Homework 2 (Written Problems)

Armand Nasseri

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1 Problem 1

DFA for no xzxy

5-tuple for the DFA is:

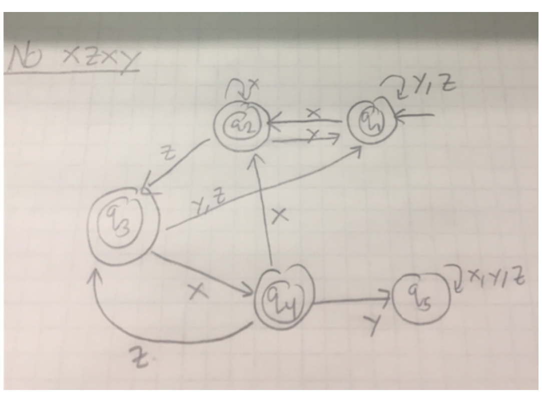
$Q = \{q_1, q_2, q_3, q_4, q_5\}$

$\Sigma = \{x, y, z\}$

δ	x	y	z
q_1	q_2	q_1	q_1
q_2	q_2	q_1	q_3
q_3	q_4	q_1	q_1
q_4	q_2	q_5	q_3
q_5	q_5	q_5	q_5

$q_0 = q_1$

$F = \{q_1, q_2, q_3, q_4\}$



DFA for z odd y even

6-tuple for the DFA is:

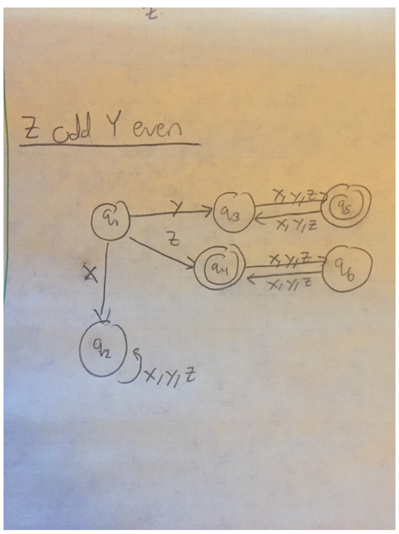
$Q = \{q_1, q_2, q_3, q_4, q_5, q_6\}$

$\Sigma = \{x, y, z\}$

δ	x	y	z
q_1	q_2	q_3	q_4
q_2	q_2	q_2	q_2
q_3	q_5	q_5	q_5
q_4	q_6	q_6	q_6
q_5	q_3	q_3	q_3
q_6	q_4	q_4	q_4

$q_0 = q_1$

$F = \{q_4, q_5\}$



2 Problem 2

A: D1 = $(Q_1, \Sigma, \delta_1, q_1, F_1)$
B: D2 = $(Q_2, \Sigma, \delta_2, q_2, F_2)$
C: D3 = $(Q_3, \Sigma, \delta_3, q_3, F_3)$

Minor(A,B,C):

x $\in A, x \notin B||C$

x $\in B, x \notin A||C$

x $\in C, x \notin A||B$

x $\notin A||B||C$

We have:

D = (Q, Σ,δ,q_0,F)

Σ is the same

Q = Q_1 x Q_2 x Q_3

q = (q_1,q_2,q_3)

δ((a,b,c),x) = (δ_1,(a,x),δ_2,(b,x),δ_3,(c,x)

for all a $\in$Q$_1$, b $\in$Q$_2$, c $\in$Q$_3$

F = F_1 x (Q_2 \F$_2$) x (Q_3 \F$_3$)$\cup$ (Q_1 \F$_1$) x F_2 x (Q_3 \F$_3$) $\cup$(Q$_1$ \F$_1$ x (Q_2 \F$_2$) x F_3 $\cup$(Q$_1$ \F$_1$) x (Q_2 \F$_2$) x (Q_3 \F$_3$)

3 Problem 3

Every string in A* can be constructed from A

$A = \{w \in$ {0,1}*$||numberOf_0(w) - numberOf_1(w)| = 1\}$

$A = \{000, 0, 1, 001, 100, 110, 011, 101...\}$

Fact: A is not regular, so there is no DFA for A and we need to show that A* is regular.

$A* = \{w = w_1, w_2, ...w_n|w_i \in A\forall n >= 0\}$

{0,1} $\subseteq A->${0,1}*$\subseteq$A*

$\Sigma*$ $\subseteq$A*$\subseteq$$\Sigma*$

A* = $\Sigma*$

4 Problem 3

$A \subseteq \{0, 1\}*$

$A \subseteq \{\epsilon, 0, 1, 00, ...1111\}$

$|x| <= 4$

$|A| <= 31$

Number of possible languages for A:

$1 + 2 + 4 + 8 + 16 = 31 - > 2^{31} = 2147483648$

Number of possible regex of size at most 10:

$(\ ) * + 1 \ 0 \ 1 - > 7^{10} = 282475249$

There are not enough regex to account for all the languages based on the pigeonhole principle.