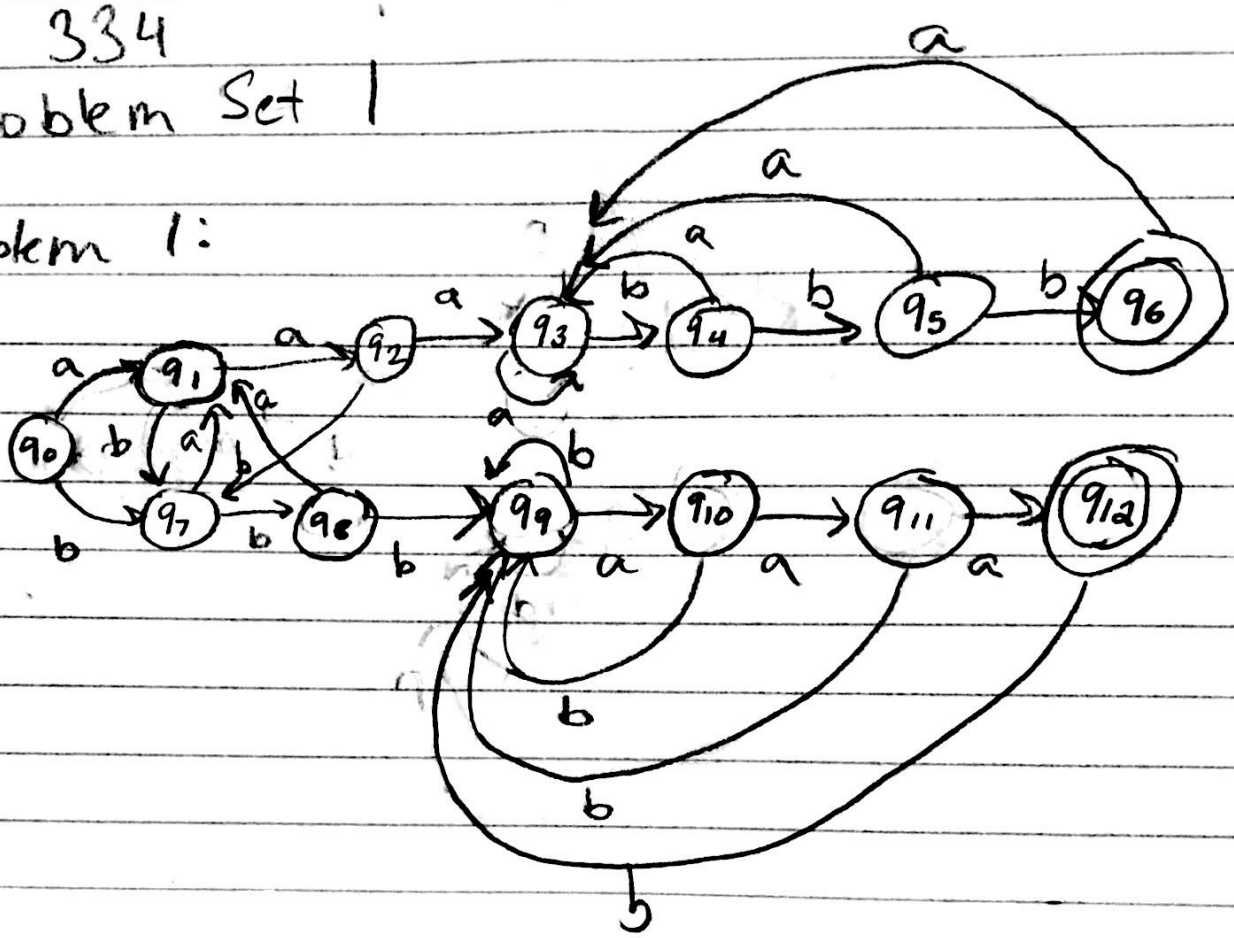
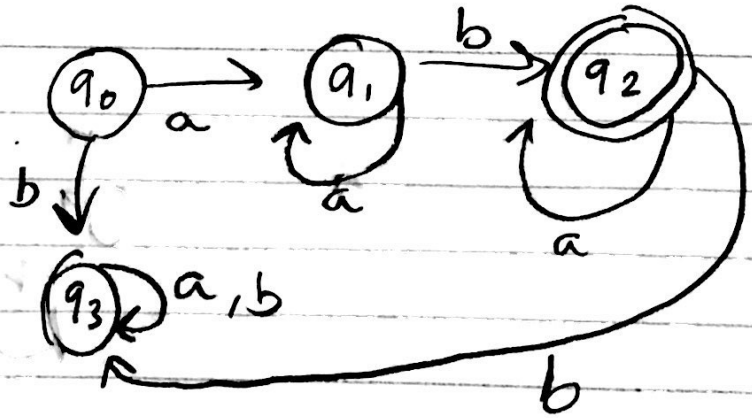
Eric Rudzin + Shreyas Keerthi
CS 334
Problem Set 1

Problem 1:

1)



2)



