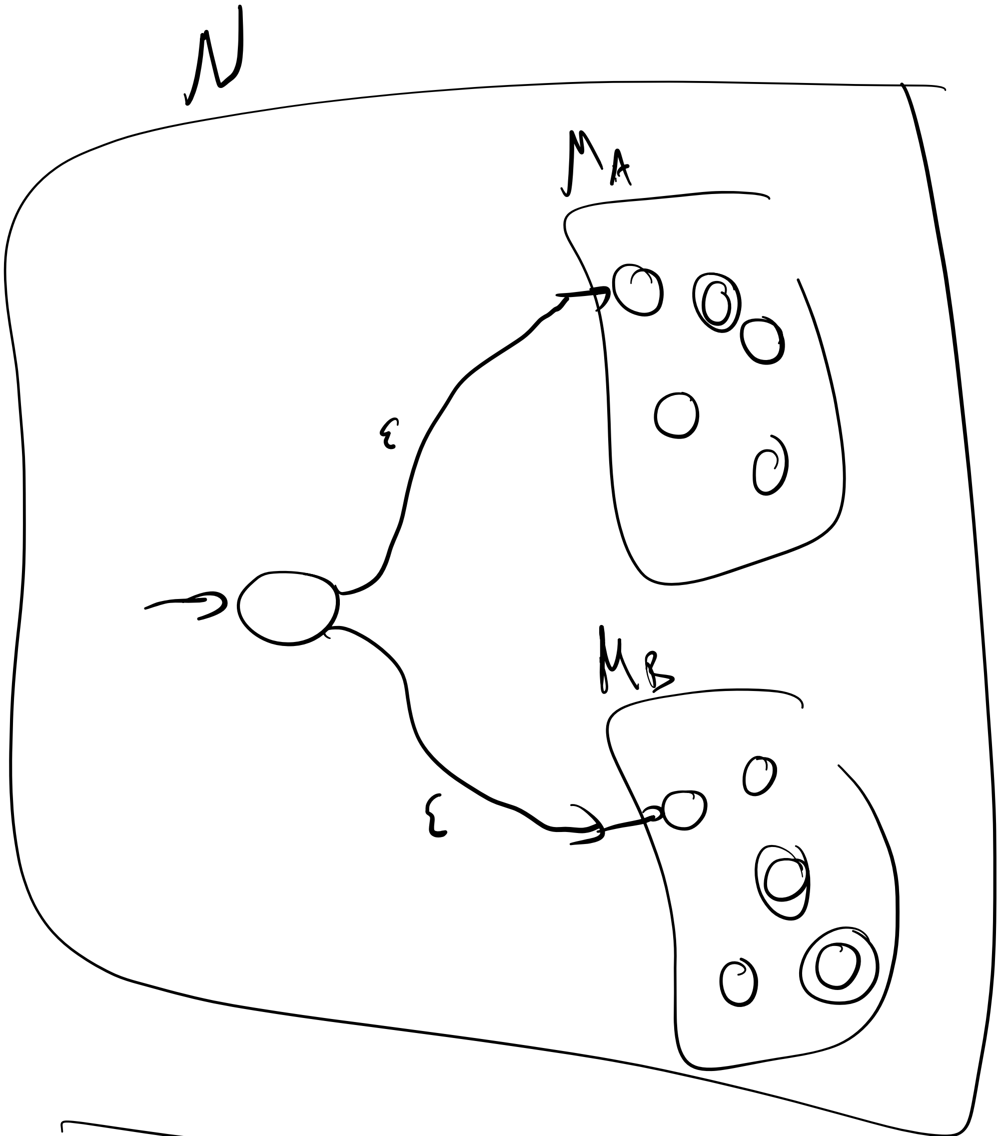
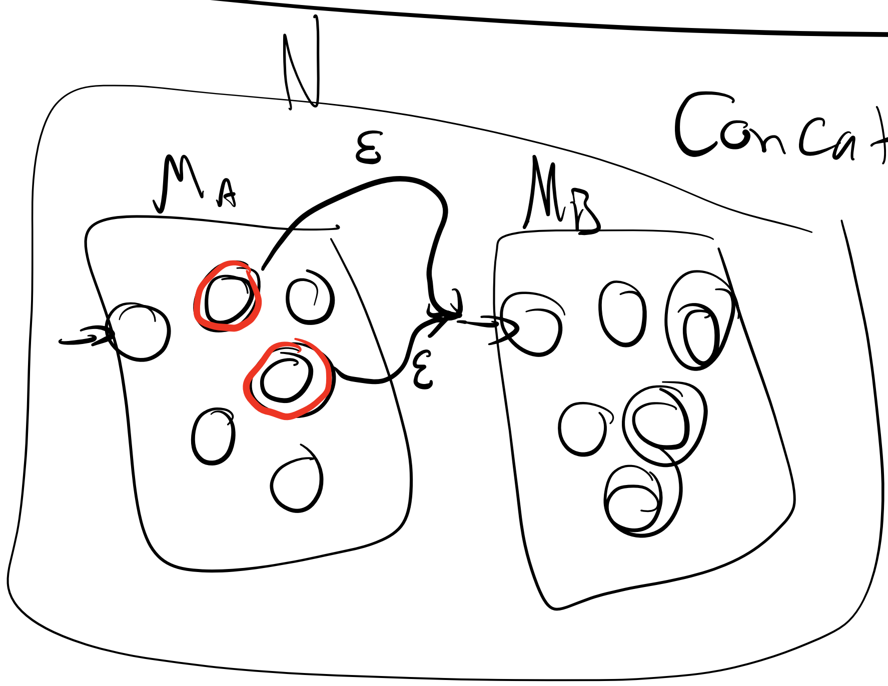
CSCI 301 - Lecture 26 - Regular Closure Proof

