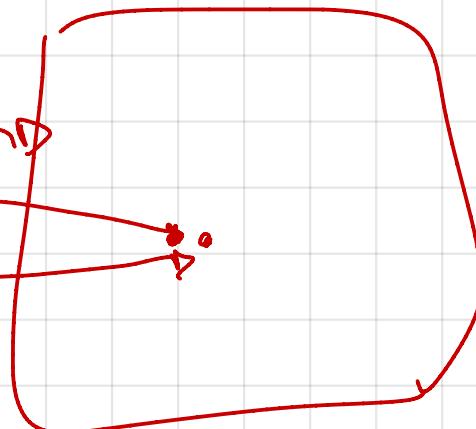
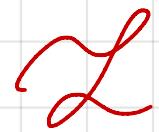
$$= \{b, bc, bcc, bcc, bcccc, \dots\} = A$$

Syntax



Reg. expr.

Semantics



Regular Languages

$$\mathcal{L}(a+b) = \{a, b\}$$

$$\mathcal{L}(b+a) = \{a, b\}$$

$$\mathcal{L}(ab^*) \supseteq \{a, ab, abb, abbb, abbabb, \dots\}$$

$$\mathcal{L}(ab^* + ob^*) = \uparrow$$

$$\mathcal{L}(\varepsilon(a+b)) = \{a, b\} = \mathcal{L}(a+b)$$

$$\mathcal{L}((a+b)^*)$$

$$[\ast] = \{\varepsilon, a, b, aa, ab, ba, bb, aaa, \\ aab, aab, abb, \\ baa, bab, bba, bbb, \\ \dots\}$$

$$\{a, b\}^* = \{a, b\}^0 \cup \{a, b\}^1$$

$$\cup \{a, b\}^2 \cup \dots$$

$$\begin{array}{c} \boxed{+} \{a, b\} \\ \swarrow \cup \searrow \\ \boxed{a} \quad \boxed{b} \\ \{a\} \quad \{b\} \end{array}$$

$$= \{\varepsilon\} \cup \{a, b\} \cup \{a, b\} \cup \{a, b\} \cup \dots = \{\varepsilon, a, b\} \cup \{aa, ab, ba, bb\}$$

$$\mathcal{L}(((a+b)^*)^*) = (\{a,b\}^*)^*$$

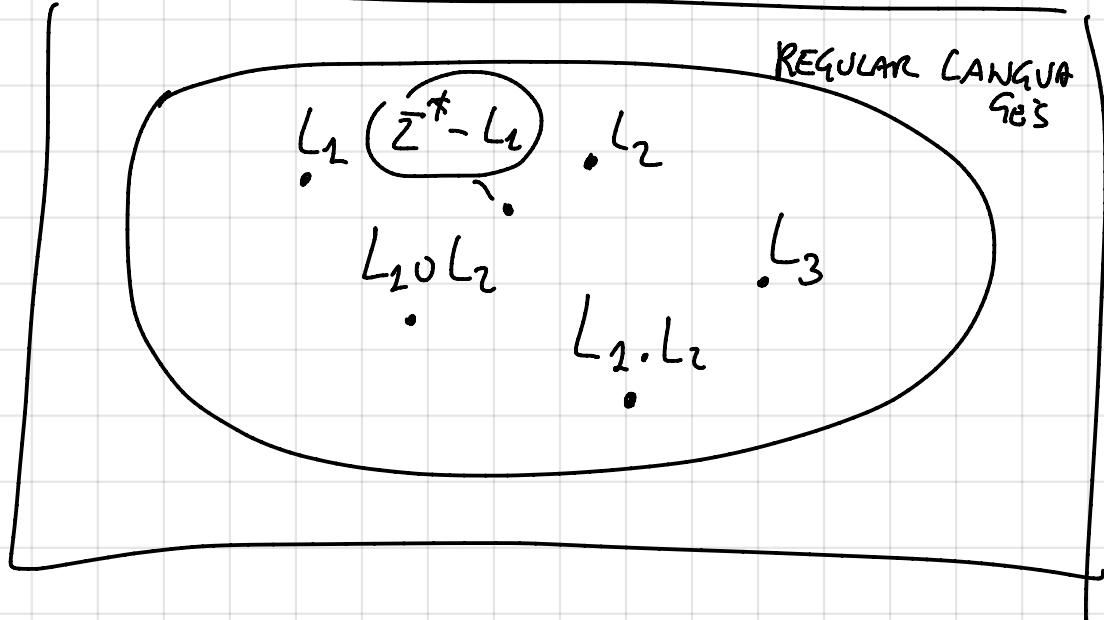
$$(\{a,b\}^*)^* = (\{a,b\}^*)^0 \cup \underbrace{(\{a,b\}^*)^1}_{\{a,b\}^*} \cup (\{a,b\}^*)^2 \cup \dots$$

$$= \{\epsilon\} \cup \{a,b\}^* \cup \{a,b\}^* \odot \{a,b\}^*$$

$$\{\epsilon, a, b, aa, ab, ba, bb, \dots\} \odot \{\epsilon, a, b, aa, ab, \dots\}$$

$$= \{\epsilon, a, b, aa, \dots, a, aa, ab, \dots\} = \{a, b\}^*$$

ALL LANGUAGES on Σ



The complement of b^* where $\Sigma = \{a, b\}$
is $\{a, b\}^* - L(b^*) = \{ a, ab, ba, aab, aba, aab, bab, baa, bba, - \}$

$$L((0+1)^* 1 (0+1)^*) \cap (\{0,1\}^* \setminus \{\epsilon, 0\}) = \{0,1\}^* = \{0,1\}^* \setminus \{\epsilon\}$$

