Auxiliar 2:
Circuitos Secuenciales

CC4301 - Arquitectura de Computadores
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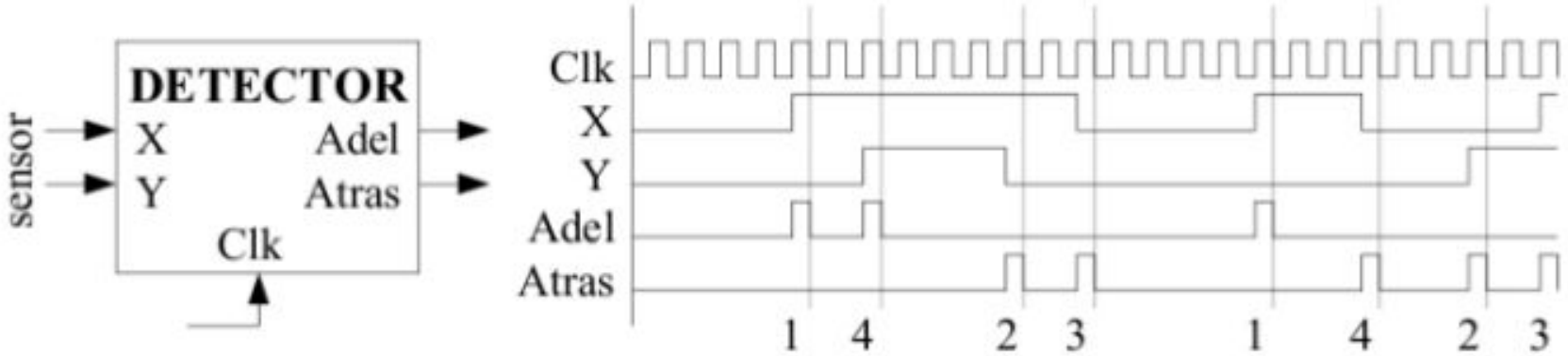
25 Marzo 2020

P1.a Examen 2016: **DETECTOR**



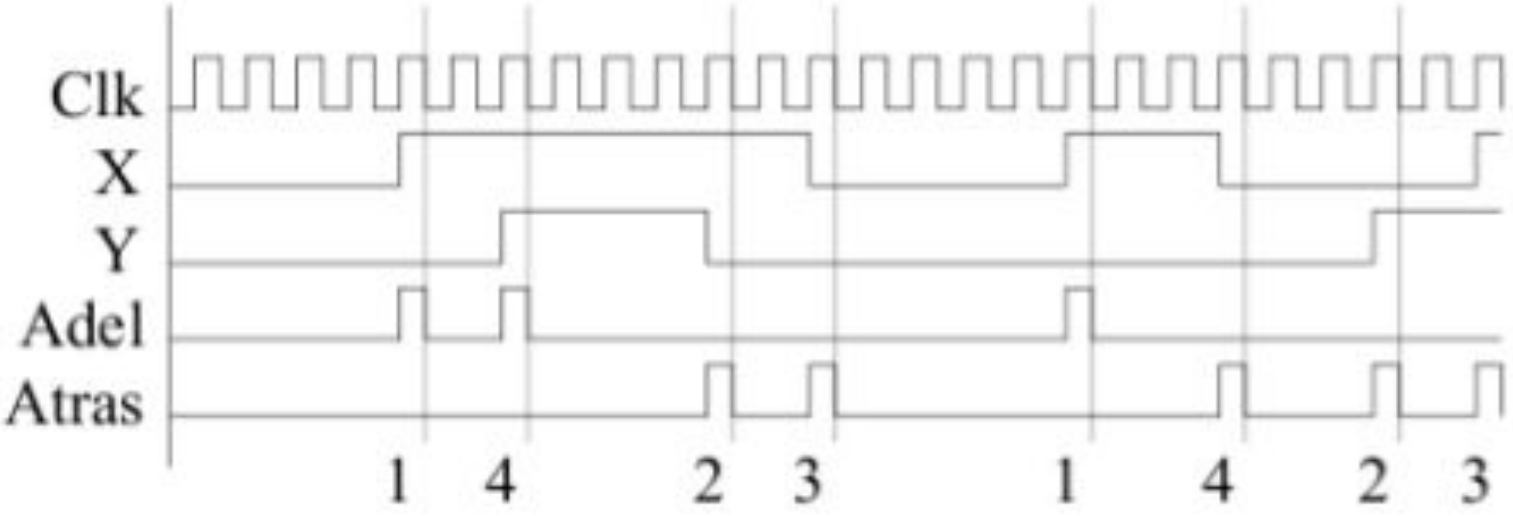
P1.a Examen 2016: **DETECTOR**

I. Un paso hacia adelante, colocando un 1 en la salida de ADEL.
   A. Cuando X e Y iguales, si cambia X. (1)
   B. Cuando X e Y distintos, si cambia Y. (4)

II. Un paso hacia atrás, colocando un 1 en la salida ATRAS.
   A. Cuando X e Y iguales, si cambia Y. (3)
   B. Cuando X e Y distintos, si cambia X. (2)

