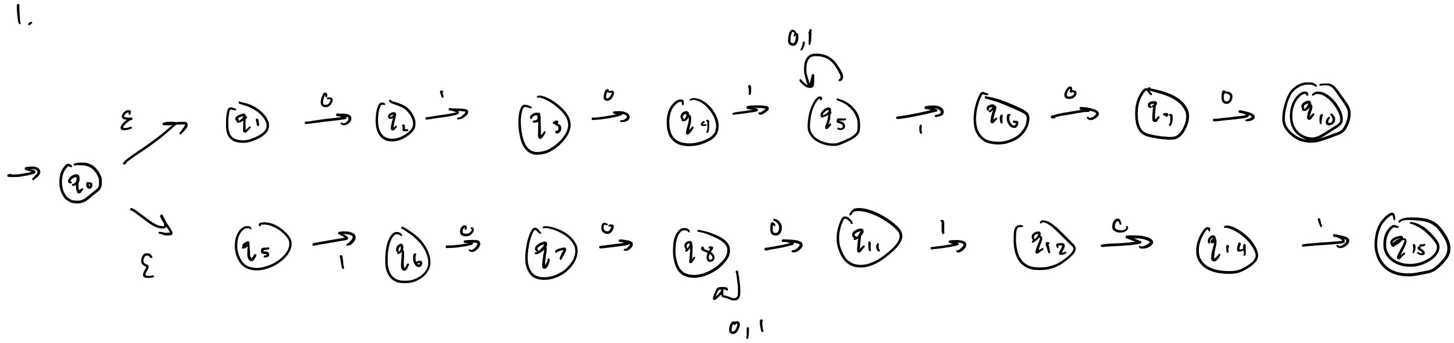
Homework 3

Tuesday, September 10, 2024 10:29 AM

1.



Ex. 010101100 accept ✓

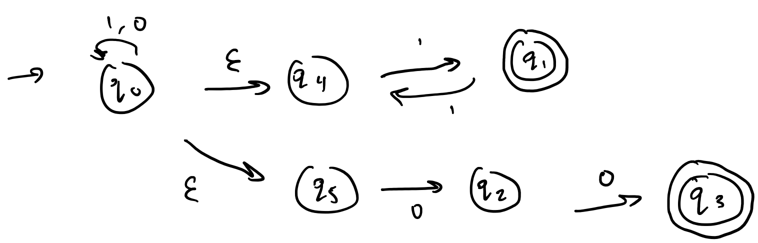
100101OO accept ✓

101101110 reject ✓

2. Given any regular language recognized by a NFA, we can create a Most-NFA by adding empty transitions to every accept state to satisfy the condition.

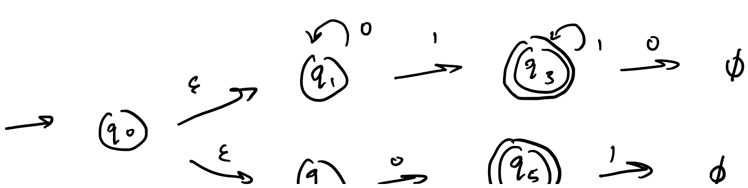
Working backwards, from a most NFA to an NFA, we remove empty transitions from accept states if possible. Then, from NFA we can create a DFA, which implies a regular language.

3.



Ex.

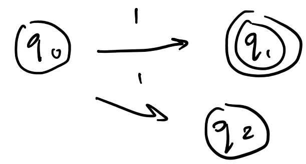
4.



Ex. 0001101 reject ✓

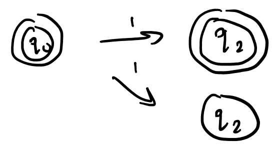
111000 accept ✓

5. Let NFA have 2 transition options at a state and alphabet $\{0,1\}$ such that...



This accepts $\{1\}$.

Flipping the states gets...



This accepts $\{\emptyset, 1\}$. $\{1\}^c = \{\emptyset, 0\}$.

Thus, in this case, flipping the states does not accept the complement.

This is due to the fact NFAs are not deterministic and can have multiple transitions given the same state & symbol.

6. Let $n = 1$.

Language $= \{0\}$

Let $n = 0$

$\rightarrow \emptyset$

Does not accept or recognize $\{0\}$

7. Let A and B be regular languages, such that there exists finite automata $(Q, \Sigma, \delta, q_0, F)$ and $(Q', \Sigma', \delta', q_0', F')$ for A and B, respectively.

define C s.t. (Q, Σ, S, q_0, F) exists for C.

Thus, A, B, C are all regular because there exists a finite automata.

Because languages are closed under concatenation, we can assert that $\{ w \mid w = a_x b_x c_x$ s.t. $a_x \in A, b_x \in B, c_x \in C \}$ is regular.

Because languages closed under star, we can assert that $\{ w \mid w = a_1 b_1 c_1 \dots a_x b_x c_x = (abc)^*$ s.t. $a_1 \dots a_x \in A, b_1 \dots b_x \in B, c_1 \dots c_x \in C \}$ is regular.

8. X is a regular language w finite automata (Q, Σ, S, q_0, F).

Let X accept $\{ x_1 x_2 \dots x_n \mid x_1 x_2 \dots x_n \in X \}$

We know that $y_1, \dots y_n \in \Sigma$, and thus $y_1 \dots y_n \in \Sigma^*$.

