Assignment - 02

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CSE331

1.

a) $L = \{w \in \{0,1\}^* : ww^R$ and w^R means w in reverse$\}$

$\Rightarrow$

$w = 0^p 1^p \quad w^R = 1^p 0^p$

$ww^R = 0^p 1^p 1^p 0^p$

Let, L is regular.

p = Pumping lemma

$S = 0^p 1^p 1^p 0^p \quad (S \in L)$

$S = xyz$

Now,

$|xy| \leq p$

$|y| > 0$

$xy^i z \in L, \; i \geq 0$

If, $i = 2, \quad s' = xy^2 z$

$= 0^{p+|y|} 1^p 1^p 0^p$

s' violate the structure ww^R [1st half is not reverse of the 2nd half]

$\therefore s' \notin L$, L is not regular.

b) $L = \{\omega \in \{a,b\}^* : \omega = b^n a^m \text{ where } n > m, m \geq 0\}$

=> Let, $S = b^{P+1} a^P$, $n > m$; satisfied

$i = 2$, $xyyz \Rightarrow b^{P+|y|+1} a^P$

$\Rightarrow 1 + P + |y| \geq P$; $n > m$ (condition satisfied)

$\Rightarrow 2P|xy| \leq P \Rightarrow |y| > 0$

Now,

$xz \Rightarrow b^{P+1-|y|} a^P$

$\Rightarrow P + 1 - |y| > P$

$\Rightarrow -|y| > P - 1 - P$

$\Rightarrow |y| < P + 1 - P$

$\Rightarrow |y| < 1$

∴ This means, it must satisfy $|y| \geq 1$, which is impossible since $|y| > 0$ by the definition of pumping lemma. So, L is not regular.

c) $L = \{w \in \{0,1,2,3\}^* : w = 1^n 0^m 3^n 2^m \text{ where } n, m \geq 0\}$

=> Let's assume L is a regular language.

$|xy| \leq p$

$|y| > 0$

$\Rightarrow w = 1^p 0^p 3^p 2^p$

Now, $i = 2$; $xyyz$

$\Rightarrow 1^{p+|y|} 0^p 3^p 2^p$

Here, it can be say that this pumping y adds more 1's in this string, which making $n \neq m$, so, L is not regular.

d) $w = 1^n$ [$L = \{w \in \{0,1\}^* : w = 1^n : n$ is a power of three]

Now, $w = 1^{3^p}$

$1^{3^1} = 111$

$1^{3^2} = 1^{9+2}$

for, $i = 2$; $xyyz$

$1^{3^p + |y|}$

Here, adding $|y| > 0$ destroys this condition of power of 3.

such as, $s = 10^9$; pumping $y = 10^{9+2} = 10^{11}$

So, L is not regular.