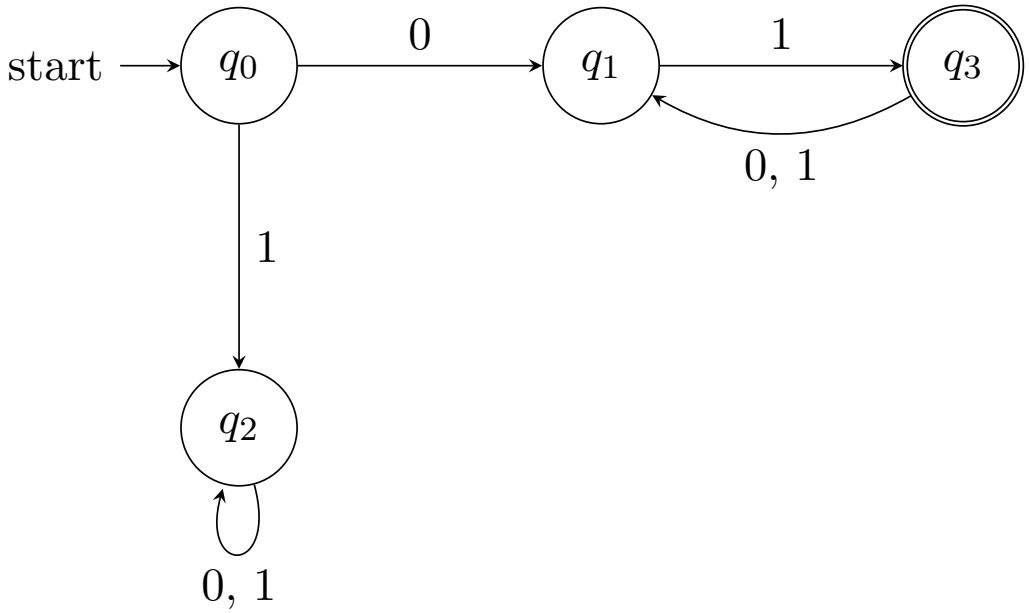
Anand Mahadevan - SID 862132182 - Disc: 022

CS150 Homework 1

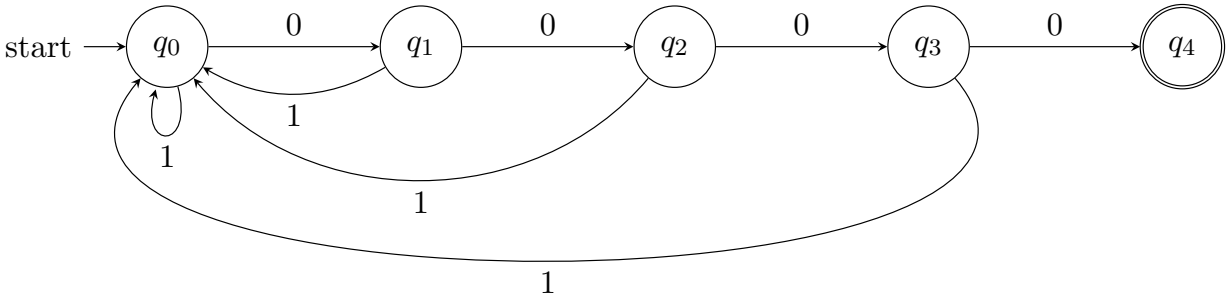
due Tuesday, October 13th 5:00 PM

Problem 1.

a) The set of all strings that begin with a 0 and end with a 1.

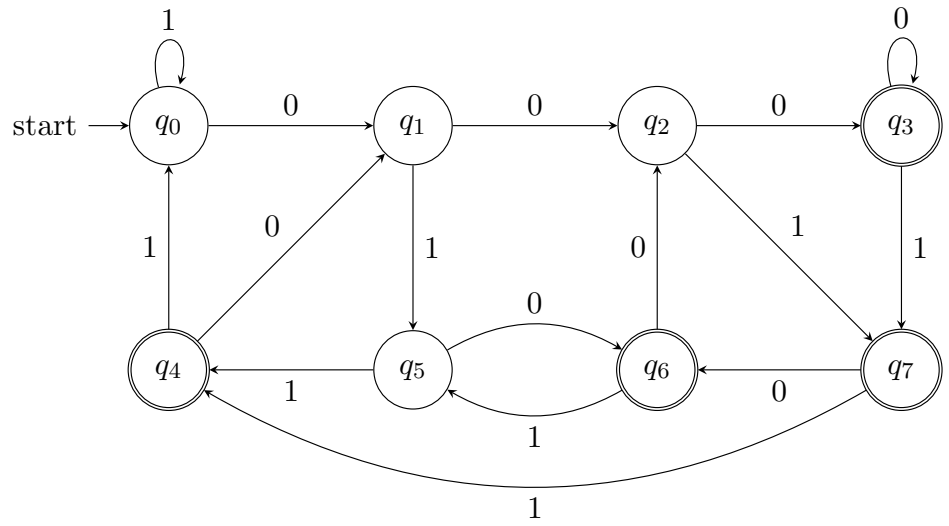


b) The set of all strings that contain four consecutive 0's.

