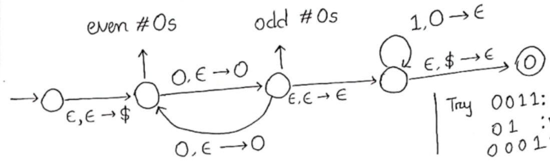
Pushdown Automata (PDA)

we will have same amount of 0s & 1s and n is odd

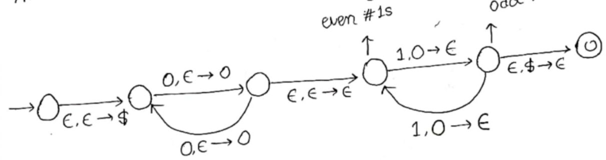
$L = \{\omega \in \{0,1\}^* : \omega = \underbrace{0^n 1^n}, \text{ where } n \text{ is odd}, n \geq 0\}$



Try 0011 : ×
01 : ✓
0001 : ×

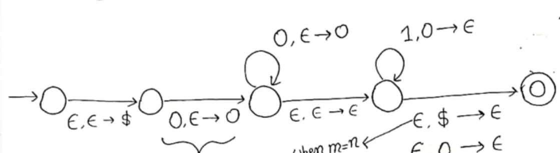
Previously, we simply counted the # 1s, which was enough. Because, if #0s = #1s, then their parity will be same. However, you can do this aswell.

Alternate solution:



* what if $L = \{\omega \in \{0,1\}^* : \omega = 0^m 1^n$, where m and n are odd.$\}$

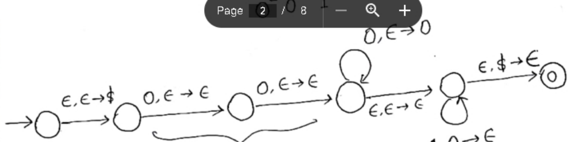
$L = \{\omega \in \{0,1\}^* : \omega = 0^m 1^n, \text{ where } \boxed{m \geq 1, n \geq 0,} \text{ and } m \geq n\}$



try 000111 : ✓
0001 : ✓
011 : ×
0 : ✓

$\boxed{\text{* what if } m \leq n?}$

$L = \{\omega \in \{0,1\}^* : \omega = \underbrace{0^{2+n} 1^n}_{0^2 0^n 1^n}, \text{ where } n \geq 0\}$

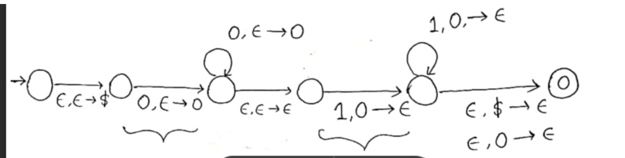


→ There will be '00' always at the beginning.

→ No need to push them in the stack.

same as $0^n 1^n$

$L = \{\omega \in \{0,1\}^* : \omega = 0^m 1^n, \text{ where } \boxed{m, n \geq 1}, \text{ and } m \geq n\}$



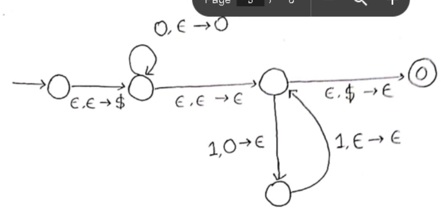
ensuring $m \geq 1$ ensuring $n \geq 1$

Try: 0 : ×
01 : ✓
011 : ×
001 : ✓

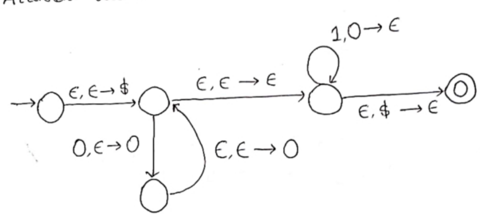
compare the problem with

$L = \{ \omega = 0^m 1^n$, where $\boxed{m \geq 1, n \geq 0}$, and $m \geq n \}$

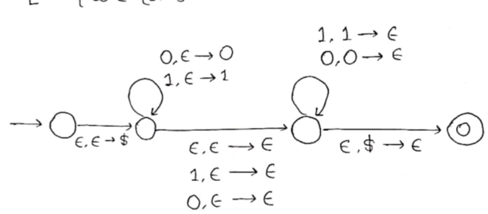
$L = \{ \omega \in \{0,1\}^* : \omega = 0^n 1^{2n}$, where $n \geq 0 \}$



