CMSC 303 Introduction to Theory of Computation, VCU
Assignment: 3
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1. (a) $R_a = 0\Sigma^*1$

   Which says: 0 concatenated with zero or more character concatenated with 1.

   (b) $R_b = (\Sigma^*0\Sigma^*)^4$

   Says: zero or more characters followed by a 0 follower by zero or more of any character, which is then repeated 4 times.

   (c) $R_c = 1 \bigcup 11 \bigcup \epsilon$

   Which explicitly states the contents of the language.

   (d) $R_d = \{\Sigma\} \bigcup \{\Sigma\Sigma\} \bigcup \{\Sigma\Sigma\Sigma\} \bigcup \{\epsilon\}$

   Explicitly allows for any strings with one character or two characters or three characters of no characters.

   (e) $R_e =$

   (f) $R_f = \Sigma^+$

   Plus indicates 1 or more.

2. (a) $M_a = (Q, \Sigma, \delta, q, F)$ such that:

$$Q = \{q_0\}\Sigma isourlanguageq = q_0F = \{q_0\}\delta = \epsilon$$

   because any transitions would mean a character was read, which would not be a part of the language we are looking for.

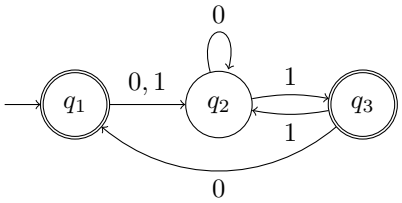
   (b) $M_b = (Q, \Sigma, \delta, q, F)$ such that:

$$Q = \{q_0, q_1, q_2, q_3\}q = q_0F = \{q_3\}$$

   Define δ by:

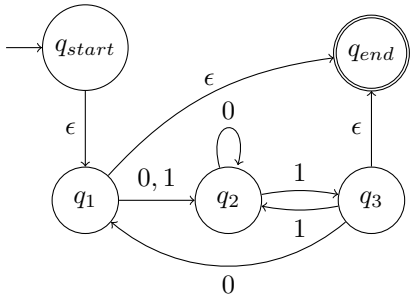
δ	0	1
q_0	q_0	q_1
q_1	q_0	q_2
q_2	q_0	q_3
q_3	q_3	q_3

3. State Diagram for M:

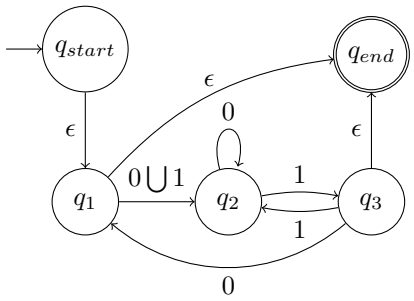


   Steps for reaching regular expression for M:

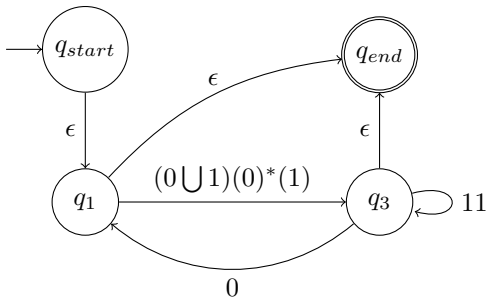
(a) Add q_{start} and q_{end} as explained in Lemma 1.60



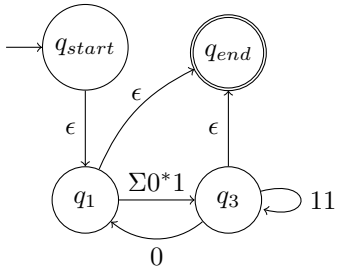
(b) Update each transition to a regular expression.



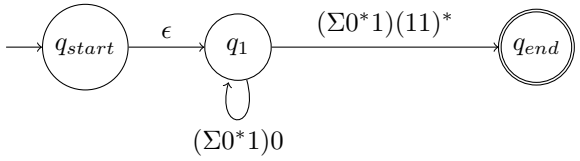
(c) $q_{rip} = q_2$



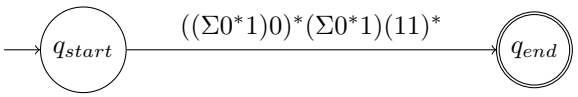
(d) Simplified to:



(e) $q_{rip} = q_3$



(f) $q_{rip} = q_1$



Thus our regular expression is $((\Sigma 0^*1)0)^*(\Sigma 0^*1)(11)^*$.

4. (a)

   (b)

   (c)

5. (a)

   (b)