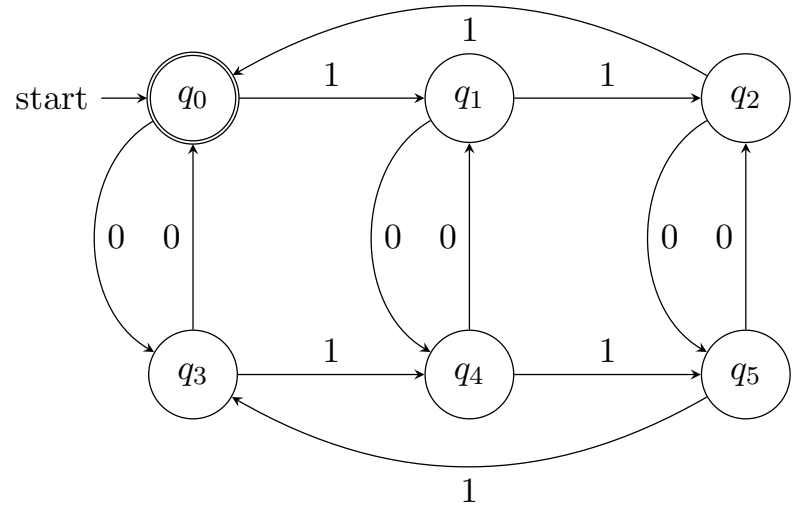


Problem 2.

a) The set of all strings whose 3rd symbol from the right end is a 0.



b) The set of strings such that the number of 0's is divisible by 2 and the number of 1's divisible by 3.



Problem 3.
Let A be a DFA and q a particular state of A, such that $\delta(q, a) = q$ for all input symbols a. Prove by induction on the length of the input that for all input strings w, $\hat{\delta}(q, w) = q$. Here, δ denotes the transition function of A and $\hat{\delta}$ denotes the extended transition function.

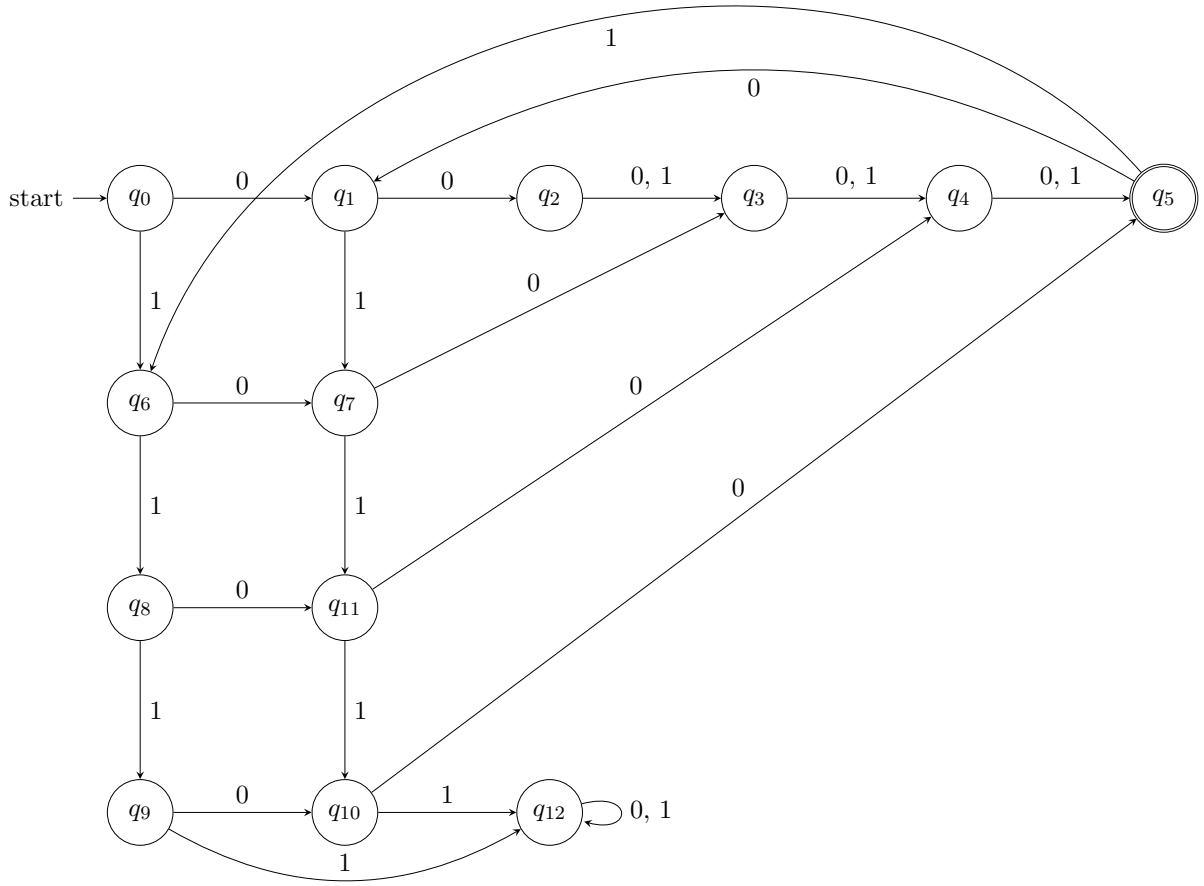
Basis:
$|w| = 0$; $w = \epsilon$; Since $\delta(q, \epsilon) = q$, $\hat{\delta}(q, \epsilon) = q$ is true.