III. Si no registró movimiento, colocando ambas líneas en 0.

Diagrama de Tiempo



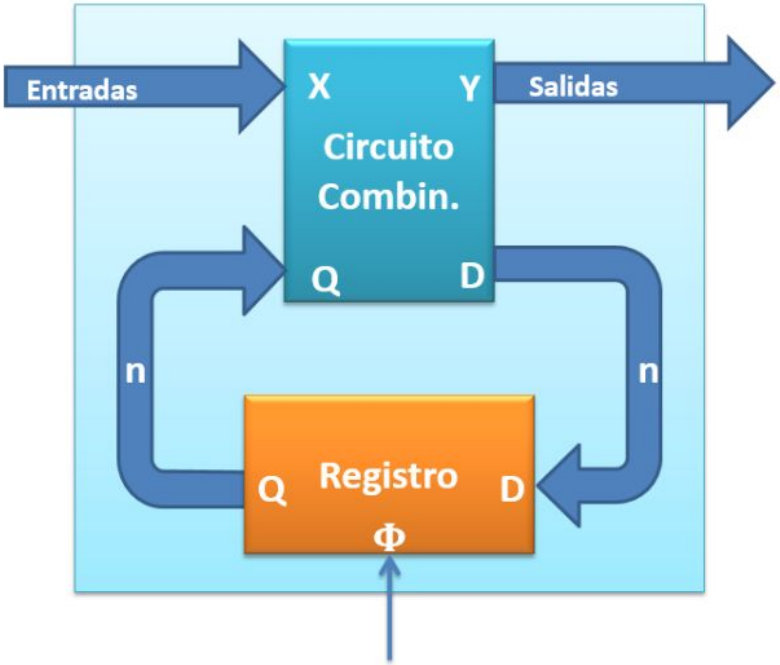

Entradas
X
Y
Salidas
Circuito
Combin.
Q
D
n
n
Q
Registro
D
Φ

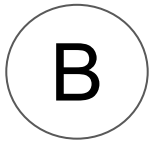
Diagrama de Estados

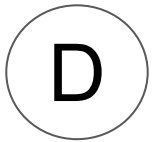
Diagrama de Estados

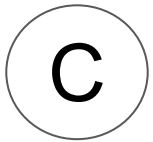
Estado	(X)	(Y)
A	0	0
B	1	0
C	1	1
D	0	1

X Y / Del Atrás

Estado	(X)	(Y)
A	0	0
B	1	0
C	1	1
D	0	1

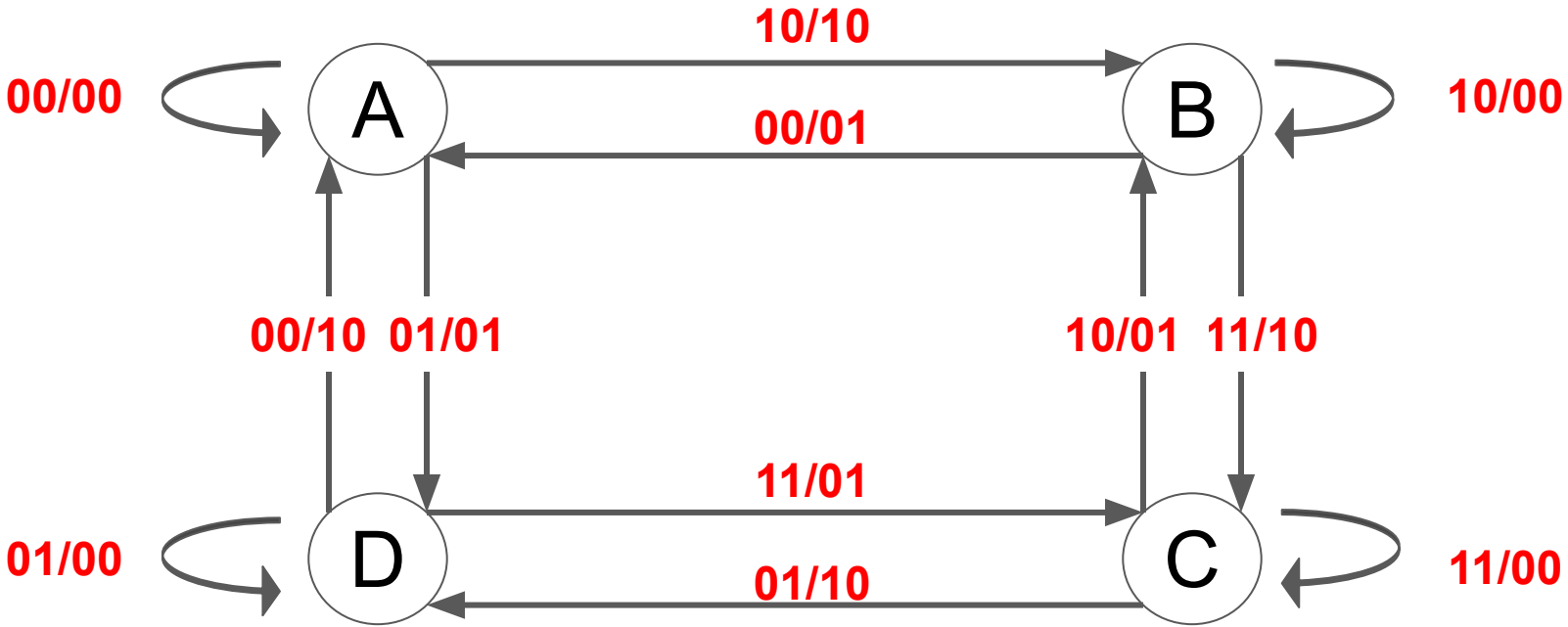




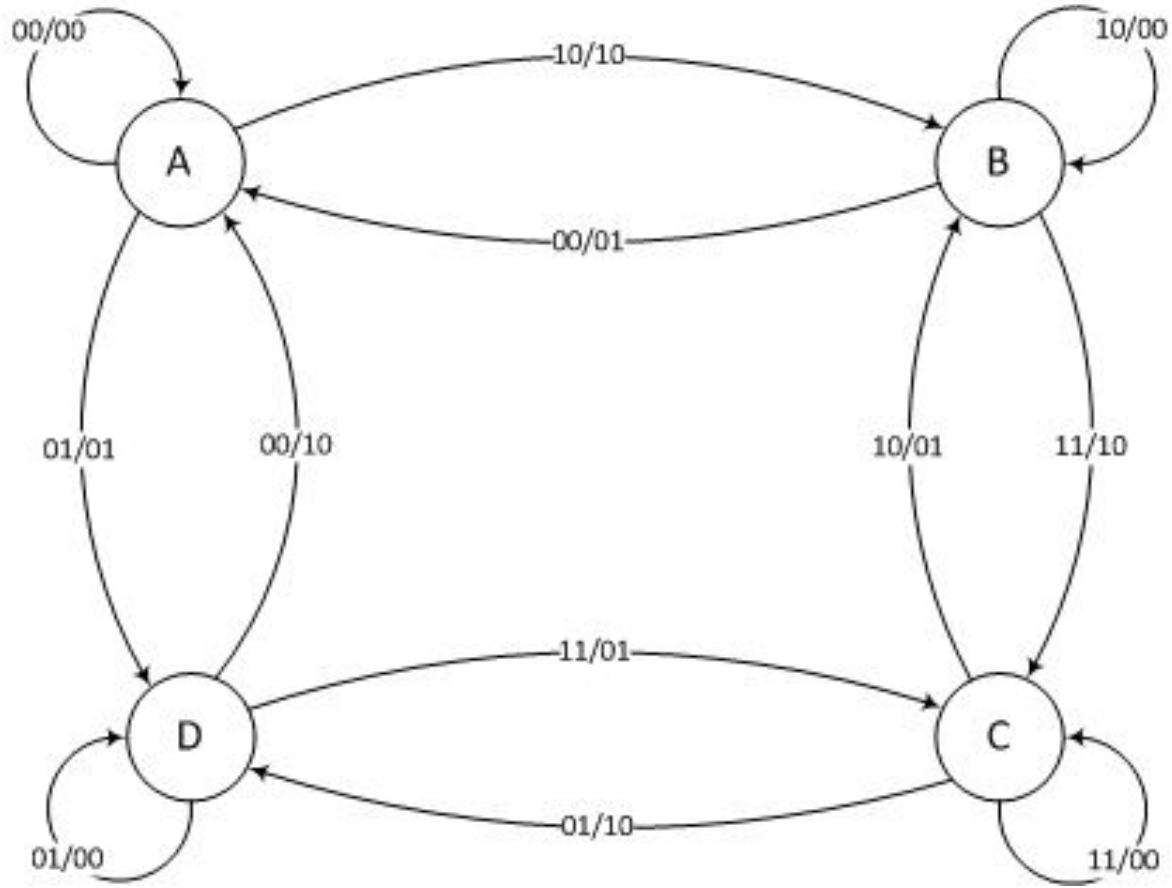


X Y / Del Atrás

Estado	(X)	(Y)
A	0	0
B	1	0
C	1	1
D	0	1



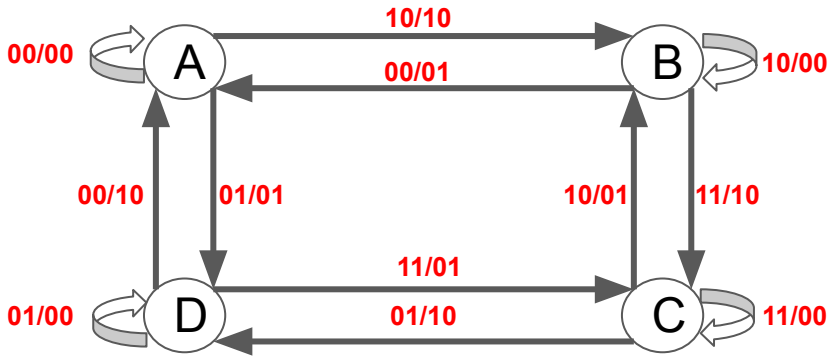
X Y/Adel Atras



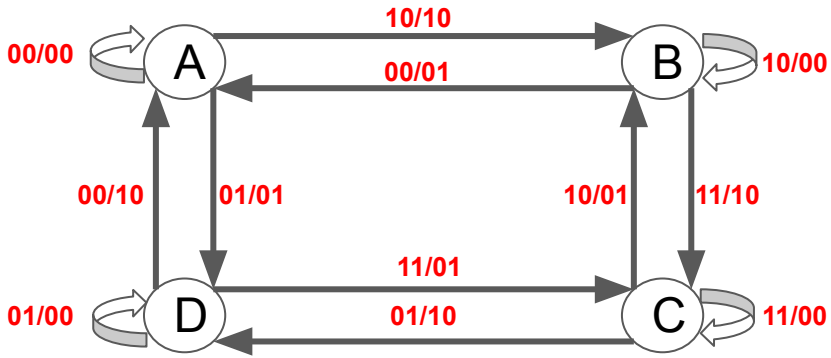
Codificación de Estados

Estado	(X) Q_0	(Y) Q_1
A	0	0
B	1	0
C	1	1
D	0	1

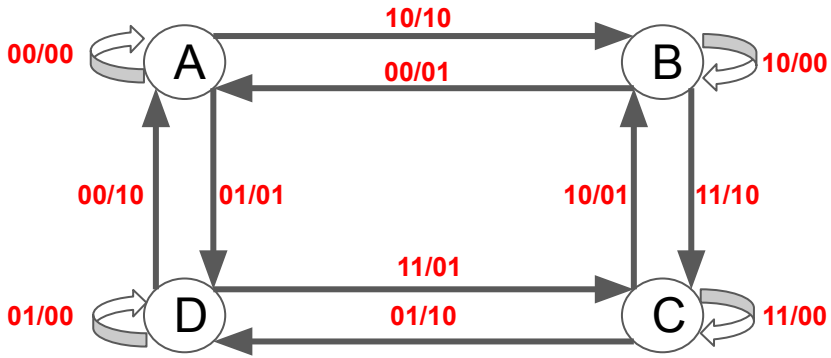
	Q_0	Q_1	X	Y	D_0	D_1	$ADEL$	$ATRAS$
	0	0	0	0				
	0	0	0	1				
A	0	0	1	0				
	0	0	1	1				
	0	1	0	0				
	0	1	0	1				
D	0	1	1	0				
	0	1	1	1				
	1	0	0	0				
	1	0	0	1				
B	1	0	1	0				
	1	0	1	1				
	1	1	0	0				
	1	1	0	1				
C	1	1	1	0				
	1	1	1	1				



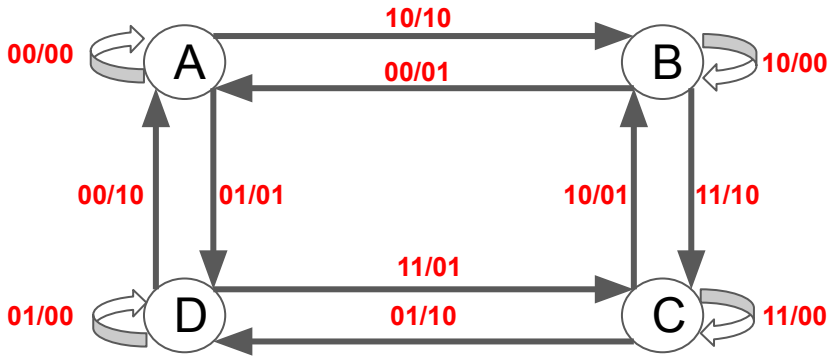
	Q_0	Q_1	X	Y	D_0	D_1	$ADEL$	$ATRAS$
	0	0	0	0	0	0	0	0
	0	0	0	1	0	1	0	1
A	0	0	1	0	1	0	1	0
	0	0	1	1	X	X	X	X
	0	1	0	0				
	0	1	0	1				
D	0	1	1	0				
	0	1	1	1				
	1	0	0	0				
	1	0	0	1				
B	1	0	1	0				
	1	0	1	1				
	1	1	0	0				
	1	1	0	1				
C	1	1	1	0				
	1	1	1	1				



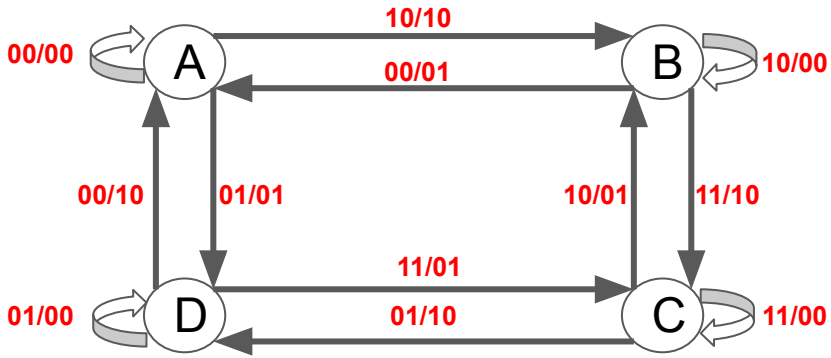
	Q_0	Q_1	X	Y	D_0	D_1	$ADEL$	$ATRAS$
	0	0	0	0	0	0	0	0
	0	0	0	1	0	1	0	1
A	0	0	1	0	1	0	1	0
	0	0	1	1	X	X	X	X
	0	1	0	0	0	0	1	0
	0	1	0	1	0	1	0	0
D	0	1	1	0	X	X	X	X
	0	1	1	1	1	1	0	1
	1	0	0	0				
	1	0	0	1				
B	1	0	1	0				
	1	0	1	1				
	1	1	0	0				
	1	1	0	1				
C	1	1	1	0				
	1	1	1	1				



	Q_0	Q_1	X	Y	D_0	D_1	$ADEL$	$ATRAS$
	0	0	0	0	0	0	0	0
	0	0	0	1	0	1	0	1
A	0	0	1	0	1	0	1	0
	0	0	1	1	X	X	X	X
	0	1	0	0	0	0	1	0
	0	1	0	1	0	1	0	0
D	0	1	1	0	X	X	X	X
	0	1	1	1	1	1	0	1
	1	0	0	0	0	0	0	1
	1	0	0	1	X	X	X	X
B	1	0	1	0	1	0	0	0
	1	0	1	1	1	1	1	0
	1	1	0	0				
	1	1	0	1				
C	1	1	1	0				
	1	1	1	1				



	Q_0	Q_1	X	Y	D_0	D_1	$ADEL$	$ATRAS$
	0	0	0	0	0	0	0	0
	0	0	0	1	0	1	0	1
A	0	0	1	0	1	0	1	0
	0	0	1	1	X	X	X	X
	0	1	0	0	0	0	1	0
	0	1	0	1	0	1	0	0
D	0	1	1	0	X	X	X	X
	0	1	1	1	1	1	0	1
	1	0	0	0	0	0	0	1
	1	0	0	1	X	X	X	X
B	1	0	1	0	1	0	0	0
	1	0	1	1	1	1	1	0
	1	1	0	0	X	X	X	X
	1	1	0	1	0	1	1	0
C	1	1	1	0	1	0	0	1
	1	1	1	1	1	1	0	0



	Q_0	Q_1	X	Y	D_0	D_1	$ADEL$	$ATRAS$
	0	0	0	0	0	0	0	0
	0	0	0	1	0	1	0	1
A	0	0	1	0	1	0	1	0
	0	0	1	1	X	X	X	X
	0	1	0	0	0	0	1	0
	0	1	0	1	0	1	0	0
D	0	1	1	0	X	X	X	X
	0	1	1	1	1	1	0	1
	1	0	0	0	0	0	0	1
	1	0	0	1	X	X	X	X
B	1	0	1	0	1	0	0	0
	1	0	1	1	1	1	1	0
	1	1	0	0	X	X	X	X
	1	1	0	1	0	1	1	0
C	1	1	1	0	1	0	0	1
	1	1	1	1	1	1	0	0

	Q_0	Q_1	X	Y	D_0
	0	0	0	0	0
	0	0	0	1	0
A	0	0	1	0	1
	0	0	1	1	X
	0	1	0	0	0
	0	1	0	1	0
D	0	1	1	0	X
	0	1	1	1	1
	1	0	0	0	0
	1	0	0	1	X
B	1	0	1	0	1
	1	0	1	1	1
	1	1	0	0	X
	1	1	0	1	0
C	1	1	1	0	1
	1	1	1	1	1

XY

$Q_0\,Q_1$	00	01	11	10
00				
01				
11				
10				

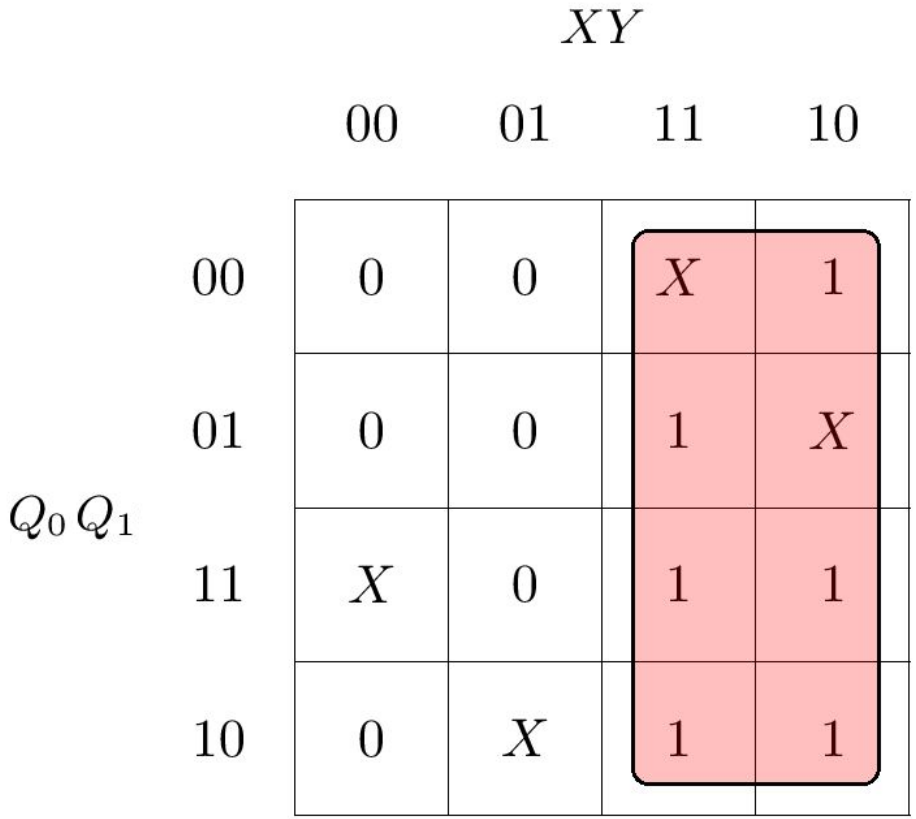
	Q_0	Q_1	X	Y	D_0
	0	0	0	0	0
	0	0	0	1	0
A	0	0	1	0	1
	0	0	1	1	X
	0	1	0	0	0
	0	1	0	1	0
D	0	1	1	0	X
	0	1	1	1	1
	1	0	0	0	0
	1	0	0	1	X
B	1	0	1	0	1
	1	0	1	1	1
	1	1	0	0	X
	1	1	0	1	0
C	1	1	1	0	1
	1	1	1	1	1

$Q_0 Q_1$ \ XY	00	01	11	10
00	0	0	X	1
01	0	0	1	X
11	X	0	1	1
10	0	X	1	1

	Q_0	Q_1	X	Y	D_0
	0	0	0	0	0
	0	0	0	1	0
A	0	0	1	0	1
	0	0	1	1	X
	0	1	0	0	0
	0	1	0	1	0
D	0	1	1	0	X
	0	1	1	1	1
	1	0	0	0	0
	1	0	0	1	X
B	1	0	1	0	1
	1	0	1	1	1
	1	1	0	0	X
	1	1	0	1	0
C	1	1	1	0	1
	1	1	1	1	1

$Q_0\,Q_1$ \ XY	00	01	11	10
00	0	0	X	1
01	0	0	1	X
11	X	0	1	1
10	0	X	1	1

	Q_0	Q_1	X	Y	D_0
	0	0	0	0	0
	0	0	0	1	0
A	0	0	1	0	1
	0	0	1	1	X
	0	1	0	0	0
	0	1	0	1	0
D	0	1	1	0	X
	0	1	1	1	1
	1	0	0	0	0
	1	0	0	1	X
B	1	0	1	0	1
	1	0	1	1	1
	1	1	0	0	X
	1	1	0	1	0
C	1	1	1	0	1
	1	1	1	1	1



$D_0 = X$

	Q_0	Q_1	X	Y	D_1
	0	0	0	0	0
	0	0	0	1	1
A	0	0	1	0	0
	0	0	1	1	X
	0	1	0	0	0
	0	1	0	1	1
D	0	1	1	0	X
	0	1	1	1	1
	1	0	0	0	0
	1	0	0	1	X
B	1	0	1	0	0
	1	0	1	1	1
	1	1	0	0	X
	1	1	0	1	1
C	1	1	1	0	0
	1	1	1	1	1

XY

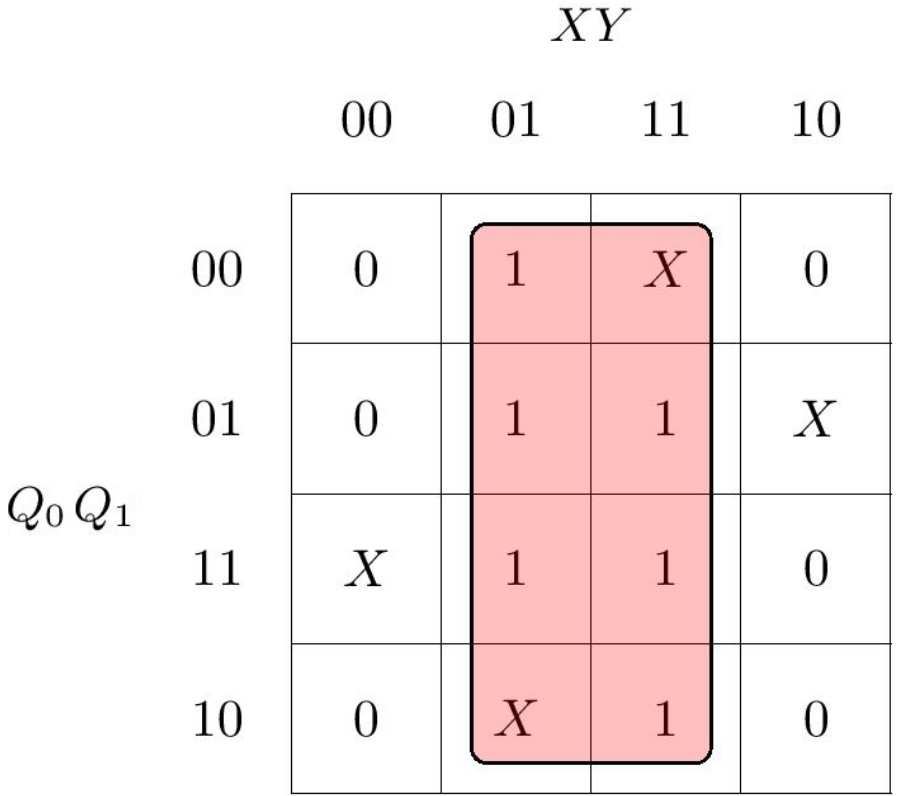
$Q_0 Q_1$	00	01	11	10
00				
01				
11				
10				

	Q_0	Q_1	X	Y	D_1
	0	0	0	0	0
	0	0	0	1	1
A	0	0	1	0	0
	0	0	1	1	X
	0	1	0	0	0
	0	1	0	1	1
D	0	1	1	0	X
	0	1	1	1	1
	1	0	0	0	0
	1	0	0	1	X
B	1	0	1	0	0
	1	0	1	1	1
	1	1	0	0	X
	1	1	0	1	1
C	1	1	1	0	0
	1	1	1	1	1

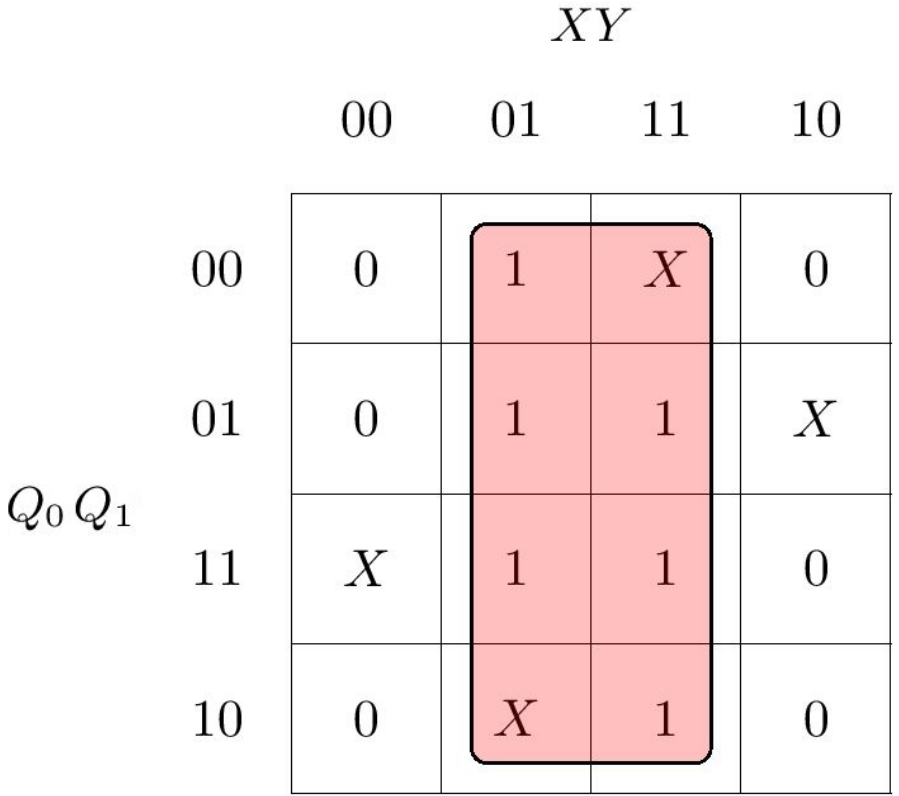
$Q_0\,Q_1$ \ XY

	00	01	11	10
00	0	1	X	0
01	0	1	1	X
11	X	1	1	0
10	0	X	1	0

	Q_0	Q_1	X	Y	D_1
	0	0	0	0	0
	0	0	0	1	1
A	0	0	1	0	0
	0	0	1	1	X
	0	1	0	0	0
	0	1	0	1	1
D	0	1	1	0	X
	0	1	1	1	1
	1	0	0	0	0
	1	0	0	1	X
B	1	0	1	0	0
	1	0	1	1	1
	1	1	0	0	X
	1	1	0	1	1
C	1	1	1	0	0
	1	1	1	1	1



	Q_0	Q_1	X	Y	D_1
	0	0	0	0	0
	0	0	0	1	1
A	0	0	1	0	0
	0	0	1	1	X
	0	1	0	0	0
	0	1	0	1	1
D	0	1	1	0	X
	0	1	1	1	1
	1	0	0	0	0
	1	0	0	1	X
B	1	0	1	0	0
	1	0	1	1	1
	1	1	0	0	X
	1	1	0	1	1
C	1	1	1	0	0
	1	1	1	1	1



$D_1 = Y$

	Q_0	Q_1	X	Y	$ADEL$
	0	0	0	0	0
	0	0	0	1	0
A	0	0	1	0	1
	0	0	1	1	X
	0	1	0	0	1
	0	1	0	1	0
D	0	1	1	0	X
	0	1	1	1	0
	1	0	0	0	0
	1	0	0	1	X
B	1	0	1	0	0
	1	0	1	1	1
	1	1	0	0	X
	1	1	0	1	1
C	1	1	1	0	0
	1	1	1	1	0

$Q_0\,Q_1$

XY

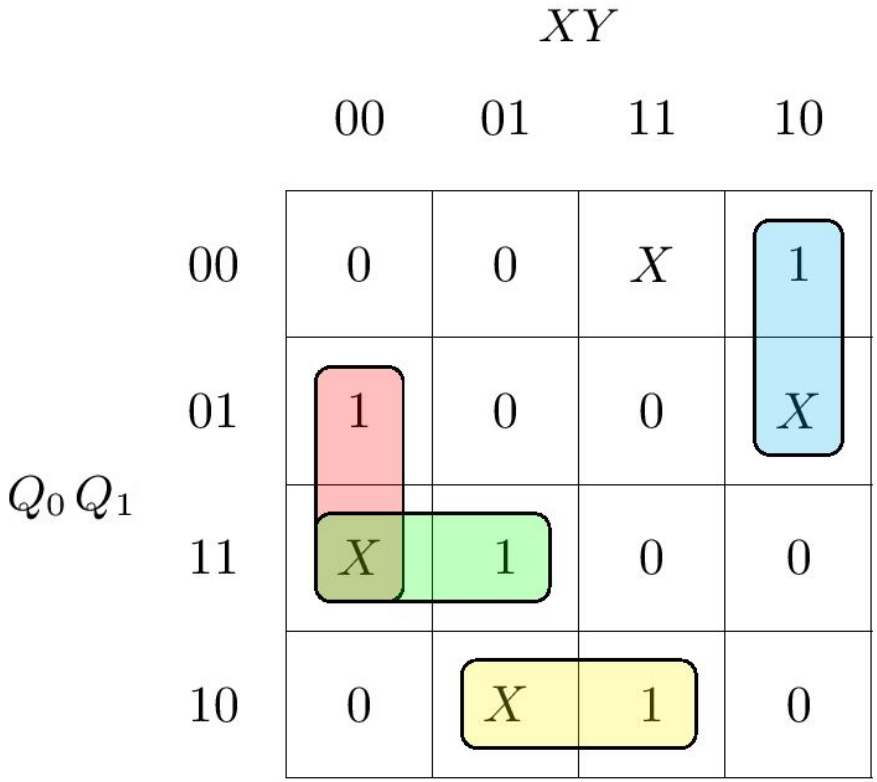
	00	01	11	10
00				
01				
11				
10				

	Q_0	Q_1	X	Y	$ADEL$
	0	0	0	0	0
	0	0	0	1	0
A	0	0	1	0	1
	0	0	1	1	X
	0	1	0	0	1
	0	1	0	1	0
D	0	1	1	0	X
	0	1	1	1	0
	1	0	0	0	0
	1	0	0	1	X
B	1	0	1	0	0
	1	0	1	1	1
	1	1	0	0	X
	1	1	0	1	1
C	1	1	1	0	0
	1	1	1	1	0

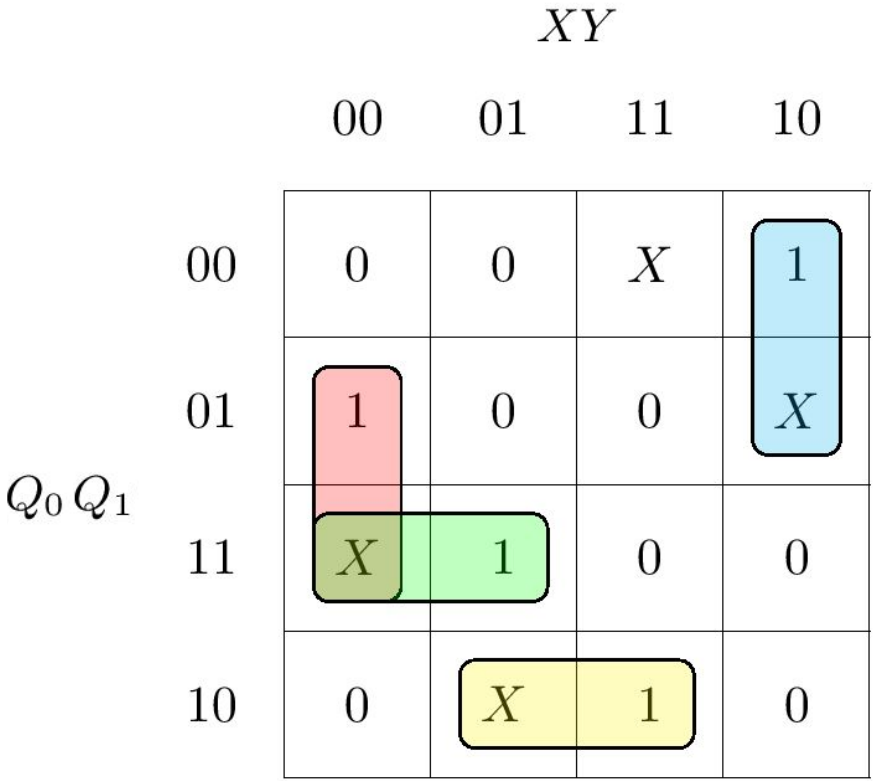
$Q_0\,Q_1$ \ XY

	00	01	11	10
00	0	0	X	1
01	1	0	0	X
11	X	1	0	0
10	0	X	1	0

	Q_0	Q_1	X	Y	$ADEL$
	0	0	0	0	0
	0	0	0	1	0
A	0	0	1	0	1
	0	0	1	1	X
	0	1	0	0	1
	0	1	0	1	0
D	0	1	1	0	X
	0	1	1	1	0
	1	0	0	0	0
	1	0	0	1	X
B	1	0	1	0	0
	1	0	1	1	1
	1	1	0	0	X
	1	1	0	1	1
C	1	1	1	0	0
	1	1	1	1	0



	Q_0	Q_1	X	Y	$ADEL$
	0	0	0	0	0
	0	0	0	1	0
A	0	0	1	0	1
	0	0	1	1	X
	0	1	0	0	1
	0	1	0	1	0
D	0	1	1	0	X
	0	1	1	1	0
	1	0	0	0	0
	1	0	0	1	X
B	1	0	1	0	0
	1	0	1	1	1
	1	1	0	0	X
	1	1	0	1	1
C	1	1	1	0	0
	1	1	1	1	0



ADEL = $Q_0Q_1\neg X$ v $Q_1\neg X\neg Y$ v $\neg Q_0X\neg Y$ v $Q_0\neg Q_1Y$

	Q_0	Q_1	X	Y	$ATRAS$
	0	0	0	0	0
	0	0	0	1	1
A	0	0	1	0	0
	0	0	1	1	X
	0	1	0	0	0
	0	1	0	1	0
D	0	1	1	0	X
	0	1	1	1	1
	1	0	0	0	1
	1	0	0	1	X
B	1	0	1	0	0
	1	0	1	1	0
	1	1	0	0	X
	1	1	0	1	0
C	1	1	1	0	1
	1	1	1	1	0

XY

$Q_0 Q_1$	00	01	11	10
00				
01				
11				
10				

	Q_0	Q_1	X	Y	$ATRAS$
	0	0	0	0	0
	0	0	0	1	1
A	0	0	1	0	0
	0	0	1	1	X
	0	1	0	0	0
	0	1	0	1	0
D	0	1	1	0	X
	0	1	1	1	1
	1	0	0	0	1
	1	0	0	1	X
B	1	0	1	0	0
	1	0	1	1	0
	1	1	0	0	X
	1	1	0	1	0
C	1	1	1	0	1
	1	1	1	1	0

$Q_0\,Q_1$ \ XY

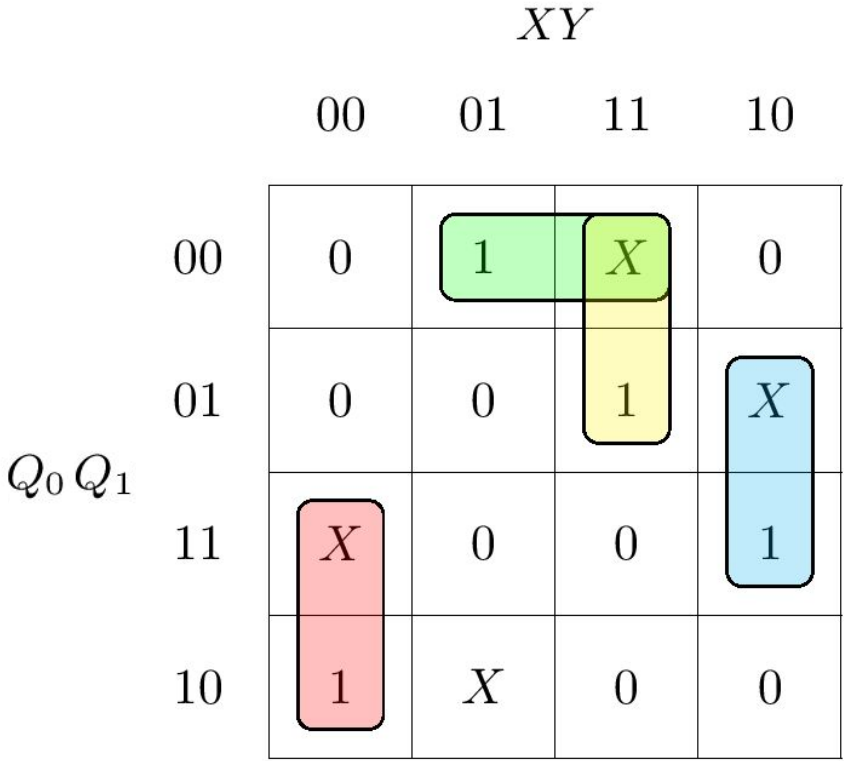
	00	01	11	10
00	0	1	X	0
01	0	0	1	X
11	X	0	0	1
10	1	X	0	0

	Q_0	Q_1	X	Y	$ATRAS$
	0	0	0	0	0
	0	0	0	1	1
A	0	0	1	0	0
	0	0	1	1	X
	0	1	0	0	0
	0	1	0	1	0
D	0	1	1	0	X
	0	1	1	1	1
	1	0	0	0	1
	1	0	0	1	X
B	1	0	1	0	0
	1	0	1	1	0
	1	1	0	0	X
	1	1	0	1	0
C	1	1	1	0	1
	1	1	1	1	0

$Q_0\,Q_1$ \ XY

	00	01	11	10
00	0	1	X	0
01	0	0	1	X
11	X	0	0	1
10	1	X	0	0

	Q_0	Q_1	X	Y	$ATRAS$
	0	0	0	0	0
	0	0	0	1	1
A	0	0	1	0	0
	0	0	1	1	X
	0	1	0	0	0
	0	1	0	1	0
D	0	1	1	0	X
	0	1	1	1	1
	1	0	0	0	1
	1	0	0	1	X
B	1	0	1	0	0
	1	0	1	1	0
	1	1	0	0	X
	1	1	0	1	0
C	1	1	1	0	1
	1	1	1	1	0

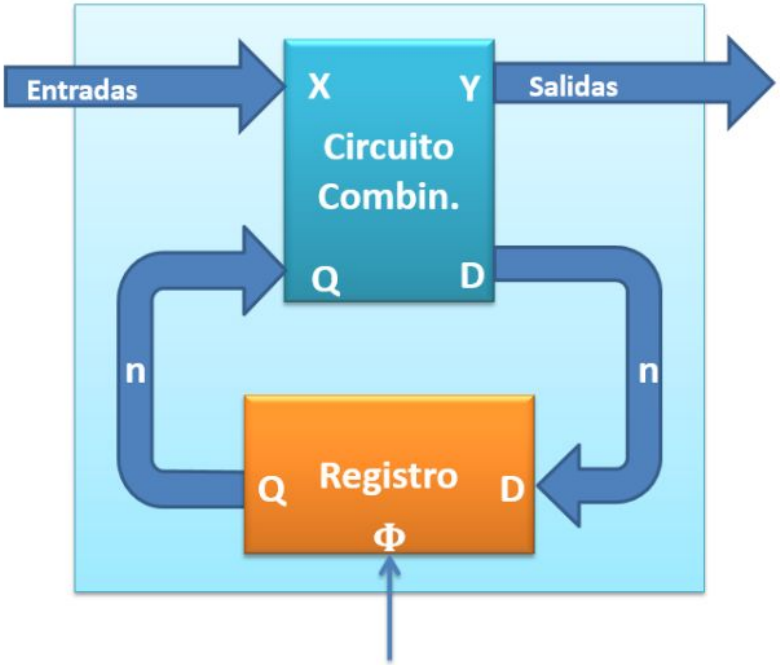


ATRAS = $\neg Q_0 \neg Q_1 Y \vee Q_0 \neg X \neg Y \vee Q_1 X \neg Y \vee \neg Q_0 X Y$

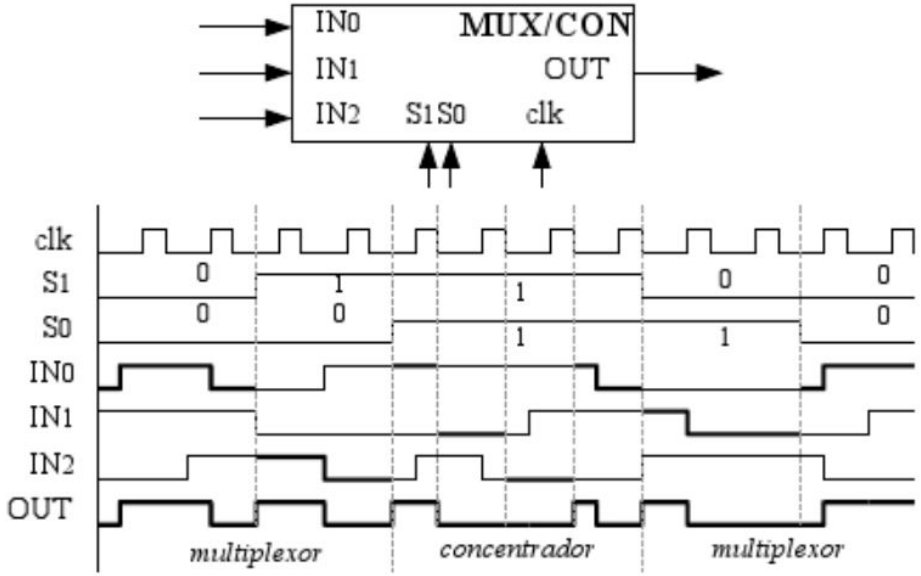
Resumen

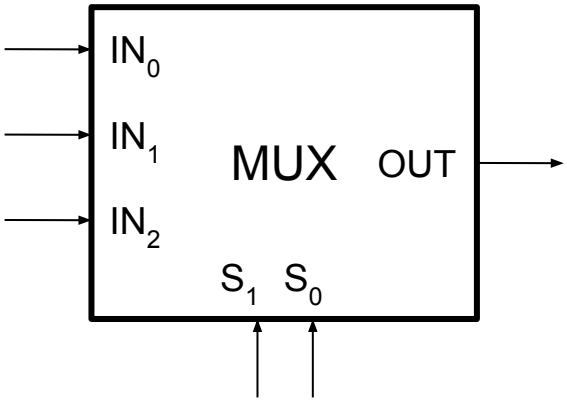
- $D_0 = X$
- $D_1 = Y$
- ADEL = $Q_0Q_1\neg X \vee Q_1\neg X\neg Y \vee \neg Q_0X\neg Y \vee Q_0\neg Q_1Y$
- ATRAS = $\neg Q_0\neg Q_1Y \vee Q_0\neg X\neg Y \vee Q_1X\neg Y \vee \neg Q_0XY$

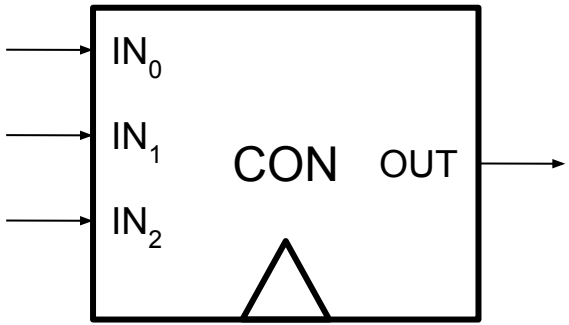
Ahora a construir el circuito ...



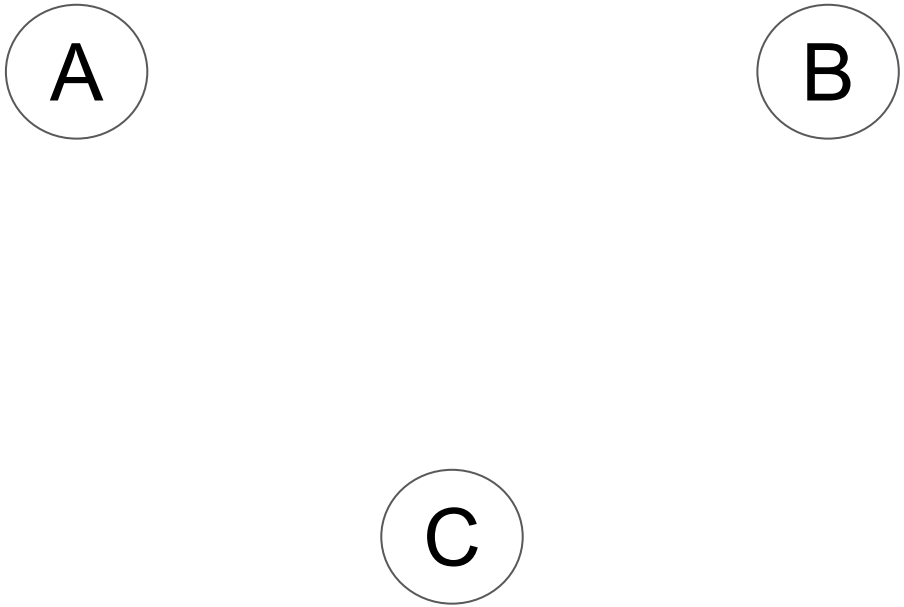
P2: P1.b Control 1, 2006




IN0
IN1
IN2
MUX
OUT
S1 S0


IN0
IN1
IN2
CON
OUT

S_1 S_2 IN_0 IN_1 IN_2 / OUT



$S_1\ S_2\ IN_0 IN_1 IN_2$ / OUT