Regular Languages, Pumping Lemma and existance of an FSA for a Language

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Continued -

Q. Find an automaton which accepts a string from L where L on $\Sigma = \{0,1\}$ where #0 == #1.

Let the automaton is finite and size N. A string that is accepted with no repetition of state must be of less than N length. Any longer string must have a repeated state.

0N1N must be accepted. Suppose it is accepted. Then there must be a repetition of states in the first N characters. Suppose ri = rj. Then 0i takes it to ri and 0j-i then takes it back to ri. If we add (0j-i)k after 0i, the resulting string will also be accepted by the automaton. But this string has more 0s than 1s. Hence $\nexists$ a finite automaton.

Proposition

Regular Language A language is said to be a regular if there exists a deterministic FSA, that recognizes it.

Pumping Lemma

If L is a regular language, then $\exists$ a natural number N called the pumping length such that if w is a string in L (i.e. w$\in$L) & $|w| \geq N$, then we can write w=xyz such that

1. y is not empty
2. $|xy| \leq N$
3. xyiz also belogs to L $\forall$ i=0,1,2,3...

L is a set of strings over {0,1} st the number of 0s exceeds the number of 1s. Not regular. Pumping lemma on 1N0N+1 proves it.