Induction:
Assume $\hat{\delta}(q, k) = q$ for some input string k
Prove $\hat{\delta}(q, ka) = q$

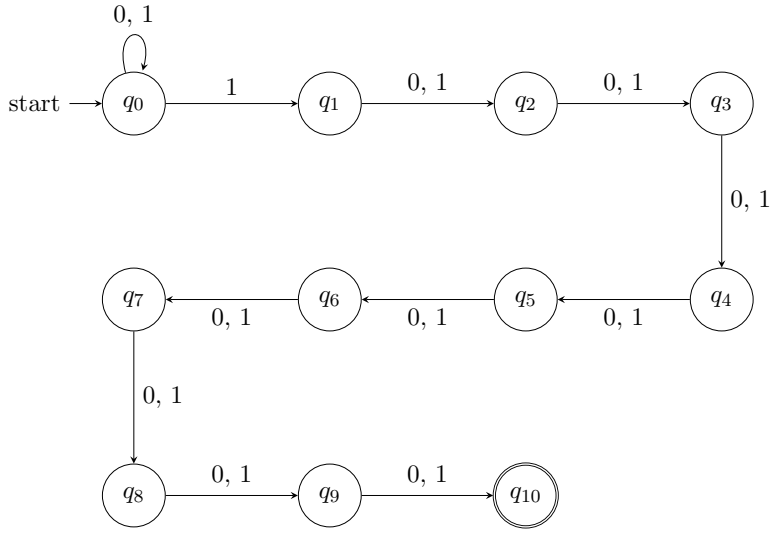
$\hat{\delta}(q, ka) = \delta(\hat{\delta}(q, k), a)$
(And since we have assumed $\hat{\delta}(q, k) = q$)
$= \delta(q, a)$
(Finally from definition $\delta(q, a) = q$)
$= q$
We have proved the inductive step. Thus, $\hat{\delta}(q, w) = q$ for all input strings w.
Q.E.D.

Problem 4.

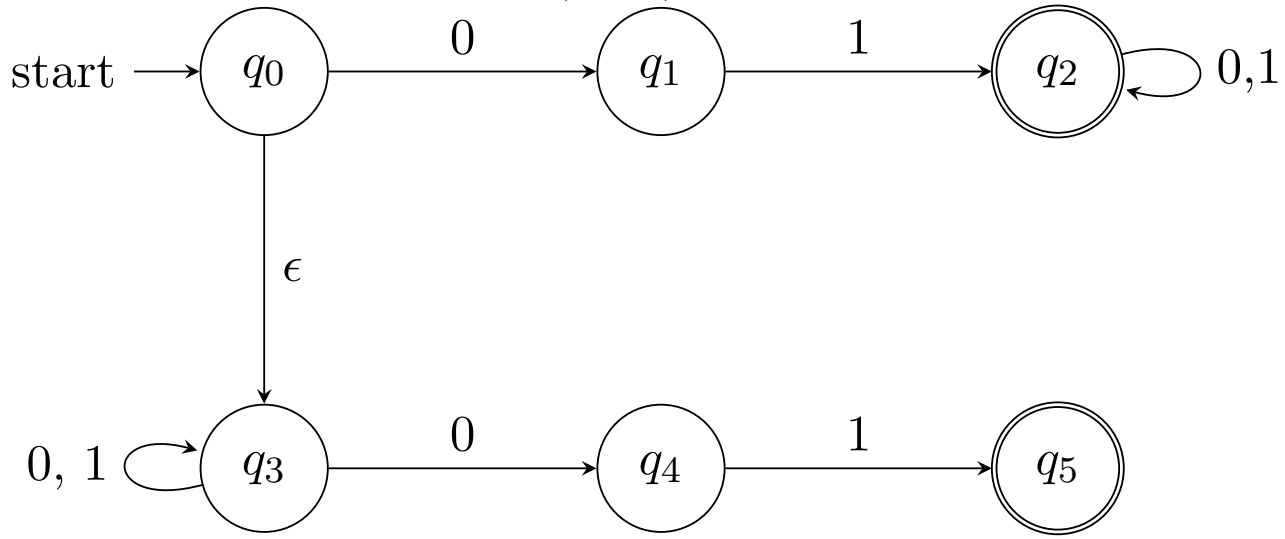
a) The set of all strings such that each block of five consecutive symbols contain at least two 0's.