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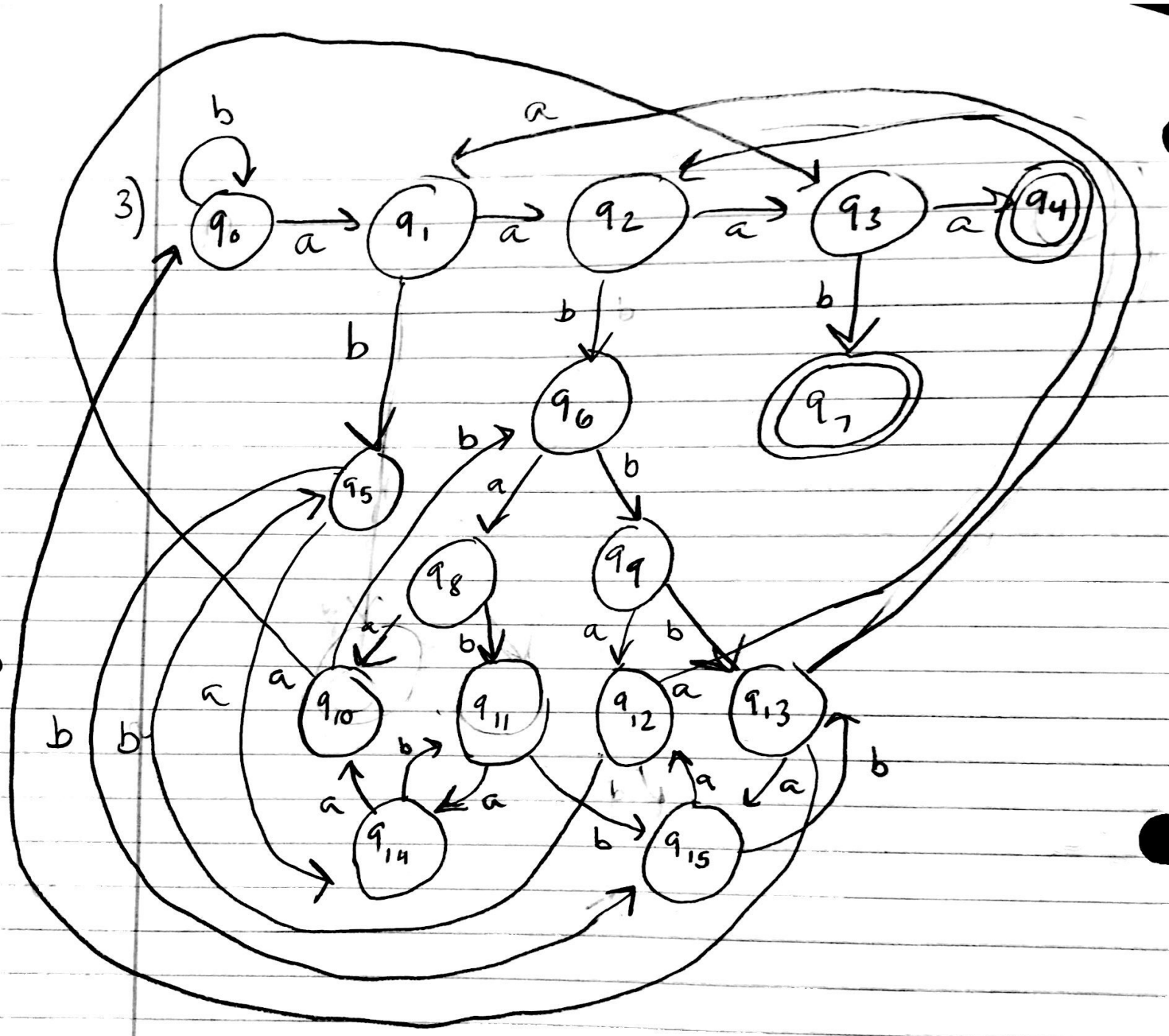

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2) The change must take place in the transition function (δ).

We define the function as:

$$\delta((r_1, r_2), a)$$

$$= \delta((r_1, a), \delta(r_2, a)) \text{ if } a \in \Sigma_1 \text{ and } a \in \Sigma_2$$

$$= (q_1, \delta(r_2, a)) \text{ if } a \in \Sigma_2 \text{ and } a \notin \Sigma_1$$

$$= (\delta(r_1, a), q_2) \text{ if } a \in \Sigma_1 \text{ and } a \notin \Sigma_2$$

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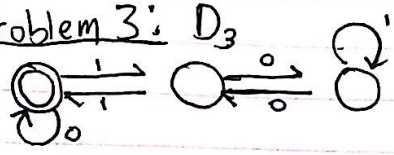
Problem 3: D_3

1. 

remainder: 0(rem) 1(rem) 2(rem)

2. D_K is regular, for every $K \geq 1$ because, by definition, a regular language uses an FSA with Finite States and would not require any memory. Using our pre-existing knowledge of how languages D_2 and D_3 work and that D_2 has two states and D_3 has three states, we can assume that for a finite K, D_K will always have K states, representing the remainders from 0 to K-1. As long as k is finite, K-1 will be finite, making D_K a regular language.

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