Regular language Examples:

1. $L = \{a^{2n} \mid n \geq 0\}$ ⇒ $(aa)^*$

2. $L = \{a^{xn} \mid x \text{ is any positive integer } n \geq 0\}$

3. $L = \{a^m b^n \mid m, n \geq 0\}$ ✓ a^*b^*

4. $L = \{a^m b^n c^k \mid m, n, k \geq 0\}$ ⇒ R.L

5. $L = \{a^n b^n c^n \mid 1 \leq n \leq 10^5\}$ ✓ CFL ⇒ RL

6. $L = \{a^m b^n \mid m + n \text{ is even no., } m, n \geq 0\}$ ⇒ Regular

$(aa)^*(bb)^* + (aa)^*a(bb)^*b$

$a^{2n} \mid n \geq 0$ → R.L

a^{even} ⇒ $(aa)^*$

$L = \{a^n b^n c^n \mid n \geq 0\}$

7- $L = \{ a^m b^n c^p \mid m \geq n \geq p \geq 0, m \leq 5 \} \Rightarrow$ R.L

$a^{\leq 5} b^{\leq 5} c^{\leq 5}$ finite $\Rightarrow$ R.L

8- $L = \{ a^m b^n c^p \mid m \geq n \geq p \geq 0, n \leq 5 \} \Rightarrow$ R.L

$a^{\geq 5}$ $b^{\leq 5}$ $c^{\leq 5}$

$L = \{ a^m \mid m \geq 5 \} \Rightarrow$ RL

9- $L = \{ a^m b^n c^p \mid m \geq n \geq p \geq 0, p \leq 5 \}$

Non Regular $\Rightarrow \{ a^{\geq 5} b^{\geq 5} \} \Rightarrow \{ a^m b^n \mid m \geq n \geq 5 \}$

Infinite Relation

10- $L = \{ a^{n^2} \mid n \geq 1 \}$ => CSL => not R.L

11. $L = \{ a^{n^2} \mid n \leq 5 \}$ => R.L

12. $L = \{ a^{n!} \mid n \geq 1 \}$ not RL

$a^{(n(n-1)(n-2)\ldots 1)}$ a^{n^n}

~~Definable~~

13. $L = \{ a^{n!} \mid n \leq 5 \}$ => R.L

14. $L = \{a^P \mid P \text{ is prime No}\}$ ⇒ Non Regular

$a^2, a^3, a^5, a^7, a^{11}, a^{13}$ ✗

15. $L = \{a^P \mid P \text{ is a prime No. } P \le 20\}$ → finite → RL

RL

16. $L = \{xy \mid x, y \in (a,b)^*\}$ → RL

RE = $(a+b)^*(a+b)^*$

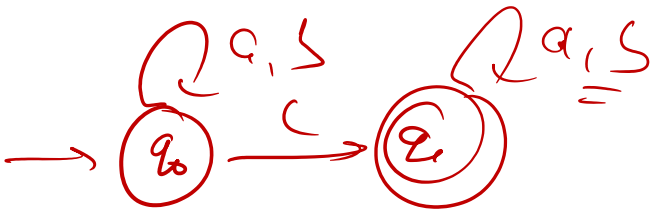
17> $L = \{xy \mid x, y \in (a,b)^*\}$

18> $\Rightarrow L = \{xy \mid x \in (a,b)^*, y \in (c,d)^*\}$

$(a+b)^*(c+d)^*$

19> $L = \{xcy \mid x, y \in (a,b)^*$

$(a+b)^* c (a+b)^*$



20) $L = \{ xy \mid x, y \in (a,b)^*, |x| = |y| \}$ (or) RE = $[(a+b)(a+b)]^*$

$L = \{ w \mid w \in (a,b)^*, |w| = 2n, n \geq 0 \}$

aab c (b, bab)

