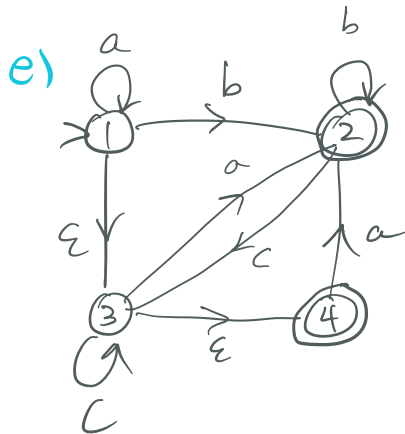
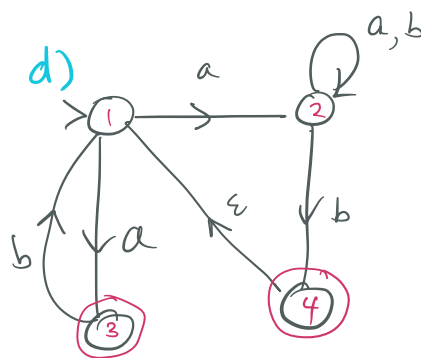
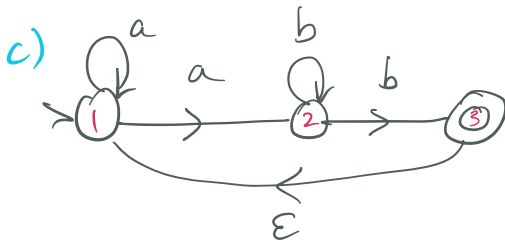
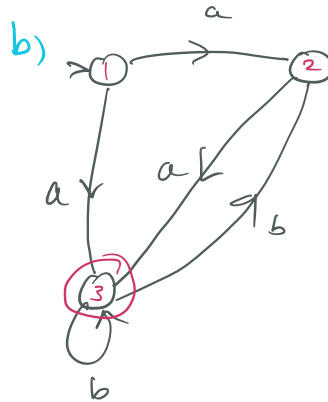
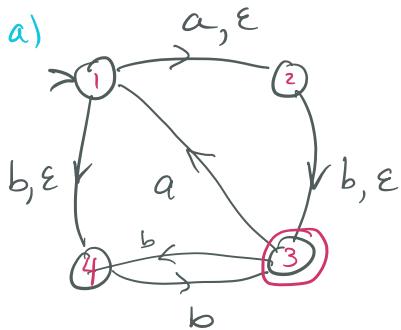


Tutorial Jan 21, 2025. All of these are HOMEWORK.

1. Convert the following NFAs into DFAs using the construction.



2. Give r.e.'s for the following languages.

a)  $\{w \in \{a, b, c\}^* \mid \text{each } a \text{ is followed immediately by either } b \text{ or } cb\}$

b)  $\{w \in \{0, 1\}^* \mid \text{each block of 0's has even length}\}$

c)  $\{w \in \{0, 1\}^* \mid \text{each block of 0's has odd length}\}$

d)  $\{w \in \{0, 1\}^* \mid \text{any occurrence of } 0001 \text{ is followed eventually by } 1110\}$

e)  $\{w \in \{0, 1\} \mid \#_0(w) \text{ is even}\}$

f)  $\{w \in \{a, b, c\}^* \mid \text{at least one of } \{a, b, c\} \text{ do not appear in } w\}$

3. <sup>For after today's lecture</sup> Convert the following r.e.s into NFAs using the construction.

\* a)  $(0+11)^*$  ✓

b)  $((10+01) \cdot 1)^*$

c)  $a^* + b \cdot b^* a$

4. "Grok and Blurt" NFA and r.e. for :

a)  $\{w \in \{0,1\}^* \mid \text{blocks of 0's are even length, blocks of 1's are odd length.}\}$

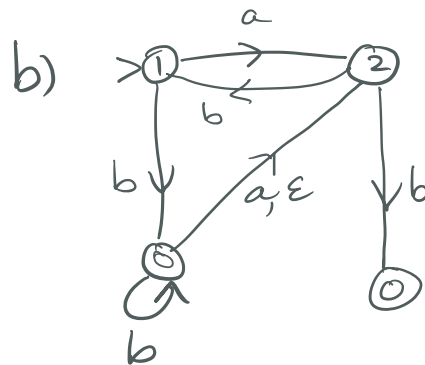
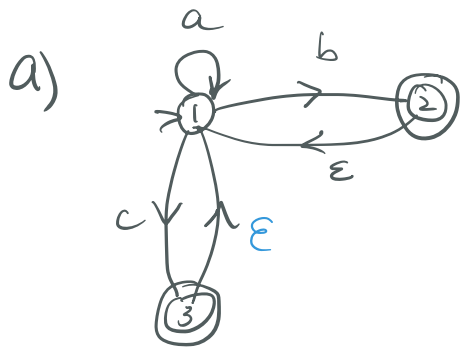
b)  $\{w \in \{0,1\}^* \mid \#_1(w) \equiv 2 \pmod{3}\}$

\* c)  $\{w \in \{0,1\}^* \mid w \text{ is the binary encoding of an integer } i, i \equiv 2 \pmod{3}\}$

Binary encoding:  $0, 00, 000, \dots = 0$   
 $1, 01, 001, \dots = 1$   
 $10, 010, 0010, \dots = 2 \quad \text{etc.}$

d)  $\{w \in \{a,b,c\}^* \mid \text{at least one of } a, b, c \text{ does NOT appear in } w\}$

5. <sup>+</sup> for after today's lecture  
 Convert the following NFAs into r.e.'s  
 using the construction.



Some simplifications are allowed in your r.e.'s

eg  $\gamma \cdot \epsilon \equiv \gamma$   $\gamma$  an r.e.

$$\gamma^* \cdot \gamma \equiv \gamma^+$$

$$(\gamma^+ + \epsilon) \equiv \gamma^*$$

$$\gamma + \gamma \equiv \gamma$$

$$\gamma(\alpha + \beta) \equiv \gamma\alpha + \gamma\beta$$

$$\alpha + \beta \equiv \beta + \alpha$$

$$(\delta^*)^* \equiv \delta^*$$

$$(\delta^+)^* \equiv \gamma^*$$