Mathematical Methods for Computer Science 2 Spring 2018

Series 6

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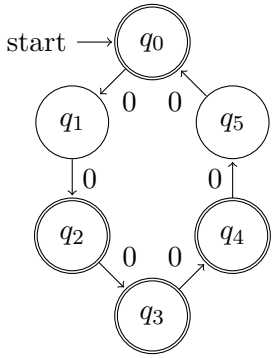
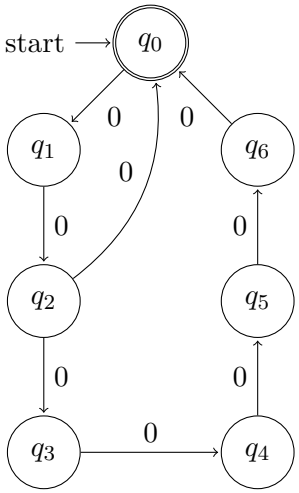
1

a)

We consider that 0 is divisible by 2 and by 3.

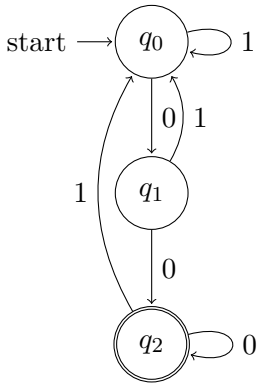


b)

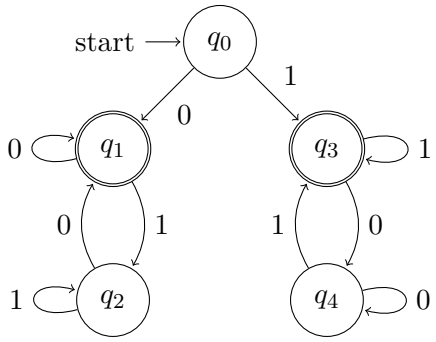


2

a)

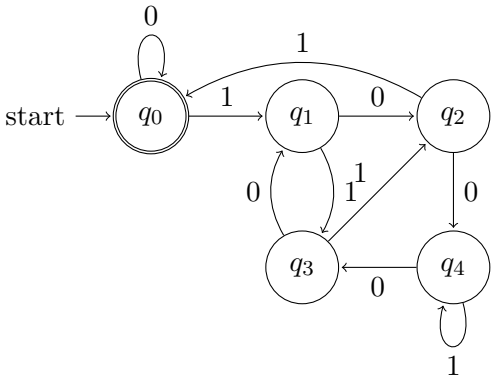


b)



c)

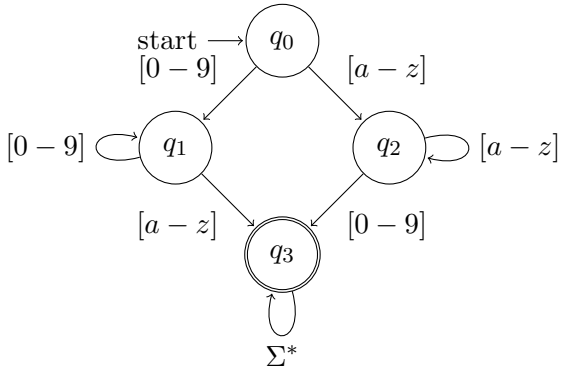
Each state represent a number from 0 to 4 (the rest of the division by 5) and then we encode the number from 0 to 9 in order to recover the correct result after the division by 5. If $n \equiv 0 \mod 5$ then it binary string reach state q_0.



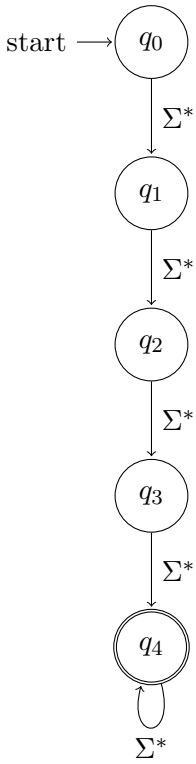
3

Note : we label with $[0-9]$ the transitions when we encounter a digit and by $[a-z]$ the ones when we encounter a letter. We also denote by Σ^* any possible symbol from the alphabet.

