CSE322: Models

Why do we need (so many of) them ?

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The main goal of this course

- Models for computation
  - Ones with different powers
  - Ultimately model the computer

Why should we study models ?

- Addition of numbers
  - Add numbers “one” and “two”
- One way

- Another way

1 + 2 = 3

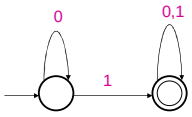
Good qualities of models

- Simple
- Capture “reality”
- Abstract

- Once we understand the model, we can do more complex things with it
  - Area of a circle of radius $r = \pi r^2$
  - Try computing the area with  s

What have we seen so far

- Regular languages
- DFAs
  - State Diagrams



  - Formal description $M=\langle Q,\Sigma,\delta,s,F\rangle$

- Why have formal definitions ?
  - More “general” ($L_k=\{w|$ k^{th} last symbol is 1$\}$)
  - “Easier” to code up (for eg if DFA is an input)

Two sides of the same coin

- NFAs
- (equivalent to) DFAs

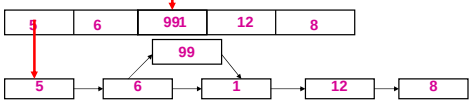
- Why do we need two different models ?

A very vaguely related analogy

- But we know it is the same person

The rationale behind multiple models

- Different models are useful for different things
- Storing a sequence of numbers
  - Linked Lists vs Arrays
- What is the 3rd element ?
- Insert 99 before the 3rd element



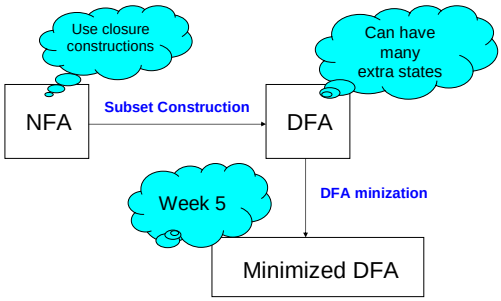
Let's compare NFAs and DFAs

NFA	DFA
Easy to construct	Harder to construct
Cannot code it up	Can code it up

L_k={w| k^{th} last symbol is 1}

How to code it ?

Uses of Equivalence



In other words

- Constructive equivalence results
  - Shows that two different models are the same
  - A method to convert from one model to another

In the next 3 weeks…

- Next week (week 4)
  - Study limits of DFAs
  - Languages that are not regular
  - Pumping Lemma
- The week after (week 5)
  - DFA minimization
  - Myhill-Nerode theorem
  - Another way to prove certain languages are not regular

Coming up next….

- Yet another model for Regular languages
- Regular expression
  - Equivalent to DFAs
- Very short description