CPSC 421: Introduction to Theory of Computing **Winter Term 1 2018-19**

Lecture 6: September 17

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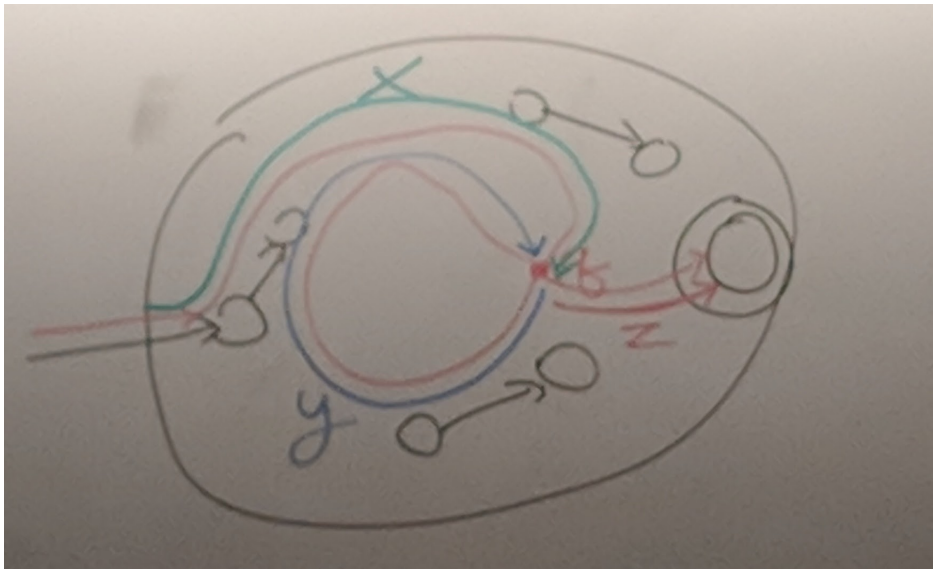
6.1 Danger with Intuition

$L = \{w : w$ has a equal # of occurrences of substrings 01 and 10 $\}$

This is a regular, surprisingly (Ex 1.48).



Give the DFA a long input string w. Computation path on input w must contain a cycle. Let x be the part of input that was processed before arriving at q. While going round cycle, read y from input. After cycle, we read z from input.

What if input were $xyyz$. The DFA also accepts; we just travel cycle twice.

Message: If L is regular, then for a sufficiently long string $w \in L$, we can repeat its special substring y, to get another string in L.

Refinement of Message: Let $p = \#$ states of DFA. If $|w| \geq p$ then computation path has length $\geq p+1$. By Pigeonhole Principle, a cycle exists. So we can assume $|xy| \leq p$. That's enough to get a cycle.

Important Point:

- We can (usually) use Pumping Lemma to prove that a language is not regular by proving that it satisfies the negation of Pumping Condition.
- We cannot use P.L to prove that a language is regular.

How to negate a statement with logical quantifiers:

- $\exists x$ s.t. f becomes $\forall x$, NOT f
- $\forall x$, g becomes $\exists x$ s.t. NOT g