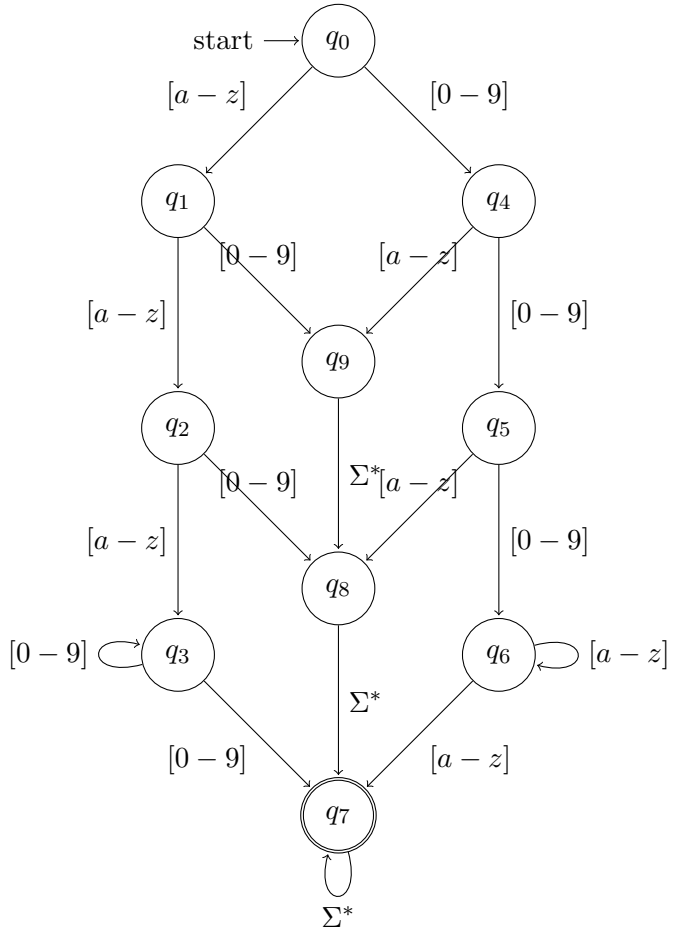
a)


start
q_0
$[0-9]$
$[a-z]$
$[0-9]$
q_1
q_2
$[a-z]$
$[a-z]$
$[0-9]$
q_3
Σ^*

b)

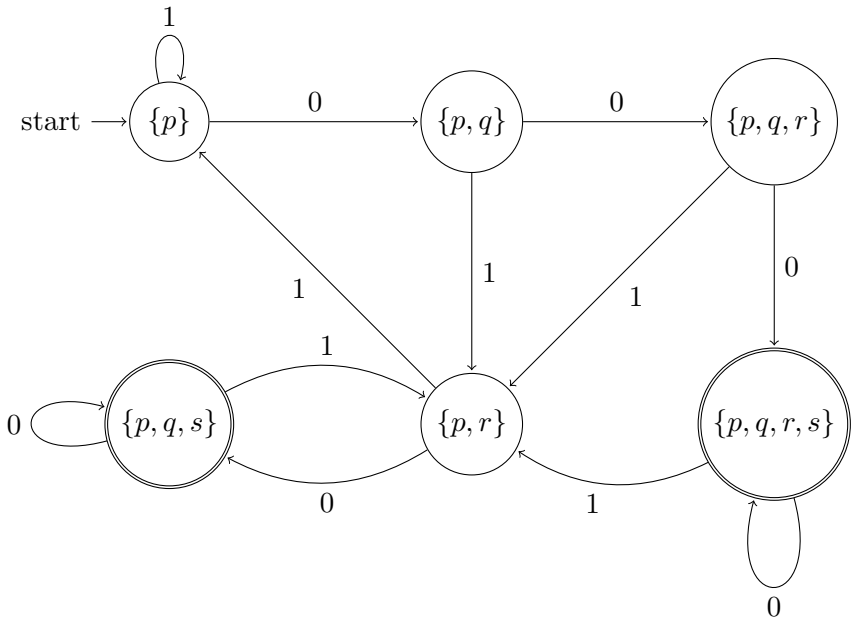

start
q_0
Σ^*
q_1
Σ^*
q_2
Σ^*
q_3
Σ^*
q_4
Σ^*

c)