21) $L = \{ x c y \mid x, y \in (a,b)^*, |x| = |y| \}$

Infinite Relation => Non Regular

22) $L = \{ xy \mid x \in (a,b)^*, y \in (c,d)^*, |x| = |y| \}$ ⇒ Not Regular

= ↳ Infinite Relation

23) $L = \{ xy \mid x, y \in (a,b)^*, x = y \}$

or

$|x| = |y|$

$L = \{ ww \mid w \in (a,b)^* \}$ ⇒ CSL

Infinite Relation ⇒ Not R.L

24) $L = \{ wcw^T \mid w \in (a,b)^* \}$ => odd length palindrom

c, aca, bcb, aacaa, bbcbb, abcba

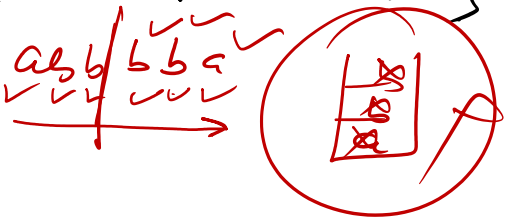
abbcbba

=> Not RL

25) $L = \{ wcw^T \mid w \in (a,b)^*, |w| \leq 10 \}$ => R.L

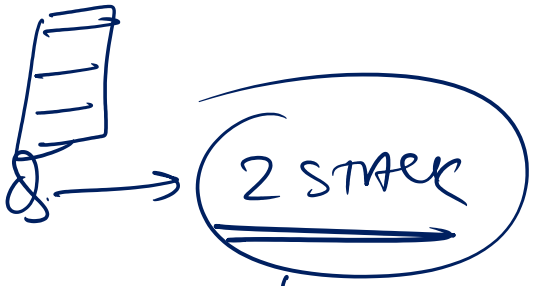
↳ finite language → R.L

26) $L = \{ w w^T \mid w \in (a,b)^* \}$ ⇒ Not R.L



27) $L = \{ w w^T \mid w \in (a,b)^*, |w| = 5 \}$ ⇒ R.L

28) $L = \{wcw \mid w \in (a,b)^*\}$ => CSL



TM or LBA

29) $L = \{w \cdot w \mid w \in (a,b)^*, |w| = 5\}$

30) $L = \{w_1 \cdot w_2 \mid w_1, w_2 \in (a,b)^*\}$

$(a+b)^* \cdot (a+b)^*$ => R.L

30) $L = \{ a^l b^m c^n \mid l > m \text{ or } l > n \} \Rightarrow$ not R.L

$l > m$, $l > n$

31) $L = \{ a^l b^m c^n \mid l, m, n \geq 0, l = m \text{ or } m = n \} \Rightarrow$ Not R.L

(or)

$L = \{ a^m b^m c^n \cup a^l b^n c^n \mid l, m, n \geq 1 \}$

32) $L = \{a^l b^m c^n \mid l = m \text{ or } m = n, m \leq 100\} \Rightarrow$ R.L

(or)

