Formal Languages Homework 1

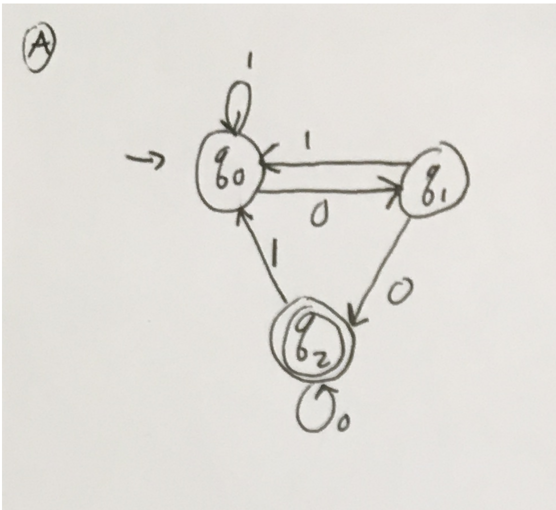
Liam Dillingham

January 29, 2019

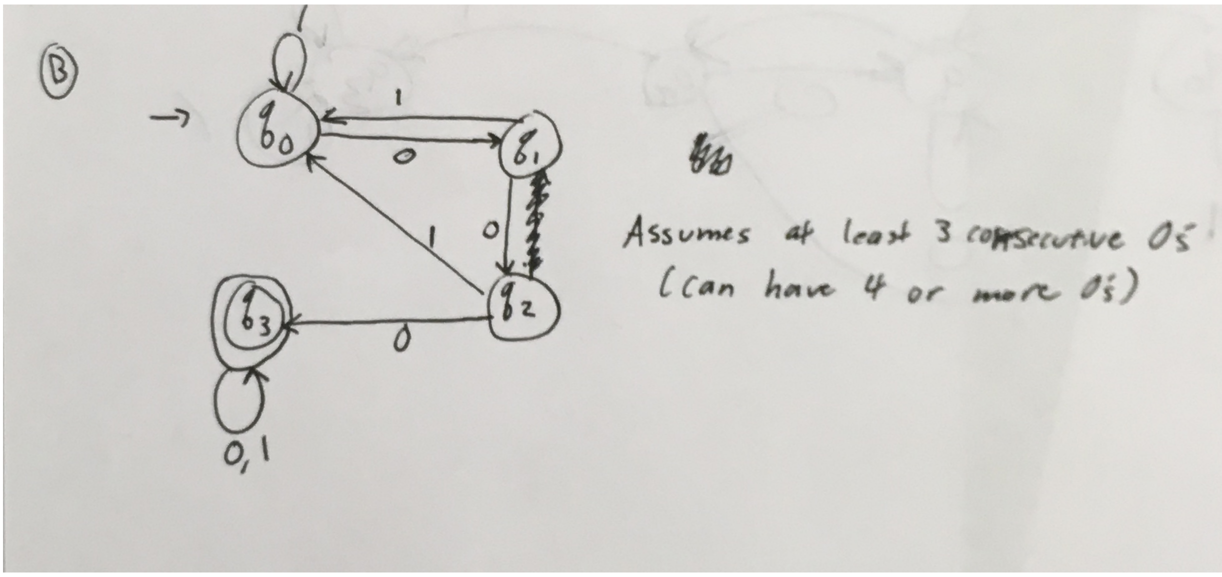
1 Problem 2.2.4

Give DFA's accepting the following languages over the alphabet $\{0, 1\}$:

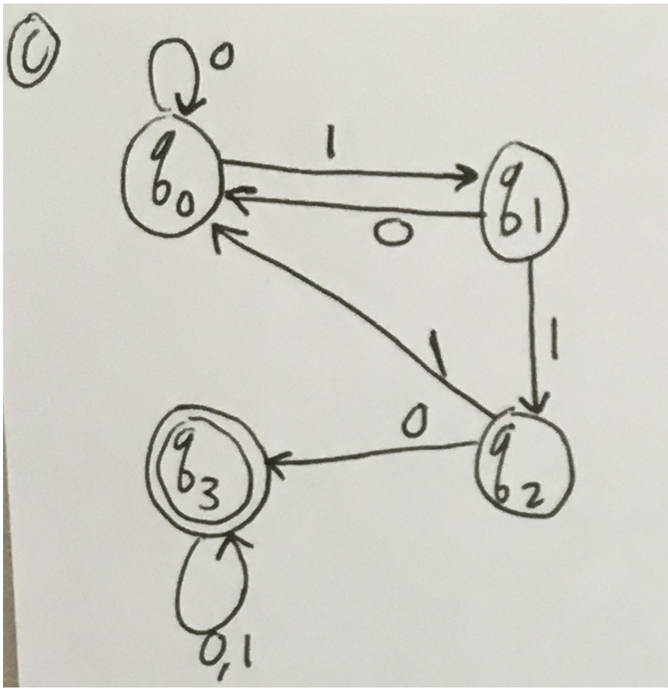
1.1 a). The set of all strings ending in 00.



1.2 b). the set of all strings with three consecutive 0's (not necessarily at the end)



1.3 c). The set of strings with 011 as a substring



2 Problem 2.2.5

Give DFA's accepting the following lagnuages over the alphabet $\{0, 1\}$.

2.1 a). The set of all strings such that each block of five consecutive symbols contains at least two 0's.

2.2 b). The set of all strings whose tenth symbol from the right end is a 1.

2.3 c). The set of strings that either begin or end (or both) with 01.

2.4 d). The set of strings such that the number of 0's is divisible by five, and the number of 1's is divisible by 3.

3 Problem 2.2.7

Let A be a DFA and q a particular state of A, such that $\delta(q, a) = q$ for all input symbols a. Show by induction on the length of the input that for all input strings w, $\hat{\delta}(q, w) = q$.

Proof:
basis: Suppose $a = \epsilon$. Then, $\delta(q, \epsilon) = q$ as a result of no inputs being taken.
hypothesis:Since for any input symbol a, $\delta(q, a) = q$, then any string of input symbols, $a_1, a_2, ..., a_n$, $\delta(q, a_i) = q$.

4 Problem 2.2.8

Let A be a DFA and a a particular input symbol of A, such that for all states q of A we have $\delta(q, a) = q$.

4.1 a). Show by induction on n that for all $n \geq 0$, $\delta(q, a^n) = q$, where a^n is the string consisting of n a's.

4.2 b). Show that if x is a nonempty string in $L(A)$, then for all $k > 0$, x^k (i.e., x written k times is also in $L(A)$.)