Let X' accept $\{ x \mid x \in X' \}$

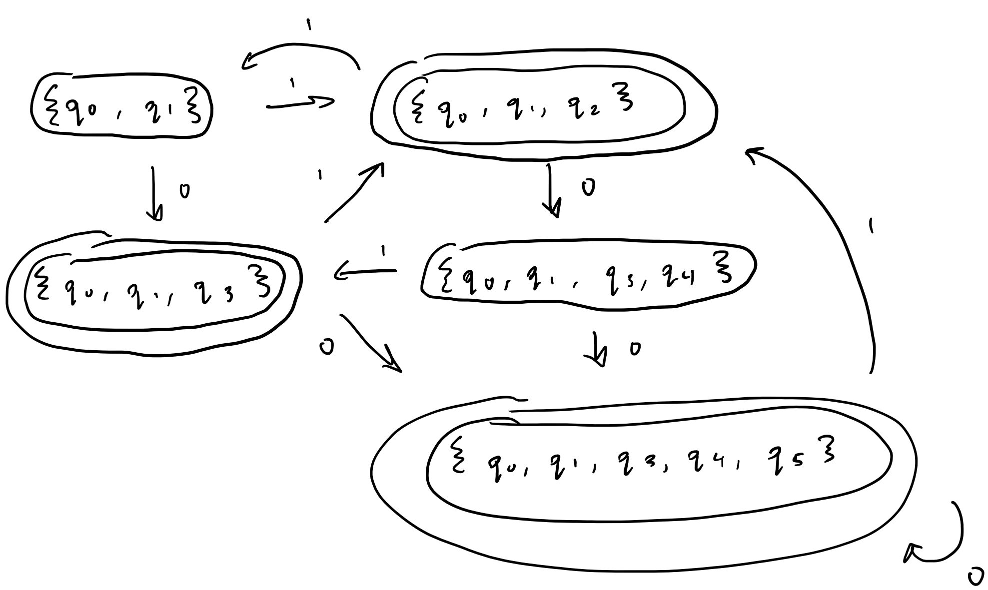
Let Y' accept $\{ y \mid y \in \Sigma \}$

Let XY' accept $\{ xy \mid x \in X', y \in \Sigma \}$ (regular under concat.)

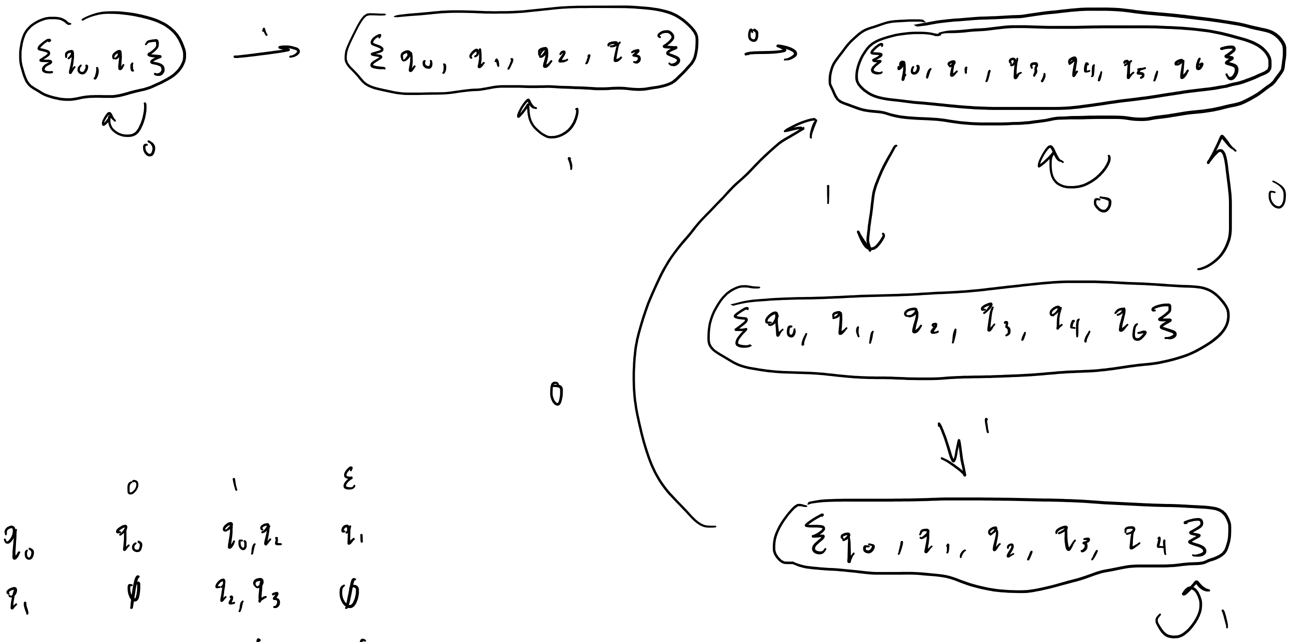
Let $X'Y'$ accept $\{ x_1 y_1 \dots x_n y_n \mid x \in X, y \in \Sigma^* \}$ (regular under star)

Thus, $\{ x_1 y_1 \dots x_n y_n \mid x \in X, y \in \Sigma^*$ (each $y_1 \dots y_n$ is a string on Σ) $\}$ is regular.

9.



10.



	0	1	ε
q_0	q_0	q_0, q_2	q_1
q_1	$\emptyset$	q_2, q_3	$\emptyset$
q_2	q_1, q_4	$\emptyset$	$\emptyset$
q_3	q_5, q_6	$\emptyset$	$\emptyset$
q_4	q_3, q_4	q_4	$\emptyset$
q_5	$\emptyset$	q_6	q_3
q_6	q_5	q_4	$\emptyset$