DATE
PAGE

Assignment - II

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- 1 Explain Myhill - Nerode theory?

Ans It is an important characterization of regular language. it has so many practical implications
One consequence of the theorem is an algorithm for minimization of DFA's which is a vital step in automata theory.

Theorem: Myhill - Nerode theorem states that for a language L such that $L \in \Sigma^*$ the following -

a) There is a DFA that accepts L (L is regular language)

b) There is a right invariant equivalence relation ~ of finite index such L is a union of some of the equivalence classes of ~.

c) $\sim_L$ is of finite index.

2 State the pumping lemma for regular language with an example?

Ans Pumping lemma for regular language -

for any language L, there exists an integer n, such that for all $x \in L$ with $|x| \geq n$, there exist $u, v, w \in \Sigma^*$ such that $x = uvw$ &

1) $|uv| \leq n$

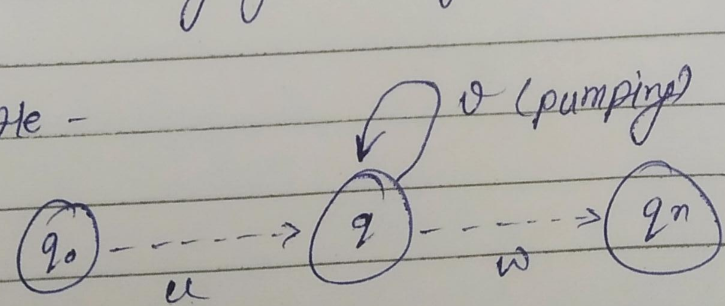
2) $|v| \geq 1$

3) for all $i \geq 0$; $uv^iw \in L$

Pumping Lemma is used as a proof for irregularity of a language. Thus if a language is regular it always satisfy pumping lemma.

In short if pumping Lemma holds, it does not mean that language is regular

Example -



Let us prove $L_{01} = \{0^n 1^n \mid n \geq 0\}$ is irregular

Let us assume that L is regular, then by pumping Lemma the above given rules follow. Let $x \in L$ & $|x| \geq n$, so by pumping Lemma there exist u, v, w such that condition ① & ② hold

We show that for all u,v,w ① & ③ does not hold.

If ① & ② hold then $x = 0^n 1^n = uvw$ with $|uv| \le n$ & $|v| \ge 1$

So, $u = 0^a$, $v = 0^b$, $w = 0^c 1^n$ where: $a+b \le n$, $b > 1$, $c \geq 0$, $a+b+c = n$

But then ③ fails for $i=0$

$uv^0w = uw = 0^a 0^c 1^n = 0^{a+c} 1^n \in L$ since, $a+c \neq n$

u	v	w
00000	000 0	0111111

↑ pumping

3 Write the regular expression for the following

a) Binary numbers that are multiple of 2.

Ans $(0|1)^*$

b) Strings of a''s & b''s with no consective a''s.

Ans $b^* (abb^*) (a|\epsilon)$.

c) Strings of a''s & b''s containing consetive a''s.

Ans $(a|b)^* aa (a|b)^*$.