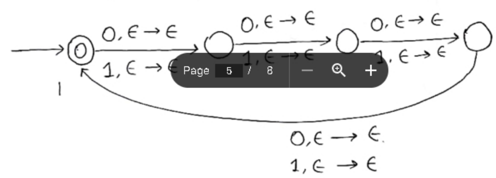
Alternate solution:



$L = \{ \omega \in \{0,1\}^* : \omega$ is a palindrome. $\}$



$L = \{ \omega \in \{0,1\}^* : \omega \mid$ the length of ω is multiple of four$\}$.



Since the language is regular, we don't have to use the stack. If you use stack, it is also fine. 'Use the stack' means, pushing and popping element from the stack.

L1 = #1s in ω is multiple of 3.

L2 = ω contains even #0s

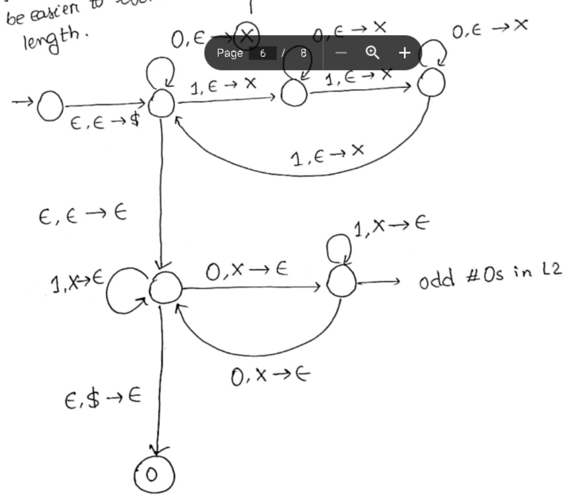
L = $W : \omega = UV$, where $U \in L1$. $V \in L2$ → regular

$|U| = |V|$ → non regular

↓

we will use stack to count the lengths are equal

Inserting a common element for both 0 and 1, it will be easier to count the length.

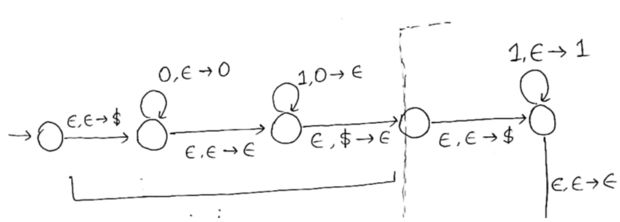


$L = \{ \omega \in \{0,1\}^* : \omega = 0^i 1^j 0^k \mid j = i+k$ and $i, k \geq 0\}$

$= 0^i 1^j 0^k$

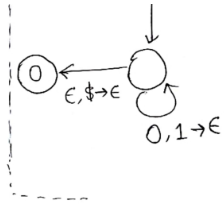
$= 0^i 1^{i+k} 0^k$

$= \underbrace{0^i 1^i} \underbrace{1^k 0^k}$



0^i1^i

1^k0^k



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$L = \{ \omega\bar{\omega}^R : \omega \in \{0,1\}^* \}$

for example, $\omega = 0100$

complement of $\omega = \bar{\omega} = 1011$

reverse of $\bar{\omega} = \bar{\omega}^R = 1101$

Doing $\omega \to \omega^R \to \bar{\omega}^R$ will be same thing.

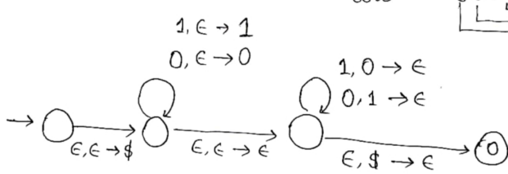
$\omega\bar{\omega}^R = 01001101$

this is even length palindrome

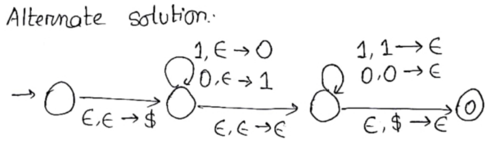
First think how to solve : $\omega\omega^R = 0100\,0010$

so if we complement the part

$\omega\bar{\omega}^R = 01001101$



Alternate solution.



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