CSE - 331 Assignment - 2 :

sec - 02

submitted by,

Kefiat Lamia Ehsani

17201097

Miss Nazmmon Nahar Aka

22101649

Faiaz Abrar Zaman Pronoy

22301061

Md Fahmidur Rahman.

20301436.

Asir Abrar Tonish.

24141236 (22101324)

(a) $L_1 = \{w \in \{0,1,2\}^* : 0^n 1^n 2^n$ where $n \geq 0\}$ is not regular

Assume, L_1 is a regular language than it should have a pumping length p and also can be divided into three parts $(S) = xyz$ satisfying the following conditions,

$|xy| \leq p$,

$|y| > 0$

$xy^iz \in L_1$, $i \geq 0$

now,

Let, $S = 0^p 1^p 2^p$

According lets assume, $p = 4$

therefore,

$w = 0^4 1^4 2^4$

now,

$w = \underbrace{000}_{x}\underbrace{0}_{y}\underbrace{11112222}_{z}$

xy^iz, $i = 2$

$\Rightarrow xyyz = 00000111112222$ this string violates pumping leema ~~there~~ fore thus L_1 is not a regular language.

~~Therefore,~~

(b) $L_2 = \{ w \in \{0,1\}^* : 0^x 1^y 0^z$ where $z > x+y$, $x, y \geq 0 \}$

lets assume L_2 is a regular language. then it must have a pumping length. p and can be divided in ~~3~~ 3 slices $S = xyz$. And satisfy the following.

- $|xy| < p$
- $|y| > 0$
- $xy^iz \in L_2$, $i \geq 0$

Let, $w = 0^p 1^{2p} 0^{p+2p+\cancel{p}1}$

$x = p$
$y = 2p$
$z = \cancel{p}\,3p+1$

Assuming,

$p = 2$

$w = 0^2 1^4 0^7$

$w = \underbrace{00}_{x}\underbrace{1111}_{y}\underbrace{0000000}_{z}$.

~~xy^iz~~ $i = 2$

$\Rightarrow xy^2z = 00111111110000000$. here $z \not> x+y$

~~there fo~~ therefore, L_2 is not a regular language.

(c) $L_3 = \{w \in \{0,1\}^* : w$ is a palindrome$\}$

Assuming L_3 is a regular language. it is bound to have a pumping length of p such that any string S in L_3 can be split in three different parts. $S = xyz$, fulfilling conditions.

* $|xy| \leq p$
* $|y| > 0$
* $xy^iz \in L$ $i \geq 0$.

therefore.
choosing, $w = 0^p 1^p 0^p$, which is palindrome which belongs to L_3. Here, $|S| = 2p + p = 3p$ so S is longer than p.

According to the pumping ~~length~~ lemma, S can also be split in xyz where $|xy| \leq p$ and $y \geq 0$ both x only must consist of 0's because the first p characters of S are all 0's considering pumping y. the string xy^iz would look like $0^{p+|y|} 1^p 0^p$ which makes the new string not a palindrome. thus, making it a irregular language

Therefore, L_3 is not a regular language.

(d) $L_4 = \{ w \in \{a,b\}^* \mid$ number of a ~~is~~ in w is a prime number$\}$

Assume L_4 is a regular language thus it has a pumping length of p also it can be devided in three parts $S = xyz$ also it should satisfy the following

* $|xy| < p$
* $|y| > 0$
* $xy^iz \in L$, $i \geq 0$

Let,

$w = a^{p+1}$ [here, $p+1$ = prime number]

$\therefore w \in L_4$

now,

Let,

$p = 4$

$w = \underbrace{aa}_{x}\underbrace{a}_{y}\underbrace{aa}_{z}$,

now,

(1) $|xy| = 4 = p$

(2) $|y| = 1 > 0$

(3) $xy^2z = xyyz =$ aaaaaa

here length of w is 6 which is not a prime number.

$\therefore L_4$ is not a regular language.

(e) $L_5 = \{w \in \{0,1\}^* \; 0^{3^m}$ where $m \geq 0\}$

Assume L_5 is a regular language so it must have a pumping length p and can be divided in 3 parts.

now,

let,

$$w = 0^{3^p}$$

here $p \geq 0$

~~now~~

let, $p = 2$

$$w = 0^{3^2} = 0^9$$

$$= \underbrace{000}_{x}, \underbrace{000}_{y}, \underbrace{000}_{z}$$

(i) $|xy| = 6 \leq p$

(ii) $|y| = 3 > 0$.

(iii) $xy^2z = xyyz = 000\,000\,000\,000$

where the ~~no.~~ number of ~~000~~ 0's dont follow 3^n pattern

thus, L_5 is not a regular language.