CFL
NDCFL
DCFL
RL

atlantis
Date
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Regular language

→ Every Regular language is also CFL, but every CFL need not be regular.

• Regular language-	• Non Regular language
1. $a^n / n \geqslant 1$	1. $a^n b^n / n \geqslant 1$
2. $a^n b^m / n, m \geqslant 1$.	2. $ww^R / w \in (a,b)^*$
3. $a^n b^n / n \leqslant 10^{10^{10^{10}}}$. (language are bounded means -finite)	3. $ww / w \in (a,b)^*$
4. $ww^R / \|w\| = 2, \Sigma = \{a,b\}$	4. a^n / n is prime.
5. $a^n b^m c^K / n, m, K \geqslant 1$.	5. $a^{n^2} / n \geqslant 1$
6. $a^i b^{2j} / i, j \geqslant 1$.	6. $a^{2^n} / n \geqslant 1$
7. $a^i b^{4j} / i, j \geqslant 1$.	7. $a^i b^{j^2} / i, j \geqslant 1$
8. a^n / n is even.	8. $\{w / n_a(w) = n_b(w)\}$
9. a^n / n is odd.	9. $ww^R w^R / w (a,b)^*$
10. $n_a(w) \bmod 3 \leqslant n_b(w) \bmod 3$.	10. $a^n b^n c^n / n \geqslant 1$
11. $a^n / n \geqslant 0$	11. $a^n b^{m+n} c^m / n, m \geqslant 1$

RL • $\{wxw^R / w, x \in (0,1)^+\}$ — (RL)

$\rightarrow$ $w = 101$ $w \quad x \quad w^R$

  $x = 100$ $w\underset{x}{\underline{101\,100\,101}}w^R$

  $w^R = 101$

  $w = 011$

  $x = 1010$ $\underset{w}{\underline{011}}\,\underset{x}{\underline{1010}}\,\underset{w^R}{\underline{110}}$

  $w^R = 110$

RF of this language = $\boxed{1\,(1+0)^*\,1 + 0\,(1+0)^*\,0}$

Start and end with same symbol.

N-RL • $\{wxw^R / w \in (0,1)^+\}$ — not Regular.

  $|x| = 5$ Because x is constant.

RL • $\{xww^Ry / x, y, w \in (0,1)^+\}$ — RL

$\rightarrow$

  $x = 10$ $w = 100$ $\underset{x}{\underline{10}}\,\underset{w}{\underline{100}}\,\underset{w^R}{\underline{001}}\,\underset{y}{\underline{11}}$

  $y = 11$ $w^R = 001$

RF of this language = $\boxed{(1+0)^*\,11\,(1+0)^* + (0+1)^*\,00\,(0+1)^*}$

contain 11 or 00 as substring.

N-RL • $\{xww^R / x, w \in (0,1)^+\}$

N-RL • $\{ww^Ry / x, w (0,1)^+\}$