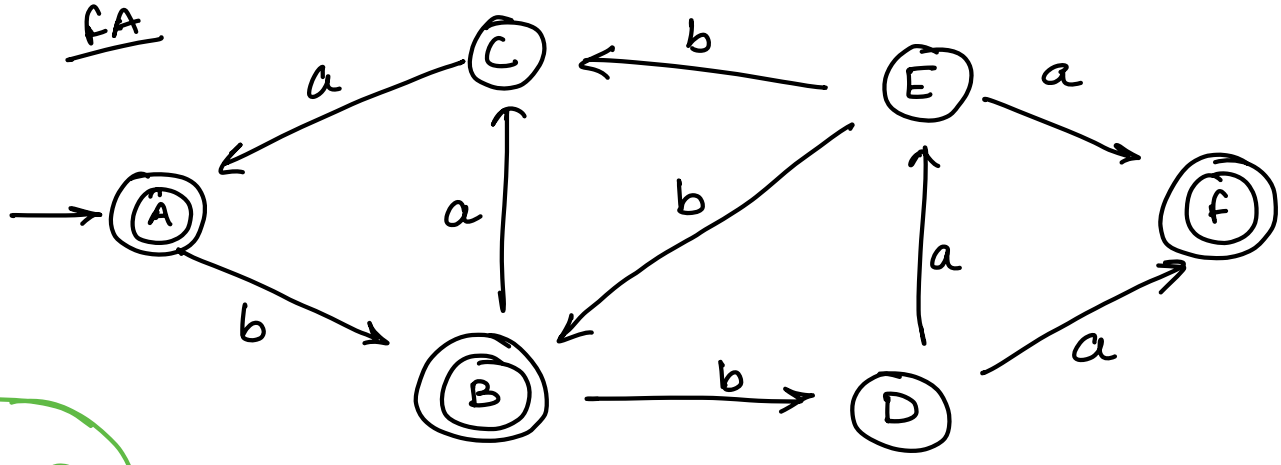
Q: FA



$R = Q + RP$

$R = QP^*$

$A = Ca + \varepsilon$

$B = Ab + Eb$

$C = Ba + Eb$

$D = Bb$

$E = Da$ } $\epsilon = Bba$

$f = Ea + Da$

Simplify
Resolve D, E

$A = Ca + \varepsilon$

$B = Ab + Bbab$

$C = Ba + Bbab$

$f = Bbaa + Bba$

$B = \underset{R}{Ab} + \underset{R}{Bbab}$ (R = Ab, Q = bab, P = bab)

$B = Ab(bab)^*$

$C = Ba + Bbab$

$C = B(a + bab)$

$C = Ab(bab)^*(a + bab)$

$A = Ca + \varepsilon$

$A = \underset{R}{Ab}\underset{R}{(bab)^*(a+bab)a} + \underset{Q}{\varepsilon}$ (P = $(bab)^*(a+bab)a$)

$A = (b(bab)^*(a + bab)a)^*$

$$B = \left(b(bab)^*(a + bab)\,a\right)^* b\,(bab)^*$$

$$f = Bbaa + Bba$$

$$f = Bba(a+\varepsilon)$$

$$f = \left(b(bab)^*(a + bab)\,a\right)^* b\,(bab)^*\,ba\,(a+\varepsilon)$$

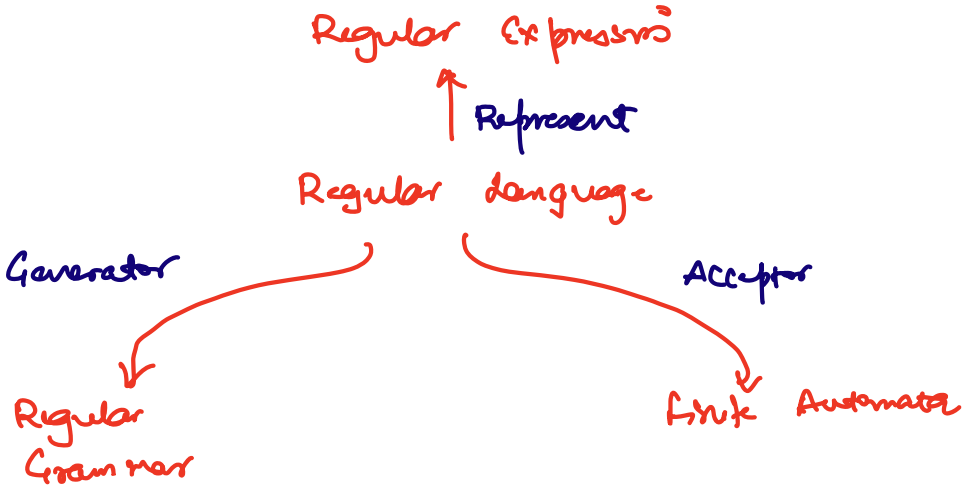
$$A + B + f$$

Kleenes Theorem:

Equivalence b/w RL, RE & fA

fA → RE : Ardens Theorem } Equivalent Power

RE → fA



Testing whether a language is Regular or not ?

- finite language → Regular
- Infinite language : are u able to give a fA or a regular expression.