Regular Expressions

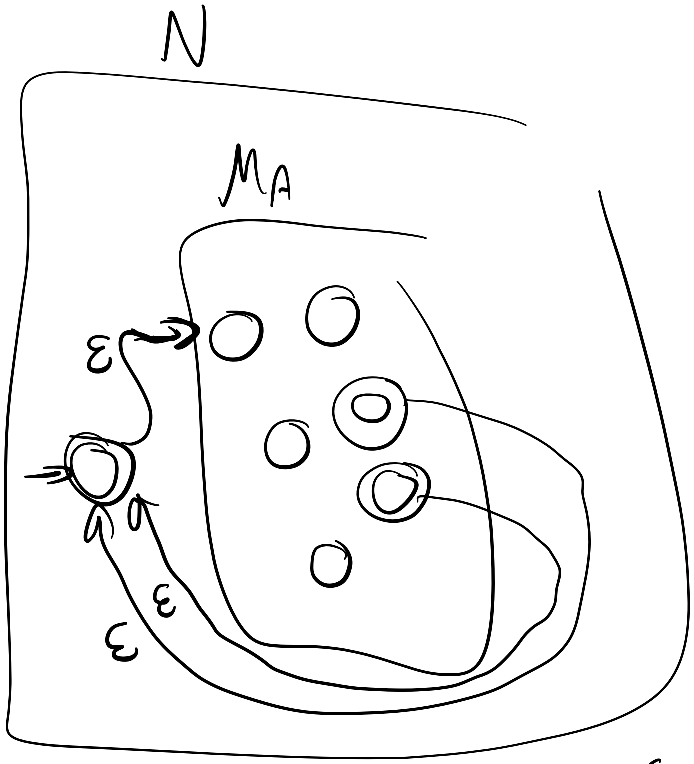


Union



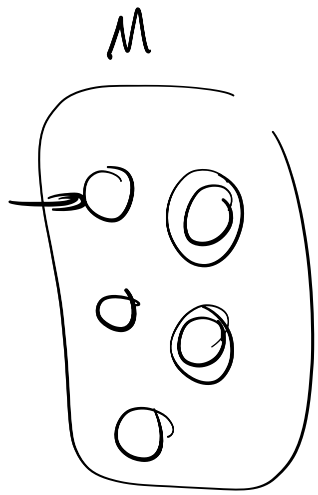
Concat

$*$

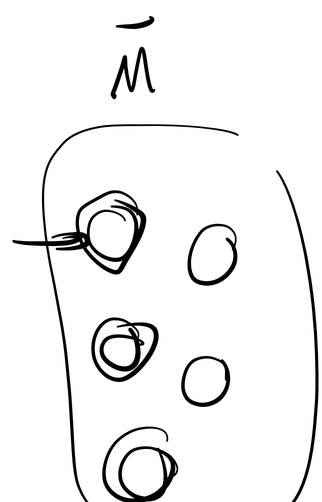


$A = \{11, 00\}$

$A^* = \{\varepsilon, 11, 00, 1111, 0000, 1100, 0011, \dots\}$



$\bar{A}$



$A \cap B = \overline{\bar{A} \cup \bar{B}}$

Regular Expressions: A meta-language for regular languages.

Definition: A regular expression over alphabet Σ is defined inductively (recursively) as follows:

Regular Expression	Language described
• ε is a R.E.	$\{\varepsilon\}$
• $\emptyset$ is a R.E.	$\emptyset$
• a is a R.E for all $a \in \Sigma$	$\{a\}$
• If R_1, R_2 are R.E.'s,	
- $R_1 \cup R_2$ is a R.E.	$R_1 \cup R_2$
- $R_1 R_2$ is a R.E.	$R_1 R_2$
• If R is a R.E., R^* is a R.E.	R^*

$\Sigma = \{0, 1\}$

$(0 \cup 1)01^*$

$\{00, 10, 001, 101, 0011, 1011, \cdots\}$

$L = \{w : w \text{ has } 1011 \text{ as a substring}\}$

RE: $(0 \cup 1)^* 1011 (0 \cup 1)^*$

B.1

RE	L
1. ab	$\{ab\}$
2. $(a \cup b \cup \varepsilon)$	$\{a, b, \varepsilon\}$
4. $\underbrace{a(a \cup b)} \cup \underbrace{b(b \cup a)}$	$\{aa, ab, bb, ba\}$
6. $(aa)^*$	$\{\varepsilon, aa, aaaa, aaaaaa, \dots\}$
8. $(a^* b^*)^*$ $aab\ a$	Σ^*

B.2 $\Sigma = \{a, b\}$

$\{w : w \text{ has at least 3 a's}\}$

$$(a \cup b)^* a (a \cup b)^* a (a \cup b)^* a (a \cup b)^*$$

$\Sigma = \{a, b\}$ $\{|w| \text{ is odd}\}$

$\Sigma = \{0, 1\}$ $\{w :$ every odd position is $1\}$