$= \{a^i b^i c^n, i \leq 100 \text{ or } a^l b^j b^j, j \leq 100\}$

$\Rightarrow \{c^n \mid n \geq 1 \text{ or } a^l \mid l \geq 1\}$

33) $L = \{a^m b^n \mid |m-n| \geq 0\}$ → Always TRUE

or

$L = \{a^m b^n \mid m, n \geq 0\}$ → R.L

34) $L = \{a^m b^n \mid |m-n| > 0\}$

or

$L = \{a^m b^n \mid m \neq n,\ m, n > 0\}$ → Not R.L

35) $L = \{ w \mid w \in (a,b)^* \}$

i) $N_a(w) = N_b(w)$

ii) $N_a(w) \leq N_b(w)$

iii) $N_a(w) \geq N_b(w)$

iv) $N_a(w) \neq N_b(w)$

$\Rightarrow$ Not R.L

36) $L = \{a^m b^n \mid m + n = 10\}$ → Finite → R.L

$\neq 10$ → R.L

≥ 10 → ? R.L

≤ 10 → R.L

> 10 → R.L

< 10 → R.L

3) $L = \{a^m b^n \mid m*n = 10\}$ → finite RL

$\neq 10$ → R.L

≥ 10 → RL

≤ 10 → R.L

> 10 → RL

< 10 → R.L

$m*n \geq 10$ ⇒ RL

↓

$m*n < 10$ → RL

38) $L = \{a^m b^n \mid m - n = 10\}$

Not R.L

$\neq 10$

≥ 10 → Infinit

≤ 10

> 10

< 10

$m - n = 10$

Infinit

$m - n < 10$

Infinit

$1 \leq m - n \leq 10$

$m - n = 10$

$m = n + 10$

$L = \{a^{n+10} b^n \mid n \geq 10\}$ ⇒

$L = \{a^{10} a^n b^n \mid n \geq 10\}$ → Infinte Relation

39. $L = \{a^m b^n \mid m/n = 10$

$\neq 10$

≥ 10

≤ 10

> 10

< 10

? Infinite

$m/n = 10$

$m = 10 * n$

$L = \{a^{10n} b^n\}_n$

not RL

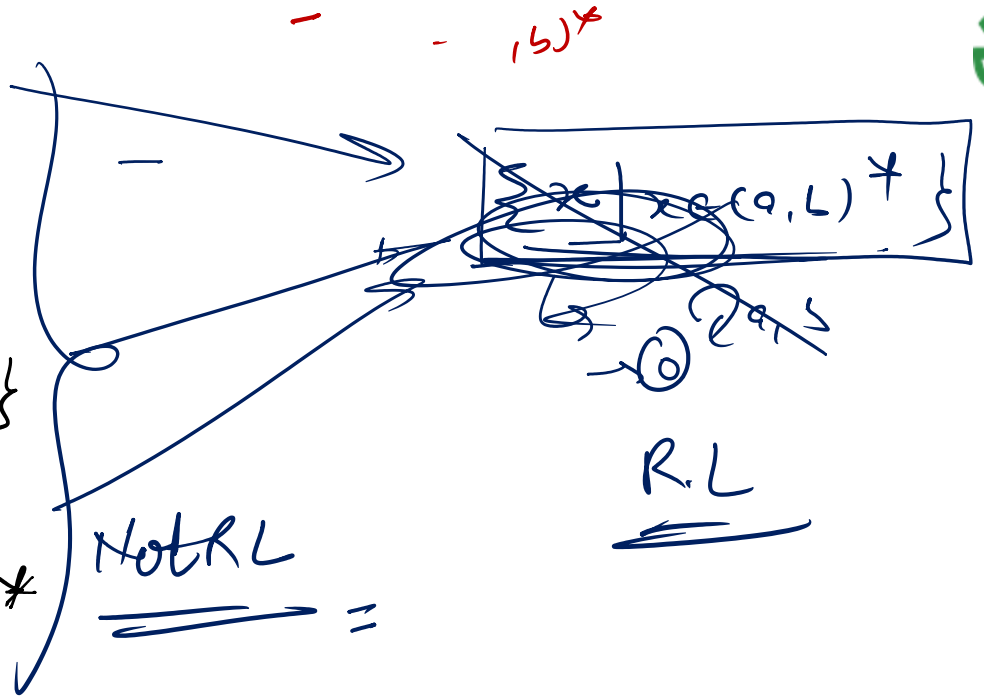
40) $L = \{ w x w^T \mid w, x \in (a,b)^* \}$

$|x| = 2$

41) $L = \{ w w^T x \mid w, x \in (a,b)^* \}$

=

42) $L = \{ x w w^T \mid w, x \in (a,b)^* \}$



43) $L = \{ w x w^T \mid w, x \in (a,b)^+ \} \Rightarrow$ R.L

$a(bbaabb)a + b(aabbaa)b$

RE.

$\Rightarrow RE: a(a+b)^*a + b(a+b)^*b$

44) $L = \{ w w^T x \mid w, x \in (a,b)^+ \}$ $\in$, $w = a$, $w = b$

NotRL $abbbbaaa$ $aaax + bbbx$

$\Rightarrow aa(a+b)^+ + bb(a+b)^+$

$(ab)bbbax$

45) $L = \{ x w w^T \mid w, x \in (a,b)^+ \}$

R.L $\Rightarrow$ ~~Not R.L~~

$x \neq \epsilon \rightarrow \{ x \mid x \in (a+b)^+ \} \Rightarrow$ R.L

46) $L = \{ wxw \mid w, x \in (a,b)^* \}$
R L
$\varepsilon \; x \; \varepsilon \longrightarrow x \mid x \in (a,b)^*$

47) $L = \{ wwx \mid w, x \in (a,b)^* \}$
↳ R.L

48) $L = \{ xww \mid w, x \in (a,b)^* \}$
↳ R L

49) $L = \{ wxw \mid w, x \in (a,b)^+$
$a\,x\,(a+b)^+a + b(a+b)^+b + a(a+b)^+b + b(a+b)^+a$
aa, bb
Not R.L

50) $L = \{ wwx \mid w, x \in (a,b)^+$
↳ Not R.L

51) $L = \{ w x w^T \mid w, x \in (a,b)^*, |x| = 10 \} = ?$ Not R.L

52) $L = \{ w x x^T w^T \mid w, x \in (a,b)^* \} \Rightarrow$ Not R.L

$x x^T$

53) $L = \{ w(w^T)^* \mid w \in (a,b)^* \}$

or

$w[\epsilon, w^T, w^T w^T, w^T w^T w^T, \ldots]$

$\Rightarrow [w, ww^T, ww^Tw^T, ww^Tw^Tw^T \ldots]$

$\Rightarrow w \in (a,b)^*$

$(a+b)^*$

$L = \{ w \mid w \in (a,b)^* \} \Rightarrow$ RL

R.L

$L = \{ xww^Ty \mid x,y \in (a,b)^* \}$

abaabbbab

$RE = (a+b)^* aa(a+b)^* + (a+b)^* bb(a+b)^*$

54) $L = \{ wxwy \mid w,x,y \in (a,b)^+ \} \Rightarrow$ R.L

RE: $a(a+b)^+ a(a+b)^+ + b(a+b)^+ b(a+b)^+ \Rightarrow$ RL

aabbaaabbaa

56) $\Rightarrow$ $L = \{ wxyw, \; w,x,y \in (a,b)^+ \}$

55) $L = \{ xwyw \mid w,x,y \in (a,b)^+ \} \Rightarrow$ R.L

RE: $(a+b)^+ a(a+b)^+ a + (a+b)^+ b(a+b)^+ b$