Eg: $a^n \mid n \geq 1$

$L = \{a, aa, aaa, aaaa \ldots\}$

FA: 

RE: $a^+ \rightarrow aa^*$

Eg: $a^n b^m \mid n, m \geq 1$

FA: 

RE: $aa^* bb^*$

$a^n b^m \quad n, m \geq 0$

FA: 

RE: $a^* b^*$

FA: 

Eg: $a^n b^n \mid n \leq 10^{10^{10}}$

finite → RL ✓

n is bounded

Eg: $a^n b^n \mid n \geq 1$

track & counting is not possible

Eg: $ww^R \mid |w| = 2 \quad \Sigma = \{a, b\}$

w	w^R	ww^R
aa	aa	aaaa
ab	ba	abba

} finite : RL

ba | ab | baab
bb | bb | bbbb

Eg: $ww^R \mid w \in (a,b)^*$

↳ w can be of any length

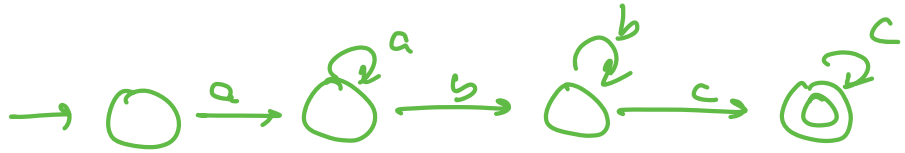
abaab baaba RLX

Eg: $ww \mid w \in (a,b)^*$ RLX

Eg: $a^n b^m c^k \mid n, m, k \geq 1$

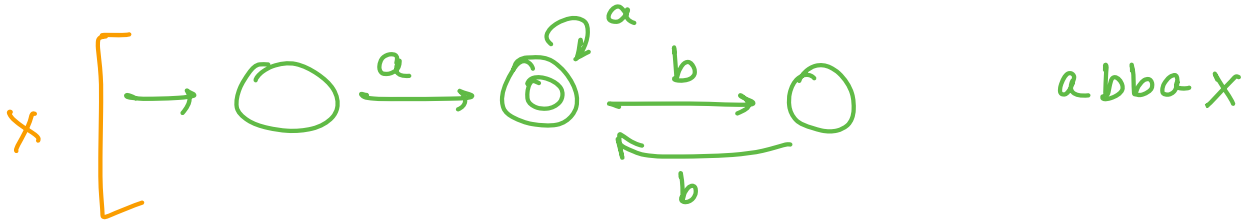
RE: $aa^* bb^* cc^*$

FA:

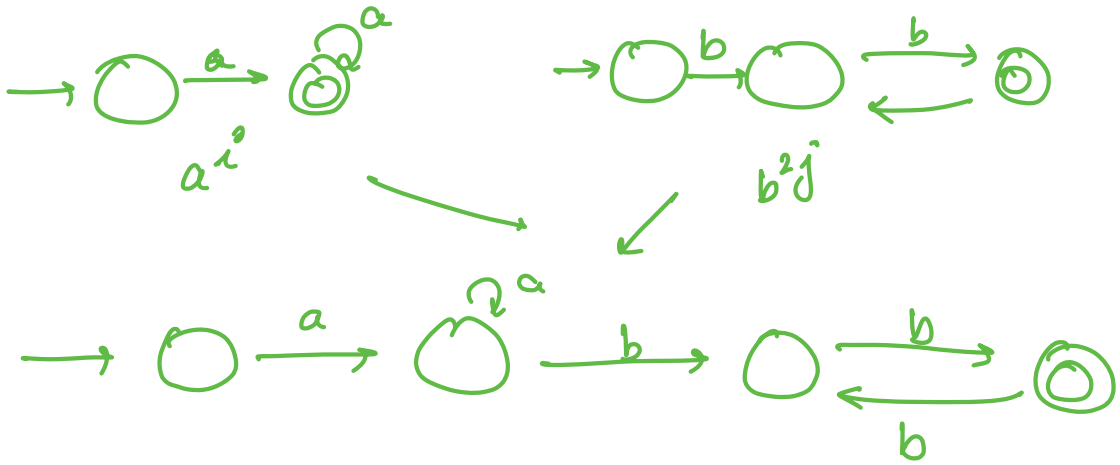


Eg: $a^i b^{2j} \mid i, j \geq 1$

any count — even



abba X



$a^i b^{2j}$

RE: $aa^*(bb)(bb)^*$ RL✓

Eg: $a^i b^{4j} \mid i, j \geq 0$

$a^*(bbbb)^*$ RL✓

Eg: $a^n \mid n$ is even

$(aa)^*$ RL✓

Eg: $a^n \mid n$ is odd

$a(aa)^*$ RL✓

Eg: $a^n \mid n$ is prime

$L = \{ a^2, a^3, a^5, a^7, a^{11}, a^{13} \ldots \}$

no common difference

no FA possible
no RE possible

RL✗

Eg: $a^{n^2} \mid n \geq 1$

$L = \{ a, a^4, a^9, a^{16}, a^{25} \ldots \}$

↓
no AP RL✗

Eg: $a^{2^n} \mid n \geq 1$

$L = \{a^2, a^4, a^8, a^{16} \ldots\}$ RLX