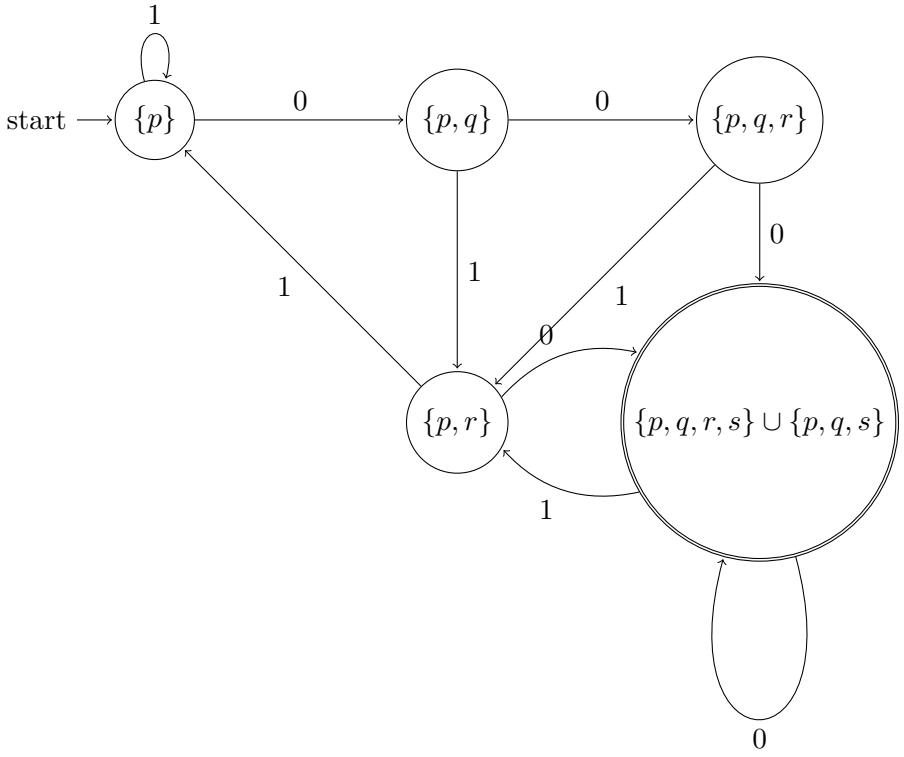


4

	0	1
$\{p\}$	$\{p,q\}$	$\{p\}$
$\{p,q\}$	$\{p,q,r\}$	$\{p,r\}$
$\{p,q,r\}$	$\{p,q,r,s\}$	$\{p,r\}$
$\{p,r\}$	$\{p,q,s\}$	$\{p\}$
$\{p,q,s\}$	$\{p,q,s\}$	$\{p,r\}$
$\{p,q,r,s\}$	$\{p,q,r,s\}$	$\{p,r\}$

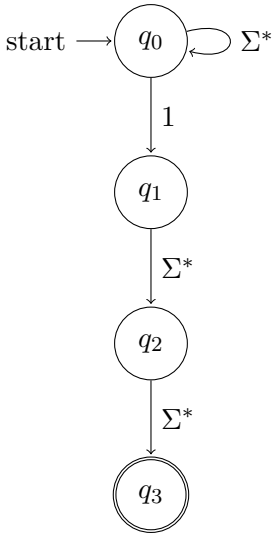


And we can merge the two accepting state :