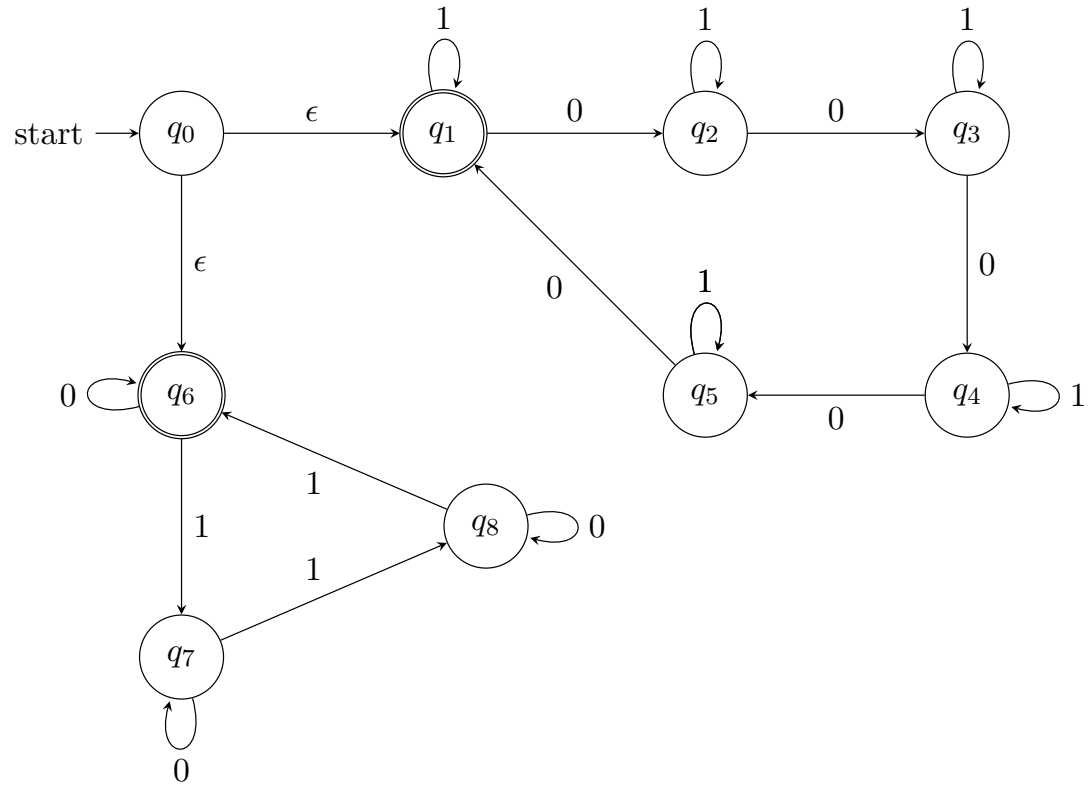
b)The set of all strings whose tenth symbol from the right end is a 1.



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



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.



Problem 5.
a)

DFA		
	0	1
→{a}	{a}	{a,b}
{a,b}	{a,c}	{a,b,c}
{a,c}	{a,d}	{a,b,d}
{a,d}	{a,e}	{a,b,e}
* {a,e}	{a}	{a,b}
{a,b,d}	{a,c,e}	{a,b,c,d}
*{a,c,e}	{a,d}	{a,b,d}
*{a,b,e}	{a,c}	{a,b,c}
{a,b,c}	{a,c,d}	{a,b,c,d}
{a,c,d}	{a,d,e}	{a,b,d,e}
*{a,d,e}	{a,e}	{a,b,e}
*{a,b,d,e}	{a,c,e}	{a,b,c,e}
*{a,b,c,e}	{a,c,d}	{a,b,c,d}
{a,b,c,d}	{a,c,d,e}	{a,b,c,d,e}
*{a,c,d,e}	{a,d,e}	{a,b,d,e}
*{a,b,c,d,e}	{a,c,d,e}	{a,b,c,d,e}

b) This DFA accepts languages whose strings' 4th letter from the right is a 1.