Name: Yinsheng Dong
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NSID: yid164
CMPT360 Assignment 5

Question 1.

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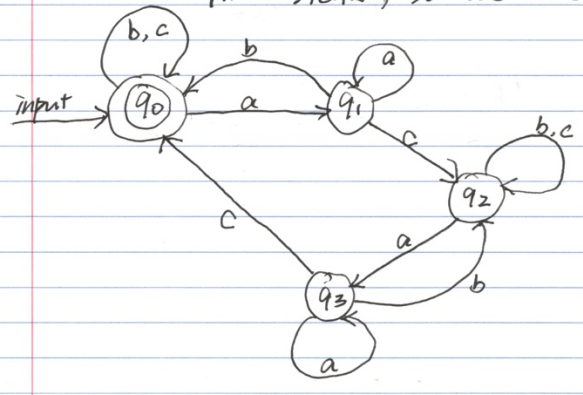
CMPT360 Assignment 5 Q1

Solution:

Given the language $\{a, b, c\}^*$ with a even number occurrences the substring 'ac'. Zero is even.

We assume 4 state: q_0, q_1, q_2, q_3 which q_0 is the start state. Since we know most zero of occurrence the substring of 'ac' is also even, so q_0 is also final state, so we have the DFA:



Then, we can test some strings which are in $\{a, b, c\}^*$

Test 1: $\{aabbccacabac\}$.

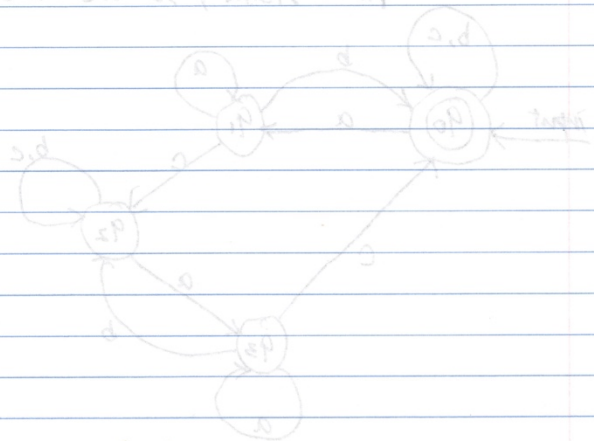
$q_0 \xrightarrow{a} q_1 \xrightarrow{a} q_1 \xrightarrow{b} q_0 \xrightarrow{b} q_0 \xrightarrow{c} q_0 \xrightarrow{c} q_0 \xrightarrow{a} q_1 \xrightarrow{c} q_2 \xrightarrow{a} q_3 \xrightarrow{b} q_2 \xrightarrow{a} q_3 \xrightarrow{c} q_0$.

Accept. ✓

Test 2: $\{abcaobacc\}$.

$q_0 \xrightarrow{a} q_1 \xrightarrow{b} q_0 \xrightarrow{c} q_0 \xrightarrow{a} q_1 \xrightarrow{c} q_2 \xrightarrow{b} q_2 \xrightarrow{a} q_3 \xrightarrow{c} q_0 \xrightarrow{c} q_0$.

Accept. ✓



Question 2.

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CMPT 360 Assignment 5 Q2.

Solution:

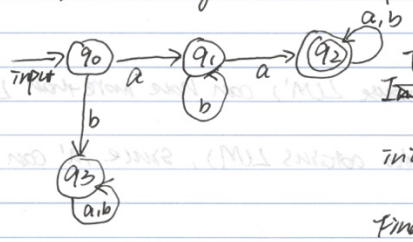
Given $M=(K,\Sigma,\delta,s,F)$: DFA.

$M'=(K,\Sigma,\delta,s,F')$: DFA

F C F'. Show the relationship between $L(M)$ and $L(M')$

Let's design a DFA for M:

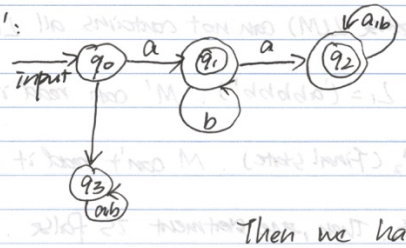
M:



For a and b, ~~Initial~~, only takes 'ab*a' as initial, and it has only 1 final stat: $F=\{q_2\}$.

Let's design a DFA for M':

M':



For a and b, ~~Initial~~ takes both 'a' or 'ab*a' as initial, and it has 2 final state: $F'=\{q_1,q_2\}$.

Then we have that F CF, and

$M = (K, \Sigma, \delta, s, F)$ and $M' = (K, \Sigma, \delta, s, F')$.

Then, we could see $L(M)$ and $L(M')$.

$L(M) = aba^*(a+b)^*$

$L(M') = ab^* + a(a+b)^* \Rightarrow ab^* + ab^*a(a+b)^*$

(i) $L(M) = L(M')$.

It is false because in my construction, $L(M')$ definitely is not equal to $L(M)$, and $L(M')$ can accept more than $L(M)$.

(ii) $L(M) \subset L(M')$

It is true because $L(M')$ can have more than $L(M)$, and $L(M')$ can also contains $L(M)$, since M' can accept $L(M)$ as well.

(iii) $L(M) \supset L(M')$.

It is false because $L(M)$ can not contains all $L(M')$ for example: $L_1 = (\text{'abbbb'})$. M' can read it and accept L_1 to q_2 (final state). M can't read it and cannot accept it. Then, the statment is false.

Question 3.

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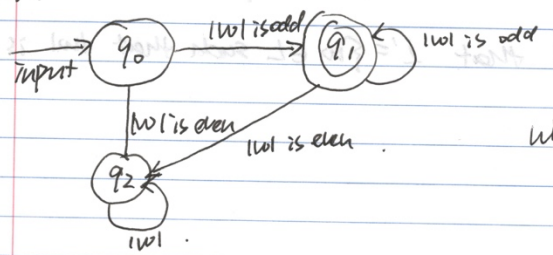
CMPT 360 Assignment 5 Q3.

Solution:

1) Design FA for $L' = \{w \in L$ such that $|w|$ is odd$\}$.

M':



which $w \in L$.

This initial state is q_0, final state is q_1, and dead state is q_2. This FA only take $w \in L$ and all w in L is odd.

2) Design FA for L.

M*:

a is * number

This initial state is q_0, Final state is q_0, it means that it can take all a^* numbers be acceptable.

Now, we can say that M can take more variables that M' since M can accept more numbers, but M' can only accept odd numbers. So $L' \subseteq L$.

So L' can be accepted by both M' or M.

So the machine does in fact accept L'. Then we can say that $L' = \{w \in L$ such that $|w|$ is odd$\}$ is regular.