5

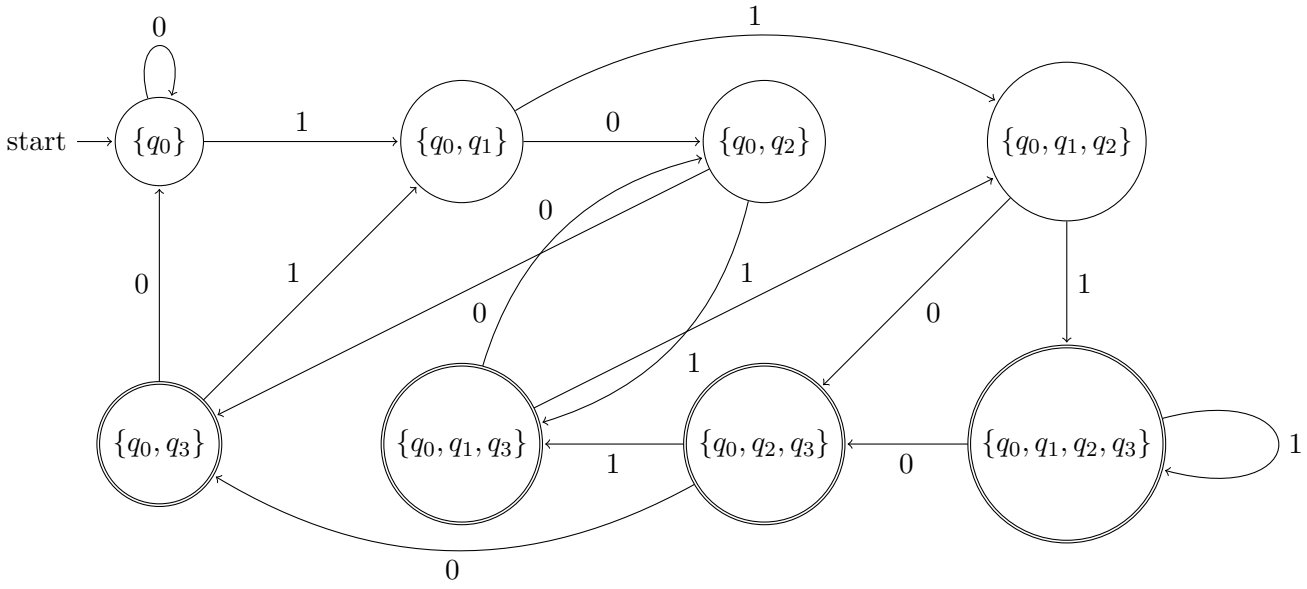
The NFA :



Transition tables :

	0	1
q_0	$\{q_0\}$	$\{q_0, q_1\}$
q_1	$\{q_2\}$	$\{q_2\}$
q_2	$\{q_3\}$	$\{q_3\}$
q_3	$\emptyset$	$\emptyset$

	0	1
$\{q_0\}$	$\{q_0\}$	$\{q_0, q_1\}$
$\{q_0, q_1\}$	$\{q_0, q_2\}$	$\{q_0, q_1, q_2\}$
$\{q_0, q_2\}$	$\{q_0, q_3\}$	$\{q_0, q_1, q_3\}$
$\{q_0, q_1, q_2\}$	$\{q_0, q_2, q_3\}$	$\{q_0, q_1, q_2, q_3\}$
$\{q_0, q_3\}$	$\{q_0\}$	$\{q_0, q_1\}$
$\{q_0, q_1, q_3\}$	$\{q_0, q_2\}$	$\{q_0, q_1, q_2\}$
$\{q_0, q_2, q_3\}$	$\{q_0, q_3\}$	$\{q_0, q_1, q_3\}$
$\{q_0, q_1, q_2, q_3\}$	$\{q_0, q_2, q_3\}$	$\{q_0, q_1, q_2, q_3\}$



We can't proceed further reduction on the state because we can't merge accepting and non-accepting states.