2AC3 Assignment 1

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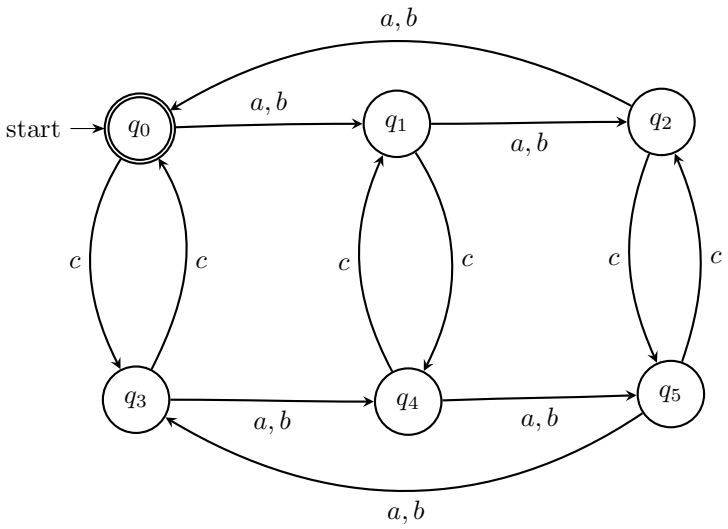
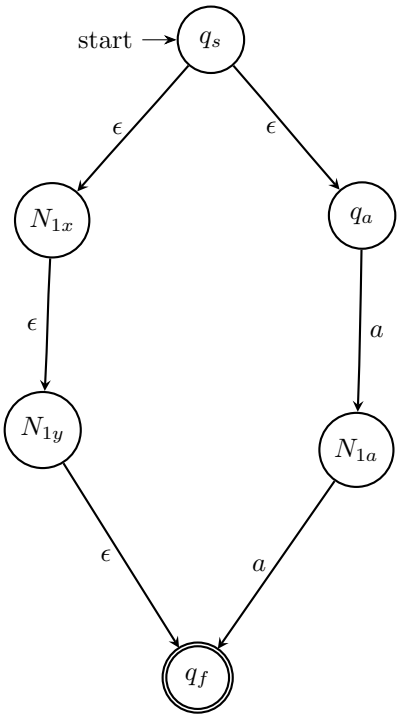
1.



q_0 acts as both the initial state and the final state. This allows ϵ to hold trivially. Furthermore, there are two rows of states that act similarly. The first row of states (q_0, q_1, q_2) represents an even number of c. The second row of states (q_3, q_4, q_5) represents an odd number of c. Both rows of states connect by cycling through a and b until the sum is divisible by 3. If the number of c is odd, the only way to get to the final state is to increase the number of c by one, causing there to be an even amount. DFA accounts for everywhere that the c may be placed.

2.



N_2 is defined as $N_2 = (Q_2, \sum, \Delta_2, q_s, q_f)$.

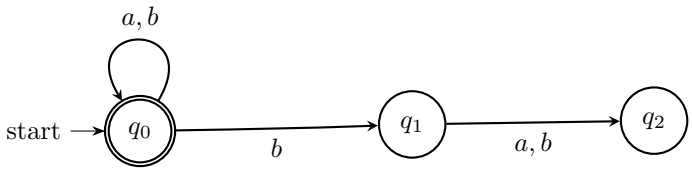
The NFA works, as it starts at state q_s, and can transition to branch xy, or branch axa on ϵ. In branch xy, $x \in L(N_1)$ is validated through N_{1x}. N_2 is able to transition to N_{1y} on ϵ, which validates $y \in L(N_1)$. Finally, N_2 reaches the final state q_f on ϵ. In branch axa, N_2 transitions to N_{1a} on a in order to fulfill the condition of axa. N_{1a} validates $x \in L(N_1)$. Then, N_2 transitions to the final state q_f on a, completing the condition of axa.

3.

N is defined as $N = (Q, \sum, \Delta, q_s, q_f)$.

N functions by starting at q_s. N loops through q_s for every $\delta \in \sum$ in order to reach v. q_s then ϵ transitions to M_1 in order to validate $v \in L(M_1)$. After validating, N ϵ transitions to q_1, which loops for every $\delta \in \sum$ of w in order to reach y. q_1 then ϵ transitions to M_2 in order to validate $y \in L(M_2)$. After validating, N ϵ transitions to the final state q_f. There is no need to loop through $\delta \in \sum$ for z, as $z \in \sum^*$ holds trivially.

4.a



4.b