

LING/C SC/PSYC 438/538

Lecture 20

Prof. Sandiway Fong

Today's Topics

- Regex (mathematical) & FSA are equivalent.
- Example:
 - a machine is (*perhaps*) easier to build than a regex.
- The state bypass method:
 - converting a FSA into a regex algorithmically
- Homework 11

FSA and regex

- Textbook Exercise: find a regex for

4. the set of all strings from the alphabet a, b such that each a is immediately preceded by and immediately followed by a b ;

Examples (** denotes string not in the language*):

**a*b **b*a

bab

λ (empty string)

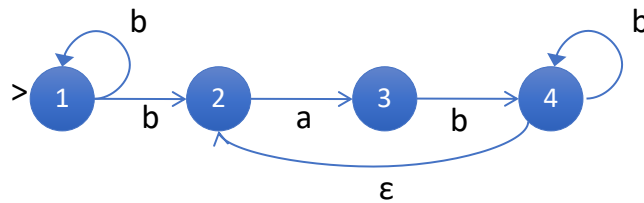
bb

**b*ab*a*

babab

FSA and regex

- Draw a FSA and convert it to a regex:



[Powerpoint
Animation]

b^* b $(ab+)^+$

$= b+(ab+)^* \mid \epsilon$

Regex from FSA

- `$ perl -le 'for (@ARGV) {if (/^(b+(ab+)*|)$/) {print "$_ accept"} else {print "$_ reject"}}' ' ' ab ba bab bb baba babab`

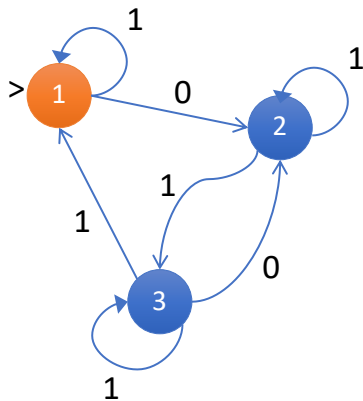
1. accept
2. ab reject
3. ba reject
4. bab accept
5. bb accept
6. baba reject
7. babab accept

Regex from FSA

- Any regex can be re-drawn as a FSA.
- Formally, we can also convert any FSA to a regex
 - *But there isn't necessarily just one solution*

Regex from FSA

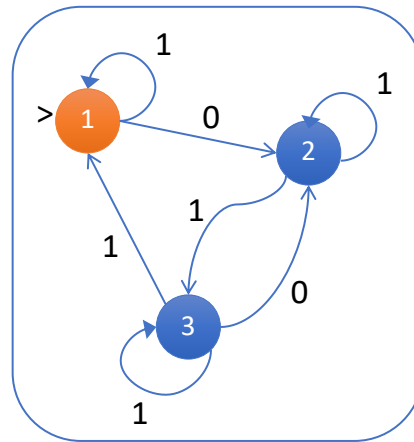
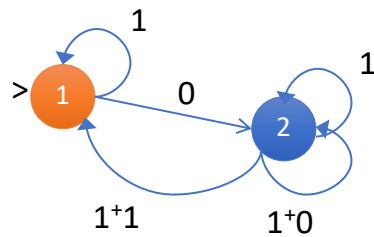
- Example:
 - Give a regex for the NDFSA:



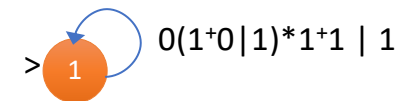
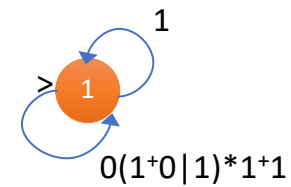
- State by-pass method:
 1. Delete one state at a time
 2. Calculate the possible paths passing through the deleted state
 3. Add the regex calculated at each stage as an arc
- e.g.
 - eliminate state 3
 - then 2...

Regex from FSA

- eliminate state 3



- eliminate state 2



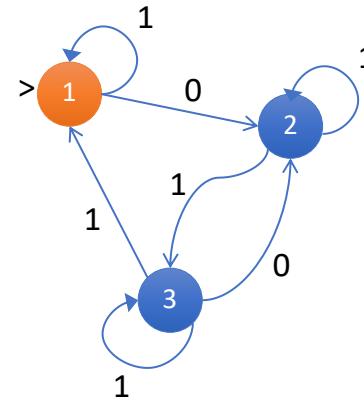
Answer: $(0(1+0|1)^*1+1 | 1)^*$

[Powerpoint animation]

Another way: Regex from FSA

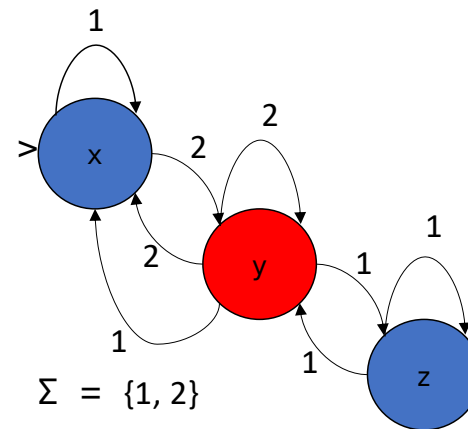
The example from two slides ago ...

- BUT:
 - let's do it in a different order, so:
 - step 1: eliminate state 2
 - step 2: eliminate state 3



Homework 12

- Let's start with **Homework 11**
- Recall Q4: let **L** be the language accepted by this machine:



Homework 12

- Question 1:
 - $L_R = \{w^R \mid w \in L\}$, w a string of L , w^R the reverse of w .
 - Example: if $1211 \in L$, $1121 \in L^R$
 - Give a **FSA** for L_R derived from the **FSA** in the previous slide
 - (A) How many states does the FSA for L_R have?
 - (B) How many end states?
 - **Recall:** *basic idea swap final/beginning states*
 - **Check your answer carefully!**
 - *By software or **legible** hand-drawn diagrams accepted*

Homework 12

- Question 2:
 - now convert $L_R = \{w^R \mid w \in L\}$ to a **DFSA**
 - use the set-of-states construction described in class
 - (A) How many states does the DFSA have?
 - (B) How many end states?
 - make sure you label your states with sets (*for ease of debugging*)
 - Check your answer!
 - *By software or **legible** hand-drawn diagrams accepted*

Homework 12

- Question 3:
 - consider $L_{RR} = \{w^R \mid w \in L_R\}$, L_R being the language in Question 2.
 - now construct the FSA for L_{RR} from the FSA of L_R in Question 2.
 - [using the method of Question 1](#)
 - (A) How many states does the FSA for L_{RR} have?
 - (B) How many end states?
 - Check your answer!
 - *By software or [legible](#) hand-drawn diagrams accepted*
 - Compare the machine you obtain here with the original machine for L .
 - (C) What is the difference?

Homework 12

- Question 4:
 - finally, convert $L_{RR} = \{w^R \mid w \in L_R\}$ to a **DFSA**
 - use the set-of-states construction described in class
 - make sure you label your states with sets (of sets)
 - (A) How many states does the **DFSA** for L_{RR} have?
 - (B) How many end states?
 - Check your answer!
 - *By software or **legible** hand-drawn diagrams accepted*
 - Compare the machine you obtain here with the (answer) machine obtained for L back in Homework 11.
 - What difference(s) do you notice?

Homework 12

- Email: to sandiway@arizona.edu
- Subject: 438/538 Homework 12 *YOUR NAME*
- Due date Sunday midnight!
 - will be reviewed next Tuesday
- One PDF file please
 - no links!
 - paste your machine (drawings) into the file