CS 373 Homework 5 Anchu A. Lee
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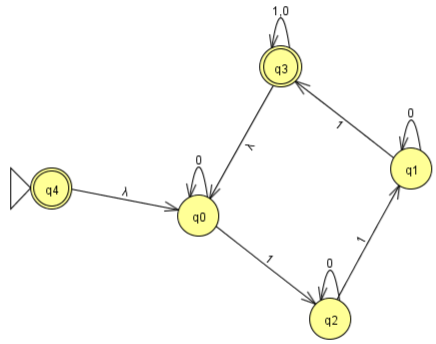
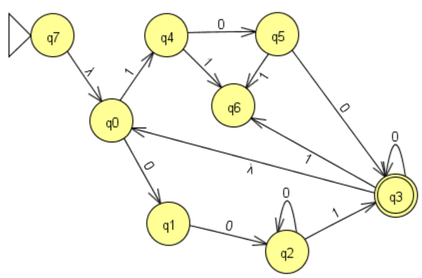
Question 1.10a Construct NFA that recognizes the star of the language in Exercise 1.6b

$$\{w \mid w \text{ contains at least three 1s}\}$$



Question 1.10b Same as before, but Exercise 1.6j

$$\{w \mid w \text{ contains at least two 0s and at most one 1}\}$$



Question 1.29b Use the pumping lemma to show that the language is not regular

$$A_2 = \{www \mid w \in \{a,b\}^*\}$$

Proof. Assume A_2 is regular, then there must exist a number n that is the pumping length. Test with the word $k = b^{n/2}b^{n/2}b^{n/2}$. $|k| > n$. Due to the nature of the language, there is only one way to split the word to satisfy the language. $x = b^{n/2}$; $y = b^{n/2}$; $z = b^{n/2}$. $|xy| \leq n$ and $|y| \geq 1$. Now consider pumping it up with xy^iz for $i = 2$. xyz is not in L because it is $b^{n/2}b^nb^{n/2}$ which does not match the definition of the language. Therefore our assumption was incorrect and A_2 is not regular. □

Question 1.46a Prove the following language is not regular using pumping lemma or closure of the class of regular languages under union, intersection, and compliment.

$$\{0^n1^m0^n \mid m, n \geq 0\}$$

Proof. Assume this language (A) is regular, so then it must be closed under compliment (A'). Then since regular languages are also closed under intersection, ($0^*1^*0^*$) is regular so $A' \cap (0^*1^*0^*)$ should be as well. However that is not the case therefore our assumption that A is regular was false. □

Question 1.46c Same as before

$$\{w \mid w \in \{0,1\}^* \text{ is not a palindrome}\}$$

Question 1.46d Same as before

$$\{wtw \mid w, t \in \{0.1\}^+\}$$

Question 1.47 Let $\sum = \{1, \#\}$ and let

$$Y = \{w \mid w = x_1\#x_2\#...\#x_k \text{ for } k \geq 0, \text{ each } x_i \in 1^*, \text{ and } x_i \neq x_j \text{ for } i \neq j\}$$

Question 1.49

- Let $B = \{1^k y \mid y \in \{0,1\}^* \text{ and } y \text{ contains at least } k \text{ 1s, for } k \geq 1\}$.
  Show that B is a regular language.

- Let $C = \{1^k y \mid y \in \{0,1\}^* \text{ and } y \text{ contains at most } k \text{ 1s, for } k \geq 1\}$.
  Show that C isn't a regular language.

Show that $\{0^n 1^m 2^k \mid k$ **divides** $n + m\}$ **is not regular.**
Convert the following NFA to a DFA: