Ανάλυση

- Περιγραφή του κυκλώματος
- Λογικές συναρτήσεις των flip-flops
- Συναρτήσεις επόμενης κατάστασης
- Πίνακας καταστάσεων
- Διάγραμμα καταστάσεων

Σύνθεση

- Περιγραφή συμπεριφοράς
- Διάγραμμα καταστάσεων
- Πίνακας καταστάσεων
- Ελαχιστοποίηση πίνακα καταστάσεων
- Επιλογή καταστάσεων
- Συναρτήσεις εισόδου των flip-flops
- Κύκλωμα

Πίνακες διέγερσης

Q(t)	Q(t+1)	S	R
0	0	0	X
0	1	1	0
1	0	0	1
1	1	X	0

Q(t)	Q(t+1)	J	K
0	0	0	X
0	1	1	X
1	0	X	1
1	1	X	0

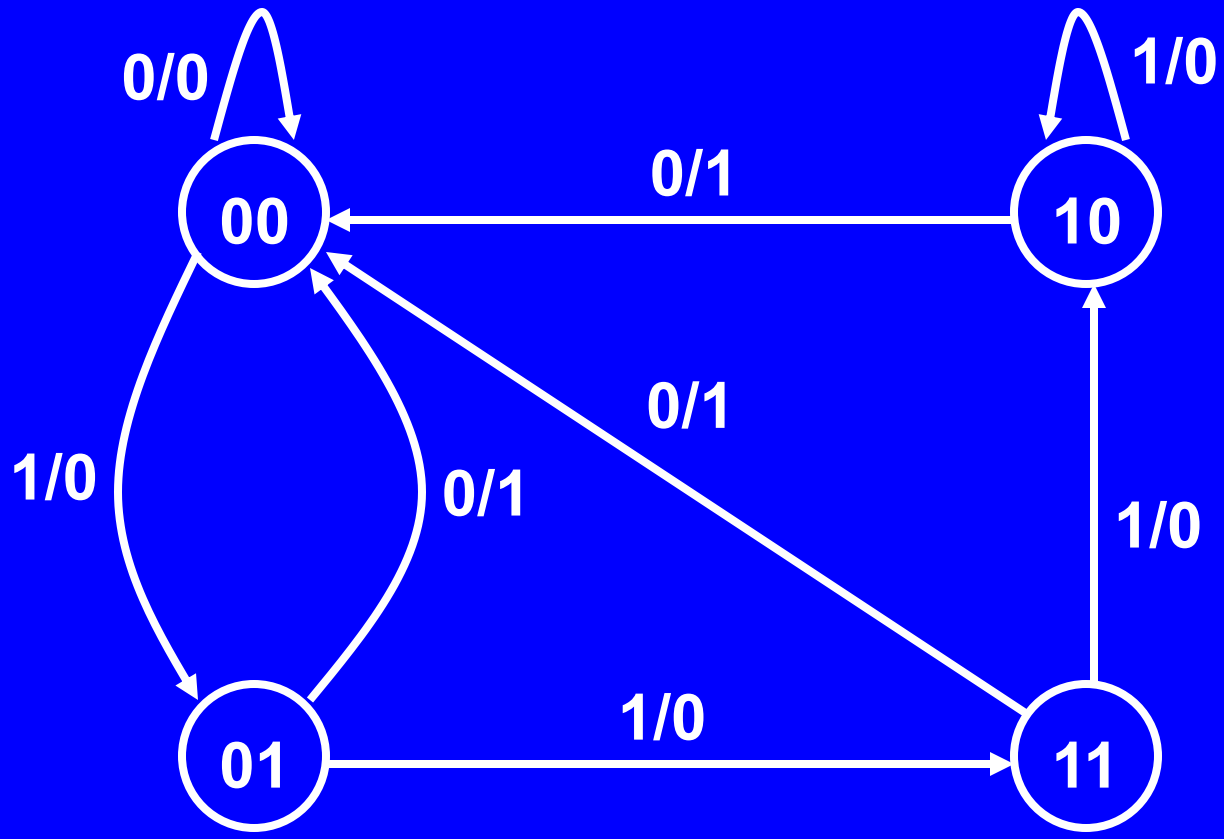
Q(t)	Q(t+1)	D
0	0	0
0	1	1
1	0	0
1	1	1

Q(t)	Q(t+1)	T
0	0	0
0	1	1
1	0	1
1	1	0

Πίνακας καταστάσεων

Αρχική		Είσοδος	Επόμενη		Έξοδος
A	B	X	A	B	Y
0	0	0	0	0	0
0	0	1	0	1	0
0	1	0	0	0	1
0	1	1	1	1	0
1	0	0	0	0	1
1	0	1	1	0	0
1	1	0	0	0	1
1	1	1	1	0	0

Διάγραμμα καταστάσεων



Σχεδίαση με JK latches

Q(t)	Q(t+1)	J	K
0	0	0	X
0	1	1	X
1	0	X	1
1	1	X	0

Αρχική		Είσοδος	Επόμενη		Είσοδοι JK			
A	B	X	A	B	JA	KA	JB	KB
0	0	0	0	1	0	x	1	x
0	0	1	0	0	0	x	0	x
0	1	0	1	1	1	x	x	0
0	1	1	1	0	1	x	x	1
1	0	0	1	1	x	0	1	x
1	0	1	1	0	x	0	0	x
1	1	0	0	0	x	1	x	1
1	1	1	1	1	x	0	x	0

JA

A \ BX	00	01	11	10
0	0	0	1	1
1	X	X	X	X

KA

A \ BX	00	01	11	10
0	X	X	X	X
1	0	0	0	1

JB

A \ BX	00	01	11	10
0	1	0	X	X
1	1	0	X	X

KB

A \ BX	00	01	11	10
0	X	X	1	0
1	X	X	0	1

JA

A \ BX	00	01	11	10
0	0	0	1	1
1	X	X	X	X

KA

A \ BX	00	01	11	10
0	X	X	X	X
1	0	0	0	1

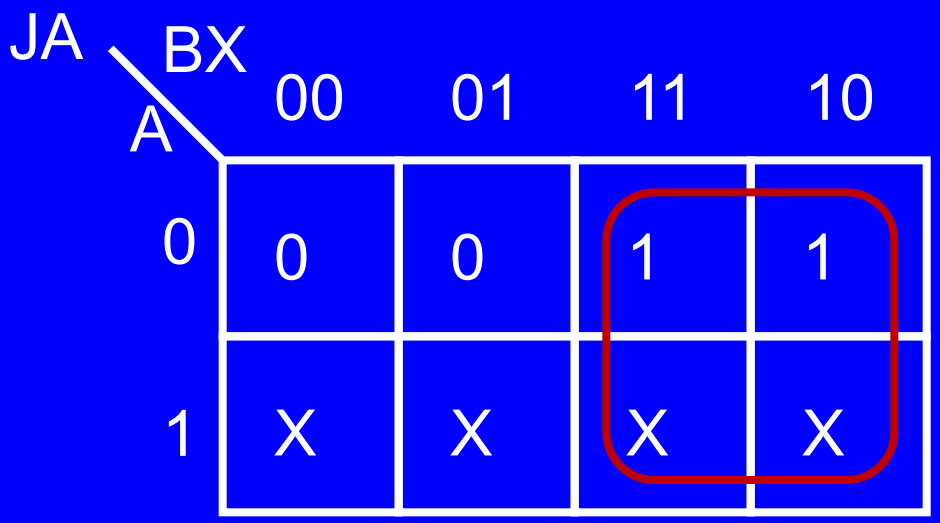
JB

A \ BX	00	01	11	10
0	1	0	X	X
1	1	0	X	X

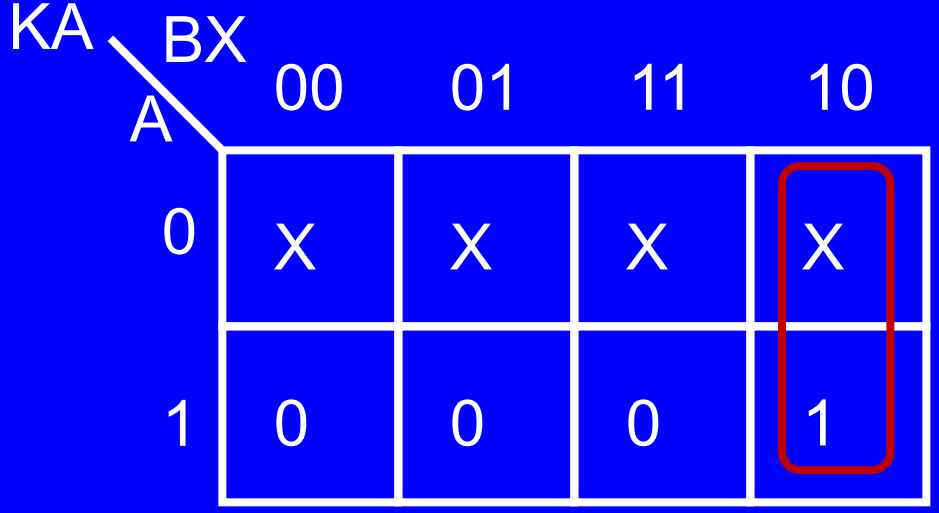
KB

A \ BX	00	01	11	10
0	X	X	1	0
1	X	X	0	1

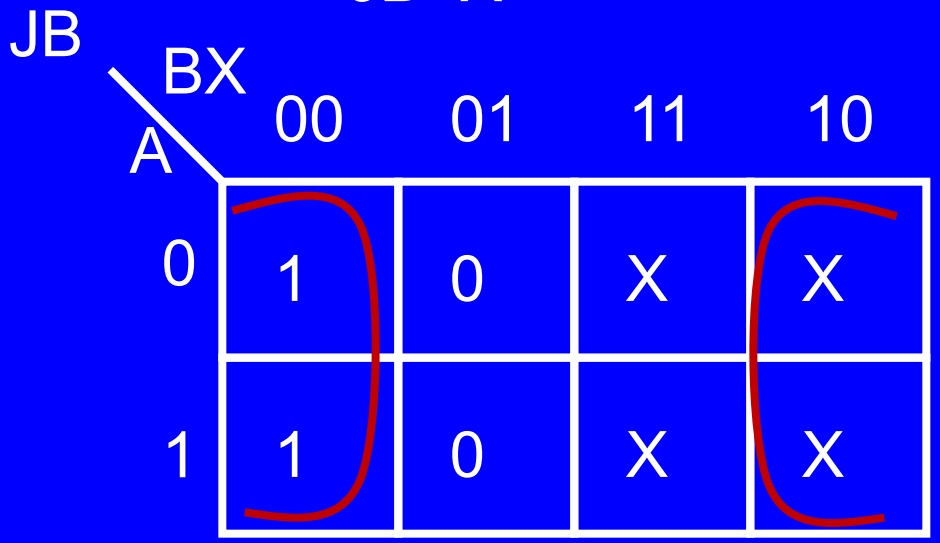
JA=B



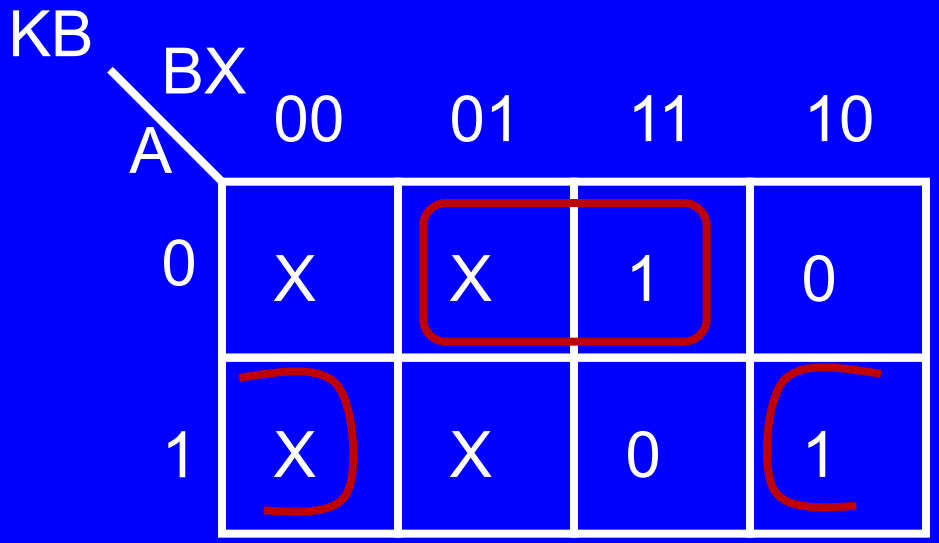
KA=BX'



JB=X'



KB=AX'+A'X



Σχεδίαση με D latches

Q(t)	Q(t+1)	D
0	0	0
0	1	1
1	0	0
1	1	1

Αρχική		Είσοδος	Επόμενη		Είσοδοι D		
A	B	X	A	B	DA	DB	Y
0	0	0	0	1	0	1	0
0	0	1	0	0	0	0	0
0	1	0	1	1	1	1	1
0	1	1	1	0	1	0	0
1	0	0	1	1	1	1	1
1	0	1	1	0	1	0	0
1	1	0	0	0	0	0	0
1	1	1	1	1	1	1	0

DA

A \ BX	00	01	11	10
0	0	0	1	1
1	1	1	1	0

DB

A \ BX	00	01	11	10
0	1	0	0	1
1	1	0	1	0

Y

A \ BX	00	01	11	10
0	0	0	0	1
1	1	0	0	0

DA=AB'+AX+A'B

DB=A'X'+B'X'+ABX

Y=AB'X'+A'BX'

DA

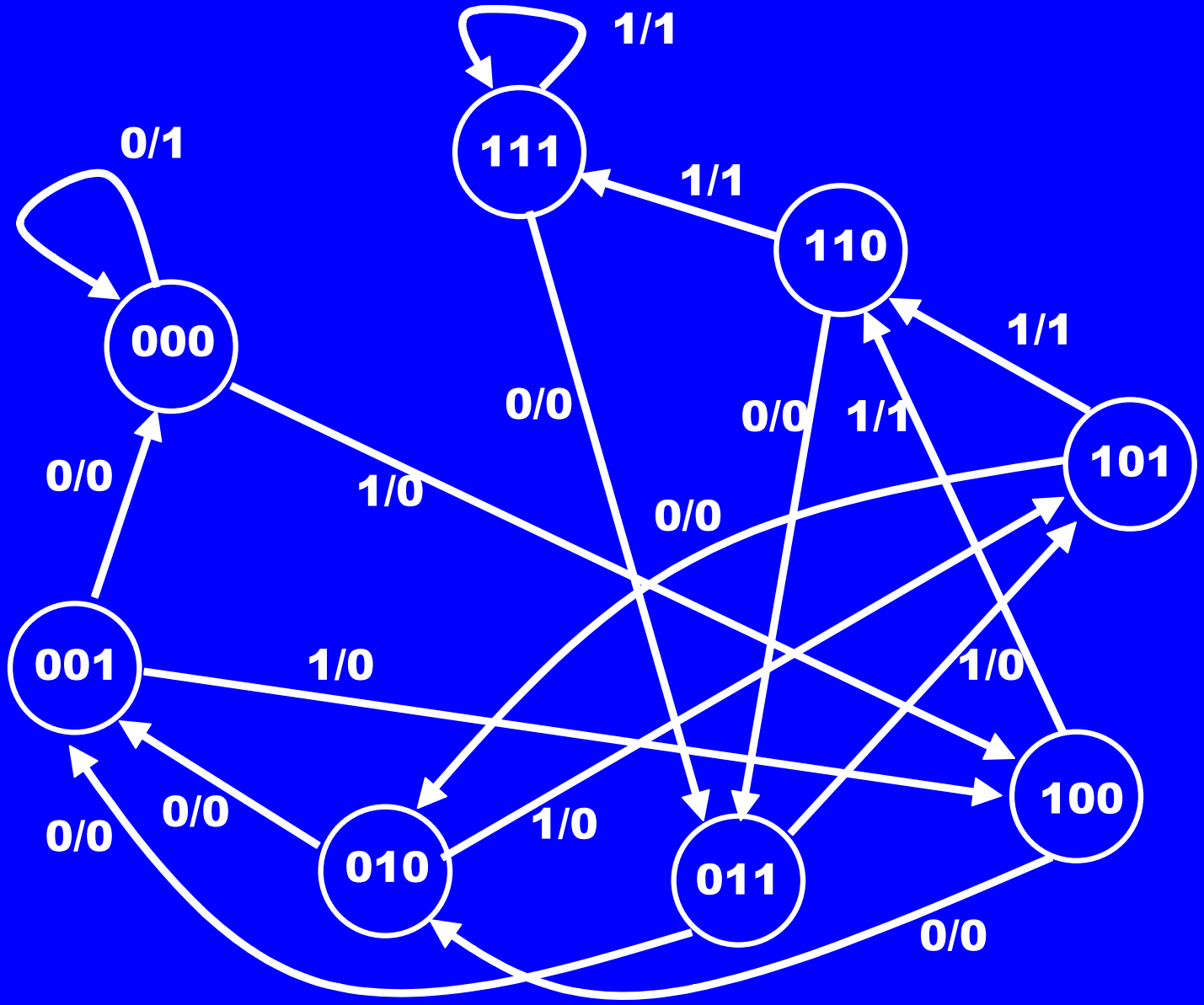
A \ BX	00	01	11	10
0	0	0	1	1
1	1	1	1	0

DB

A \ BX	00	01	11	10
0	1	0	0	1
1	1	0	1	0

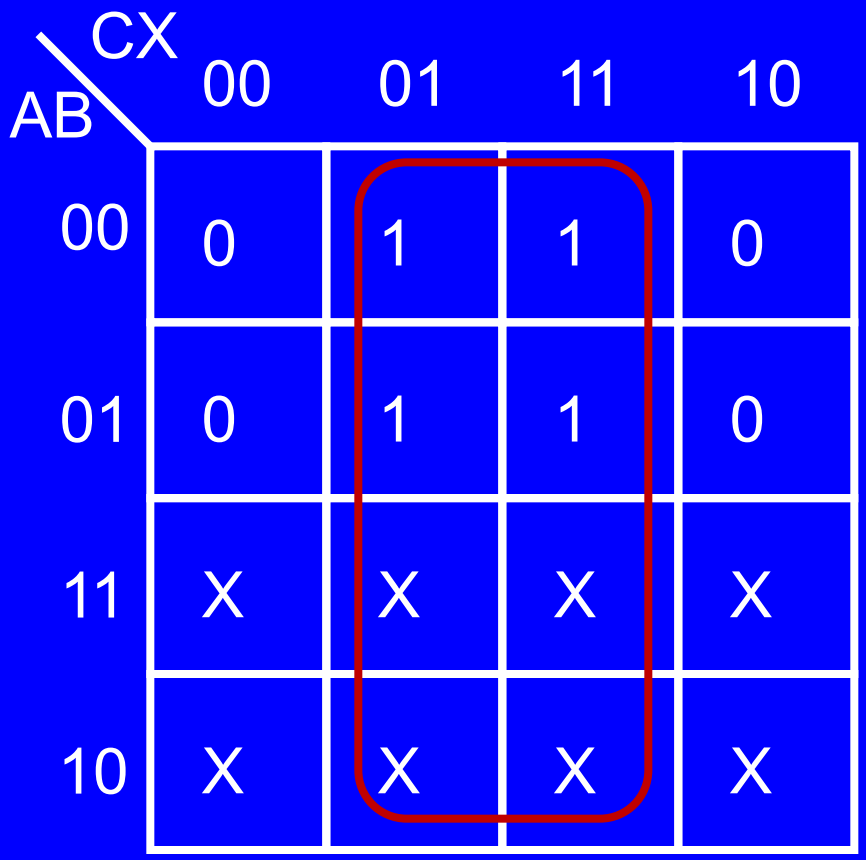
Y

A \ BX	00	01	11	10
0	0	0	0	1
1	1	0	0	0

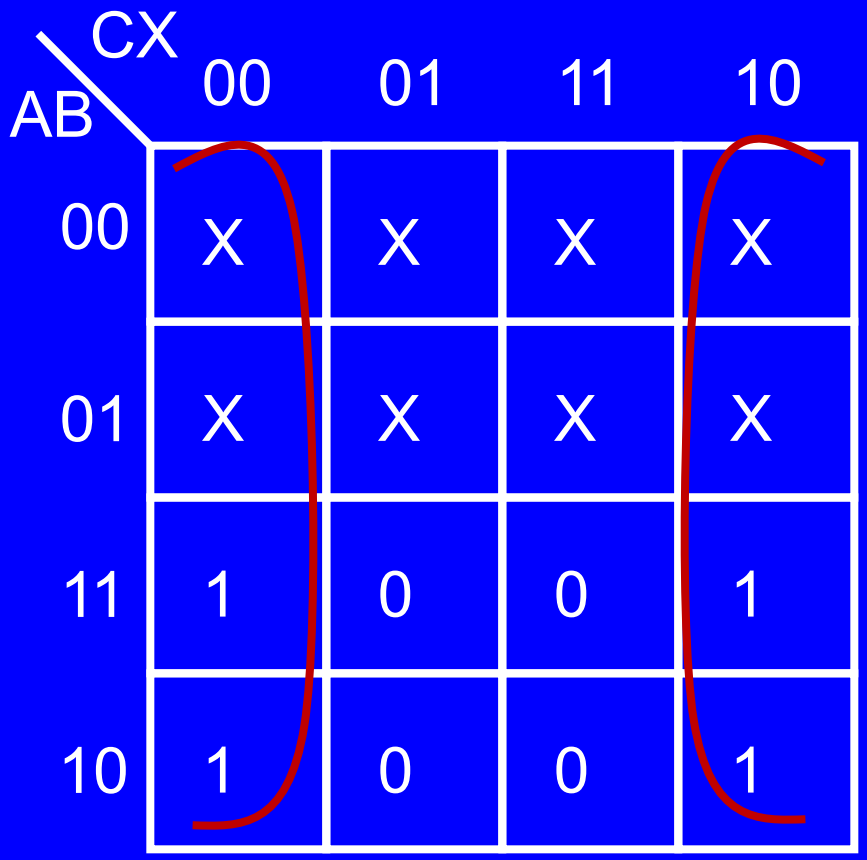

1/1
111
0/1
1/1
110
000
1/1
0/0
0/0
1/1
101
0/0
1/0
0/0
001
1/0
1/0
100
0/0
0/0
1/0
010
011
0/0

A	B	C	X	A	B	C	Y	JA	KA	JB	KB	JC	KC
0	0	0	0	0	0	0	1	0	X	0	X	0	X
0	0	0	1	1	0	0	0	1	X	0	X	0	X
0	0	1	0	0	0	0	0	0	X	0	X	X	1
0	0	1	1	1	0	0	0	1	X	0	X	X	1
0	1	0	0	0	0	1	0	0	X	X	1	1	X
0	1	0	1	1	0	1	0	1	X	X	1	1	X
0	1	1	0	0	0	1	0	0	X	X	1	X	0
0	1	1	1	1	0	1	0	1	X	X	1	X	0
1	0	0	0	0	1	0	0	X	1	1	X	0	X
1	0	0	1	1	1	0	1	X	0	1	X	0	X
1	0	1	0	0	1	0	0	X	1	1	X	X	1
1	0	1	1	1	1	0	1	X	0	1	X	X	1
1	1	0	0	0	1	1	0	X	1	X	0	1	X
1	1	0	1	1	1	1	1	X	0	X	0	1	X
1	1	1	0	0	1	1	0	X	1	X	0	X	0
1	1	1	1	1	1	1	1	X	0	X	0	X	0

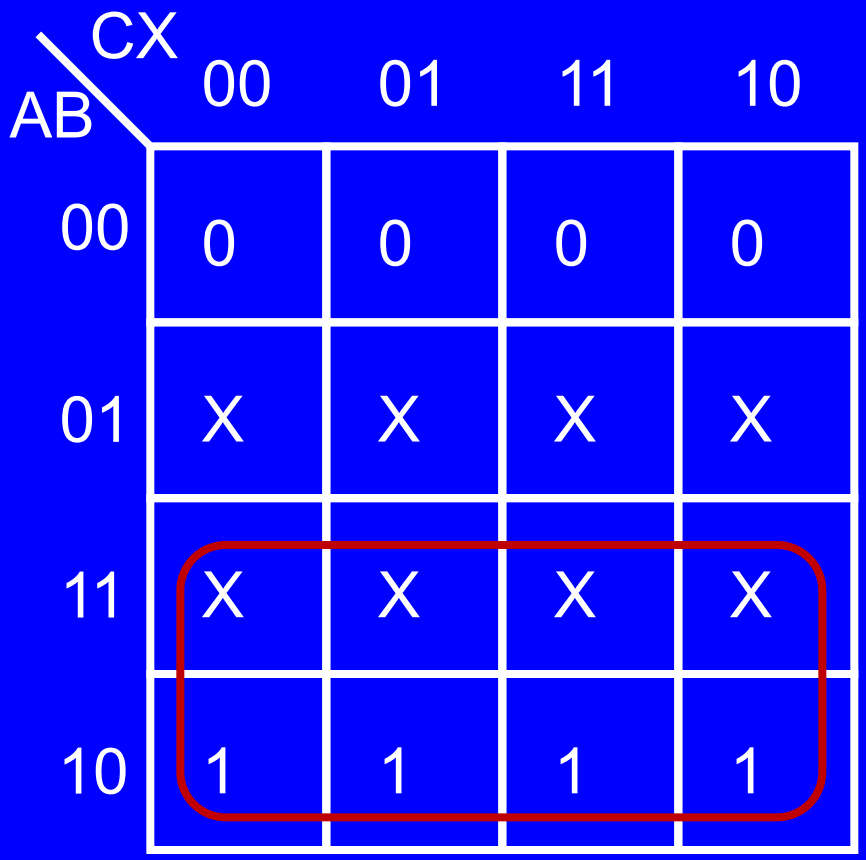
JA=X


CX
AB
00
01
11
10
00
0
1
1
0
01
0
1
1
0
11
X
X
X
X
10
X
X
X
X

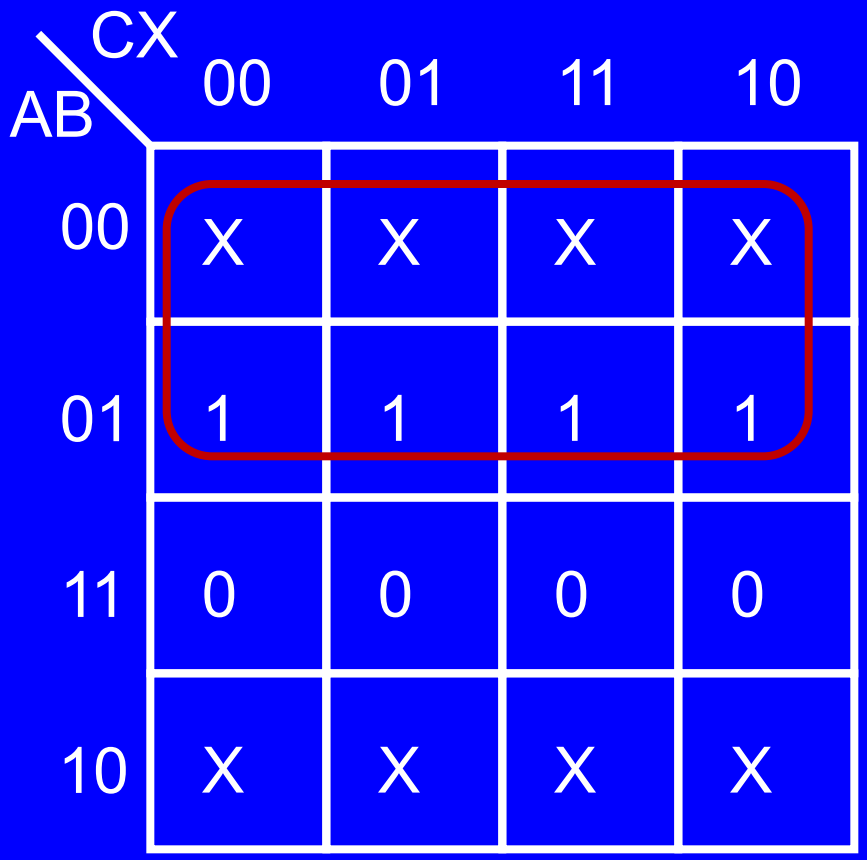
KA=X’


CX
AB
00
01
11
10
00
X
X
X
X
01
X
X
X
X
11
1
0
0
1
10
1
0
0
1

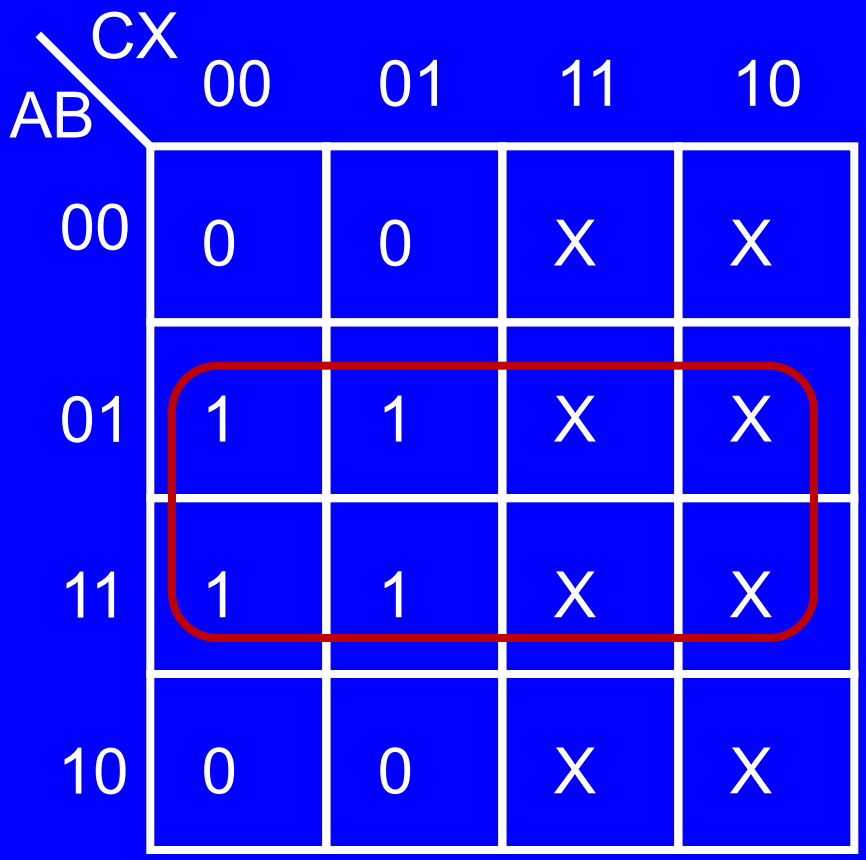
JB=A


CX
AB
00
01
11
10
00
0
0
0
0
01
X
X
X
X
11
X
X
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X
10
1
1
1
1

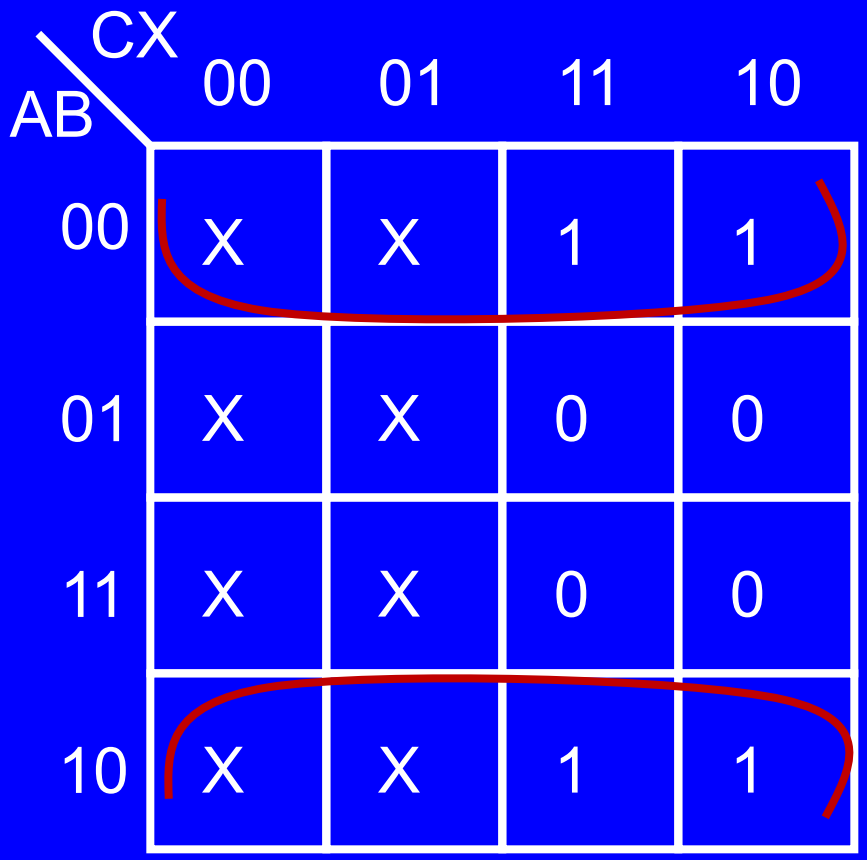
KB=A’


CX
AB
00
01
11
10
00
X
X
X
X
01
1
1
1
1
11
0
0
0
0
10
X
X
X
X

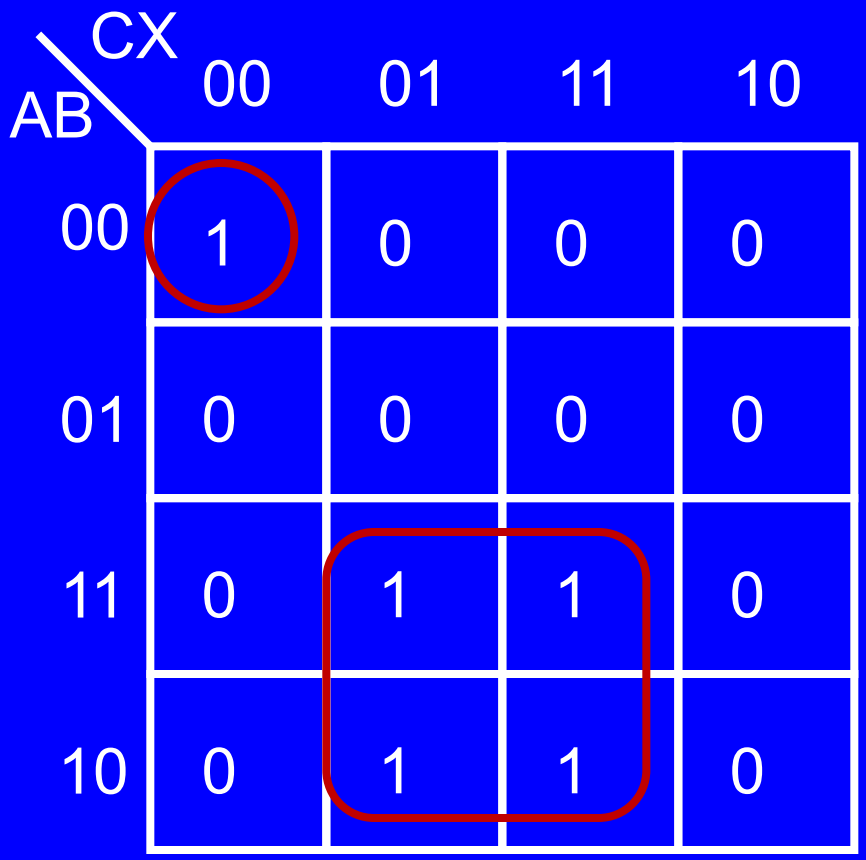
JC=B


CX
AB
00
01
11
10
00
0
0
X
X
01
1
1
X
X
11
1
1
X
X
10
0
0
X
X

KC=B’


CX
AB
00
01
11
10
00
X
X
1
1
01
X
X
0
0
11
X
X
0
0
10
X
X
1
1

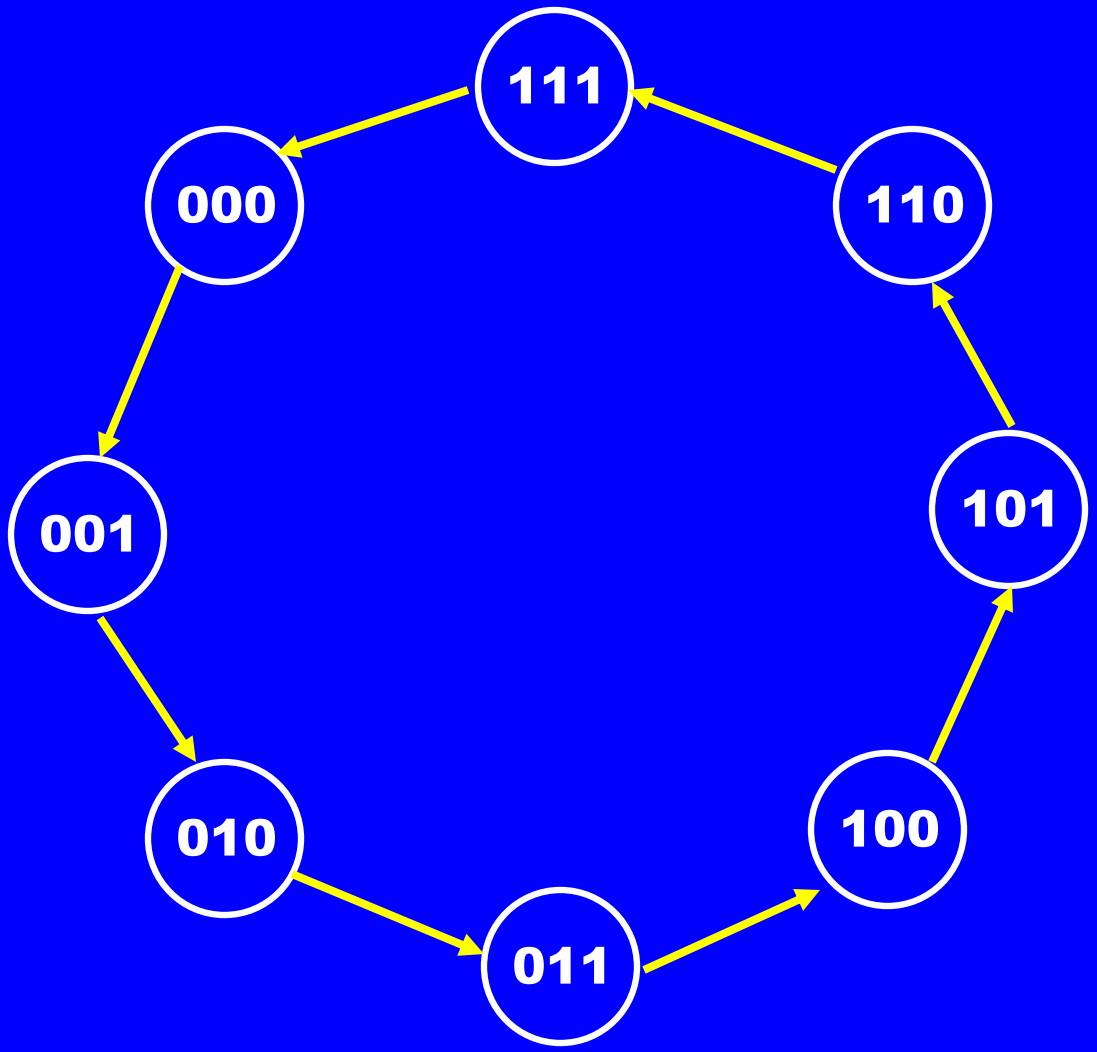
Y=A’B’C’D’+AX



Μοντέλα ακολουθιακών κυκλωμάτων

- Mealy
  - οι έξοδοι είναι συναρτήσεις των καταστάσεων και των εισόδων
- Moore
  - οι έξοδοι είναι συναρτήσεις των καταστάσεων και μόνο

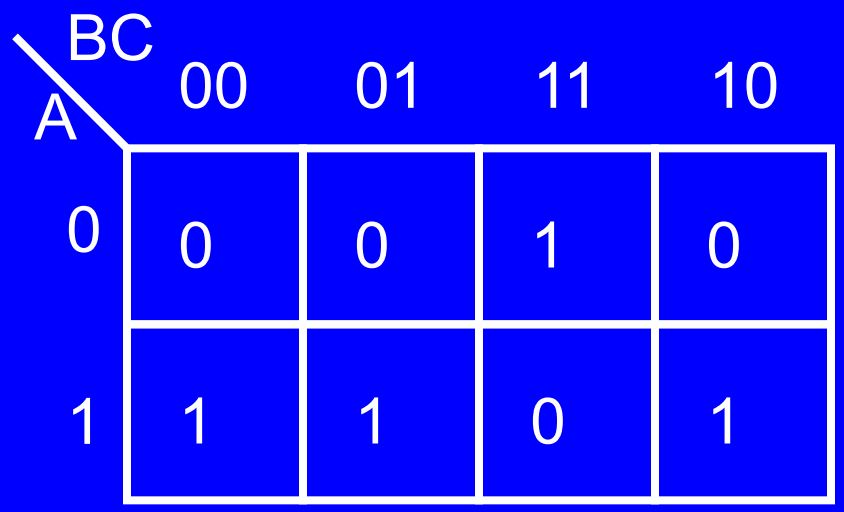
Μετρητές

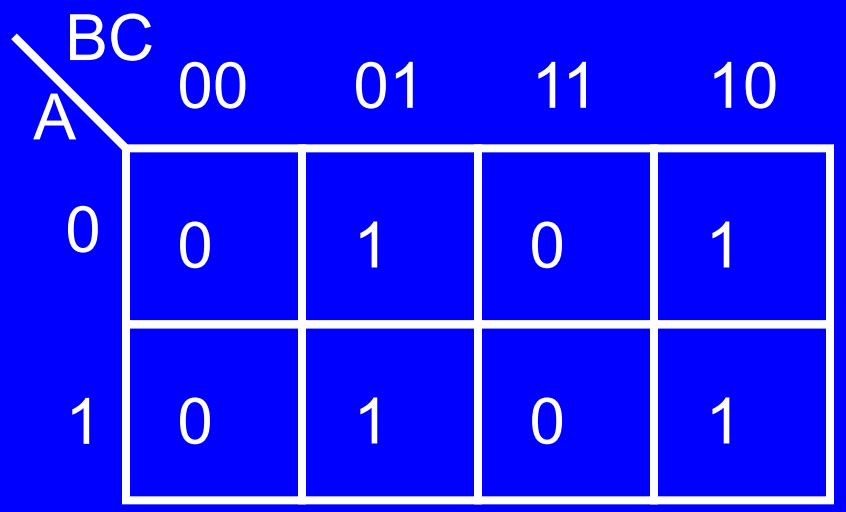


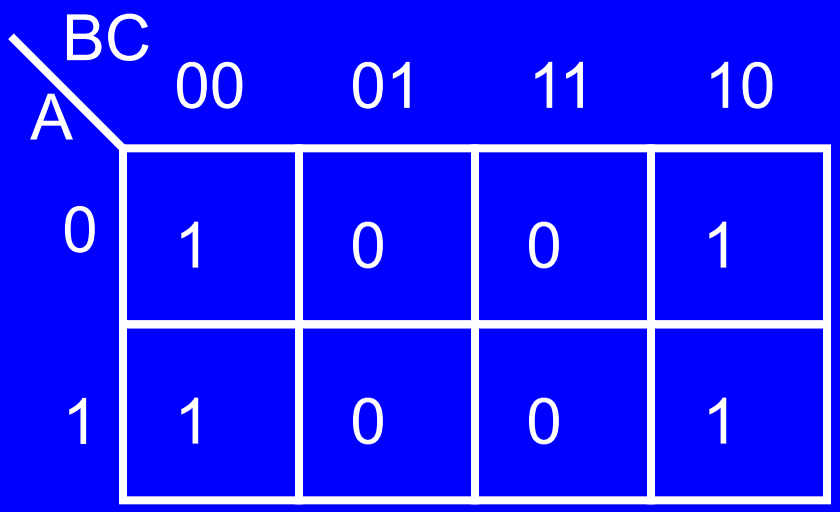
Μετρητές

A	B	C	DA	DB	DC
0	0	0	0	0	1
0	0	1	0	1	0
0	1	0	0	1	1
0	1	1	1	0	0
1	0	0	1	0	1
1	0	1	1	1	0
1	1	0	1	1	1
1	1	1	0	0	0

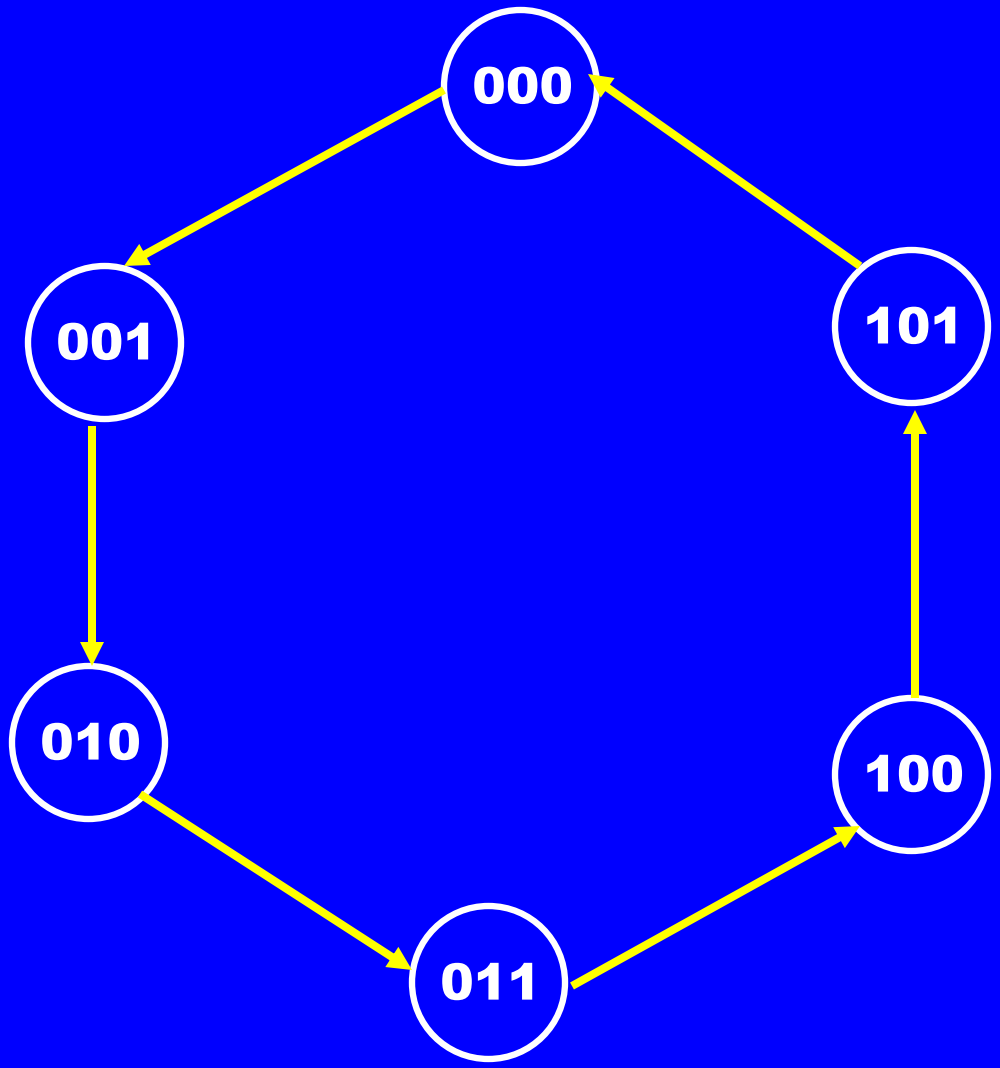
Μετρητές


BC
A
00
01
11
10
0
1
0
0
1
0
1
1
0
1


BC
A
00
01
11
10
0
1
0
1
0
1
0
1
0
1


BC
A
00
01
11
10
0
1
1
0
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1
0
0
1

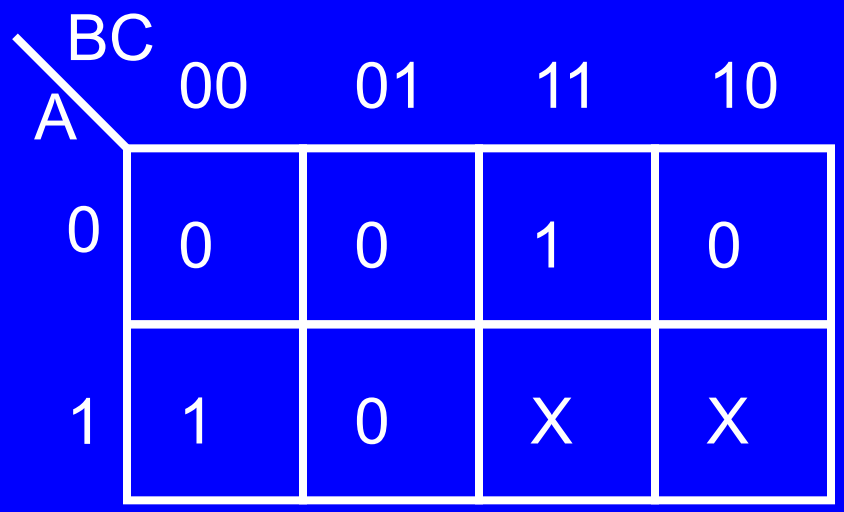
Μετρητές

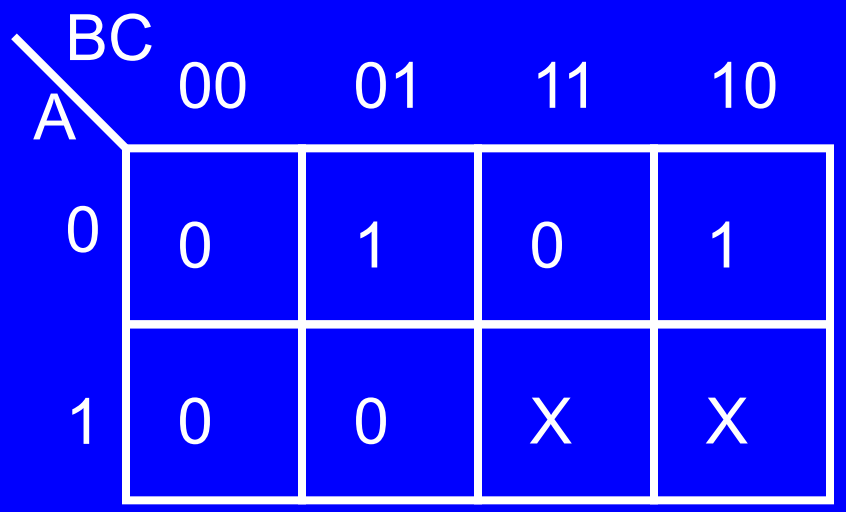


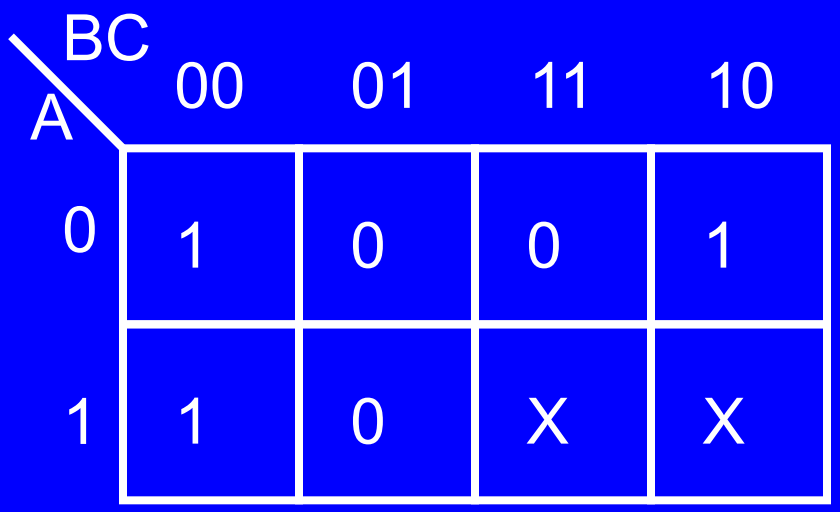
Μετρητές

A	B	C	DA	DB	DC
0	0	0	0	0	1
0	0	1	0	1	0
0	1	0	0	1	1
0	1	1	1	0	0
1	0	0	1	0	1
1	0	1	0	0	0
1	1	0	X	X	X
1	1	1	X	X	X

Μετρητές

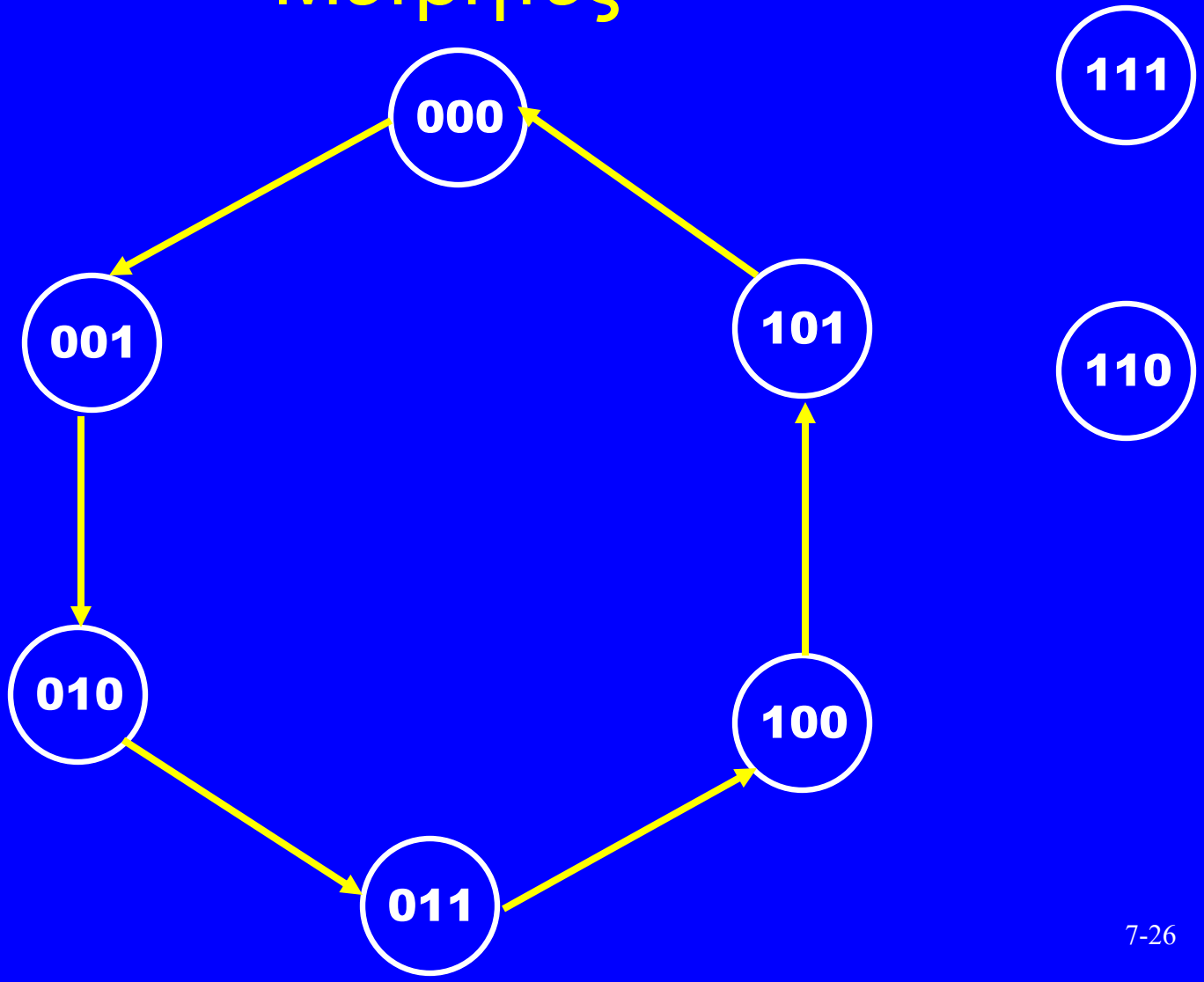

BC
A
00
01
11
10
0
0
0
1
0
1
1
0
X
X


BC
A
00
01
11
10
0
0
1
0
1
1
0
0
X
X


BC
A
00
01
11
10
0
1
0
0
1
1
1
0
X
X

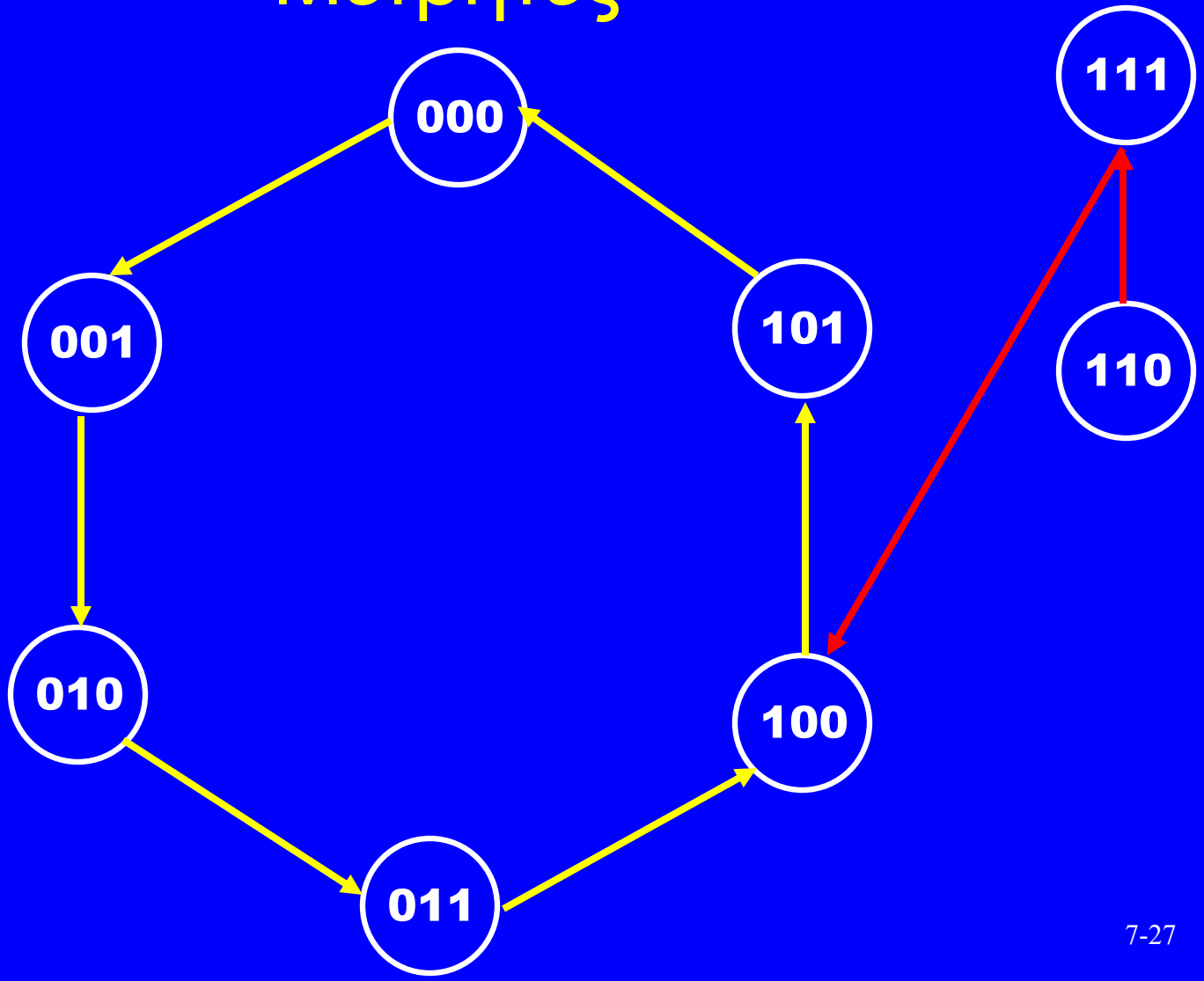
DA=AC’+BC
DB=BC’+A’B’C
DC=C’

Μετρητές

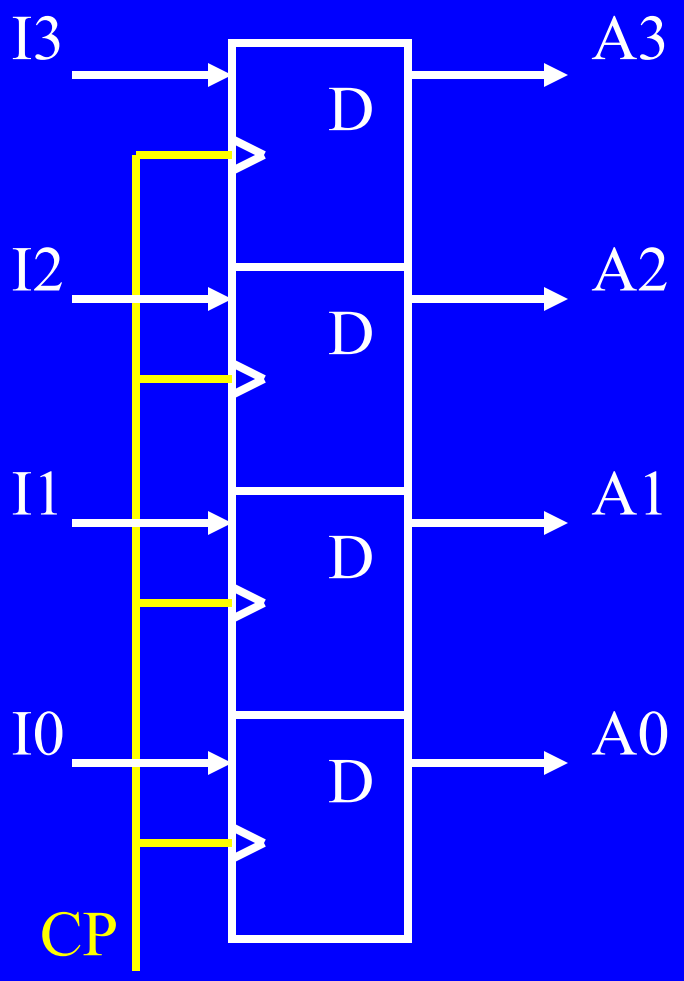


DA=AC’+BC
DB=BC’+A’B’C
DC=C’

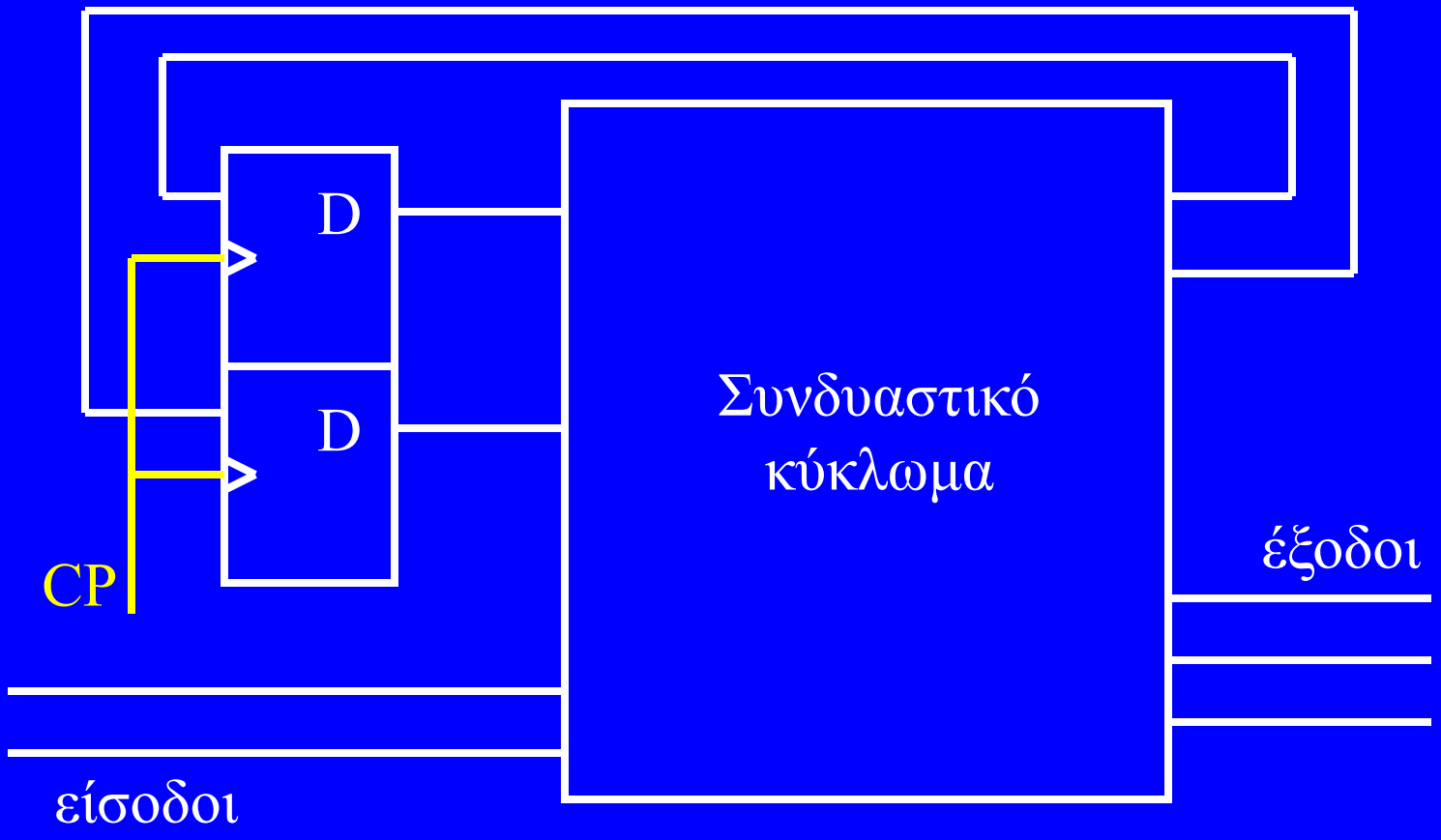
Μετρητές



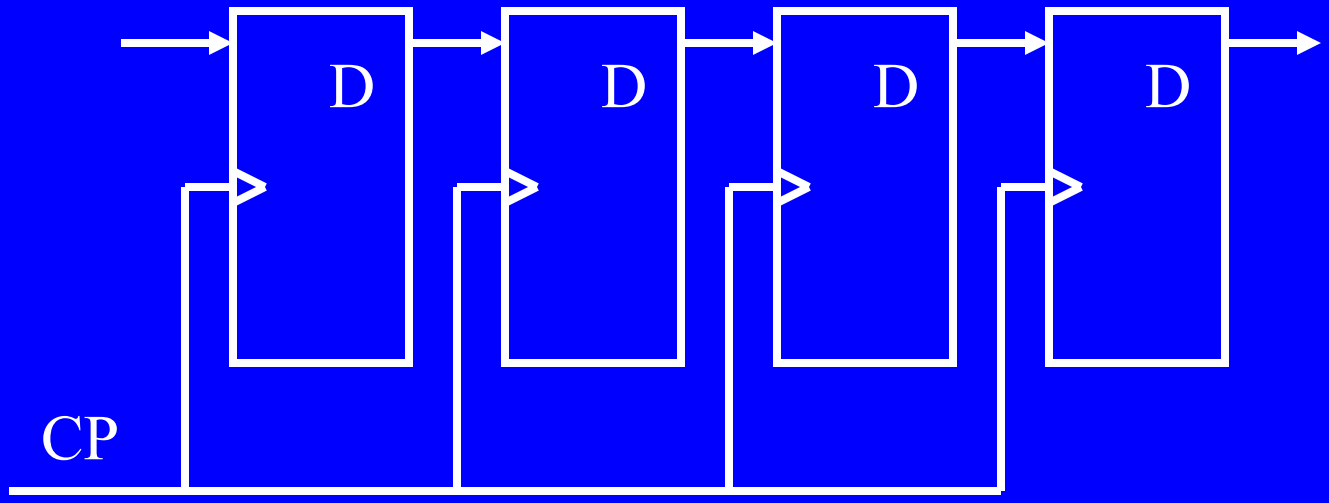
Καταχωρητής



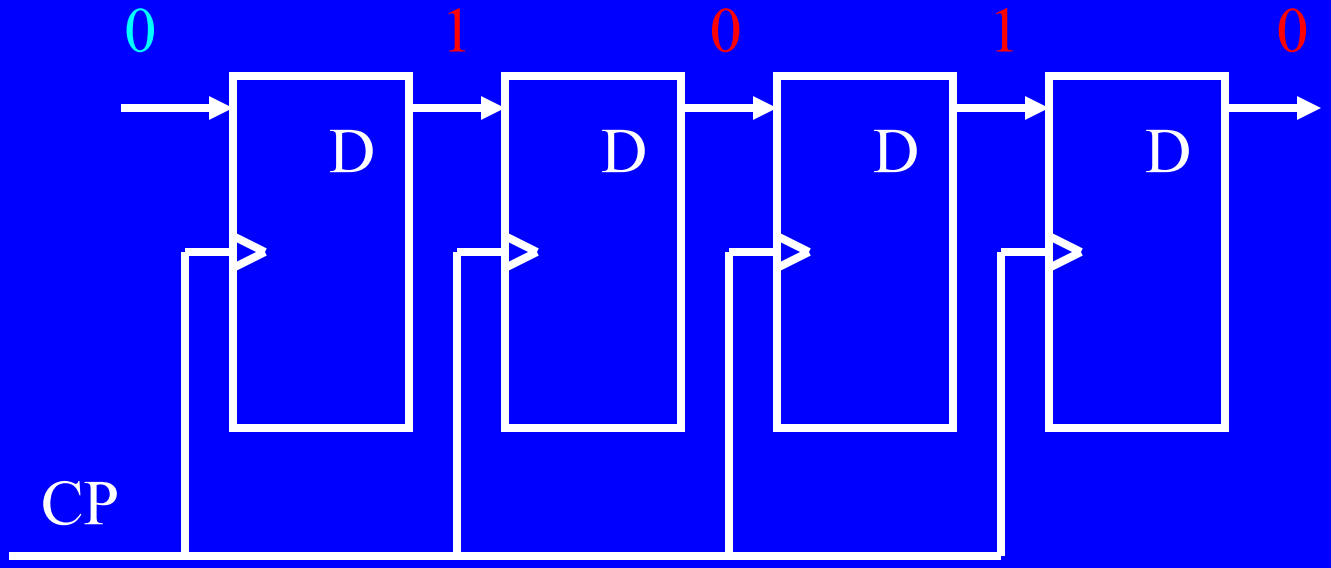
Υλοποίηση ακολουθιακής λογικής



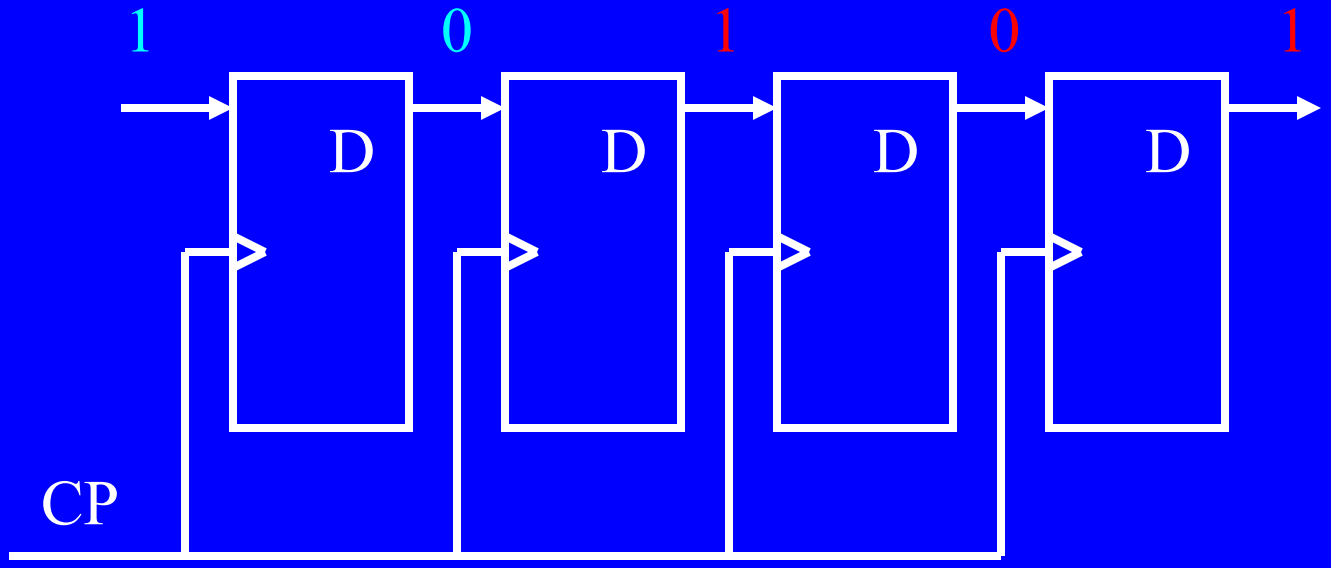
Καταχωρητές ολίσθησης



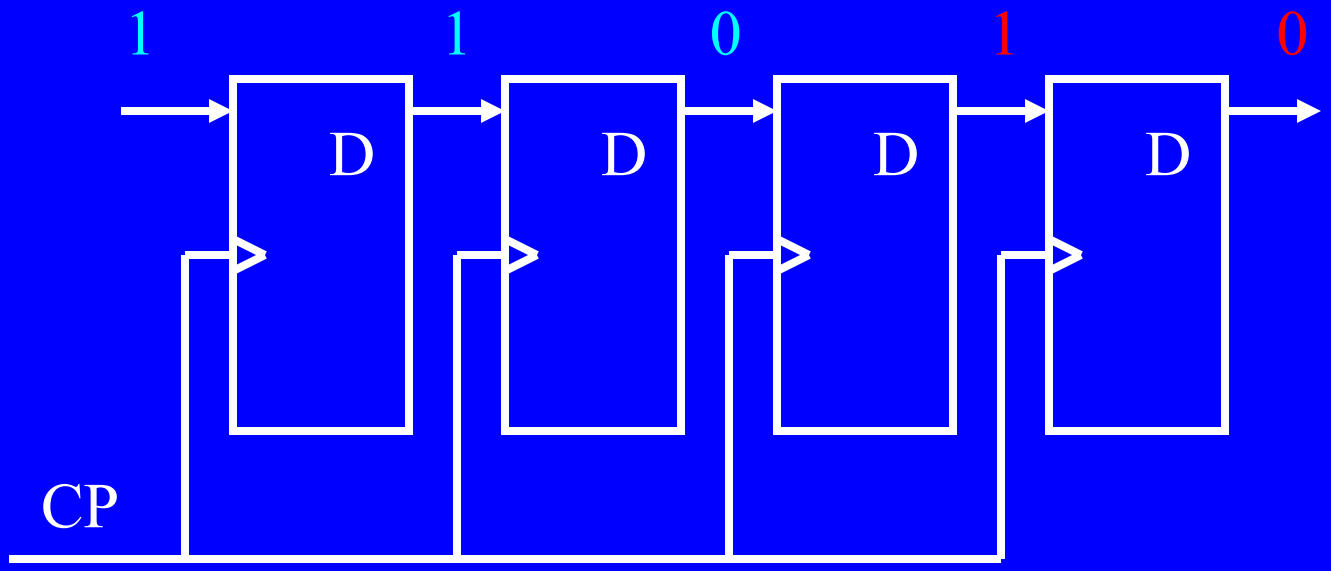
Καταχωρητές ολίσθησης



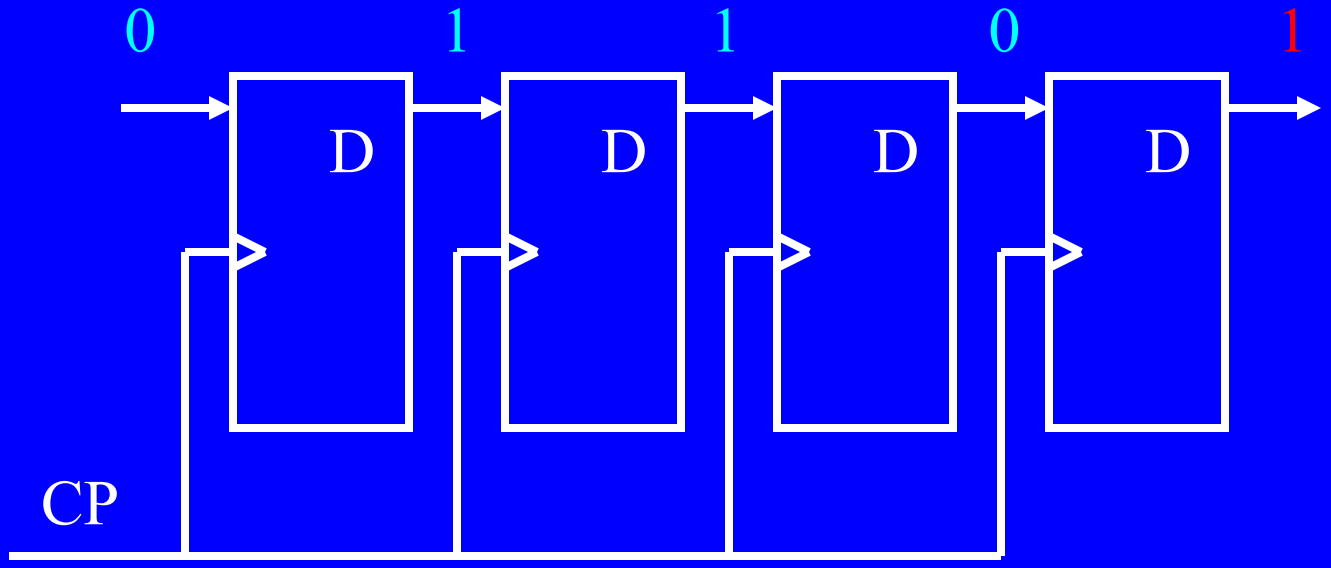
Καταχωρητές ολίσθησης



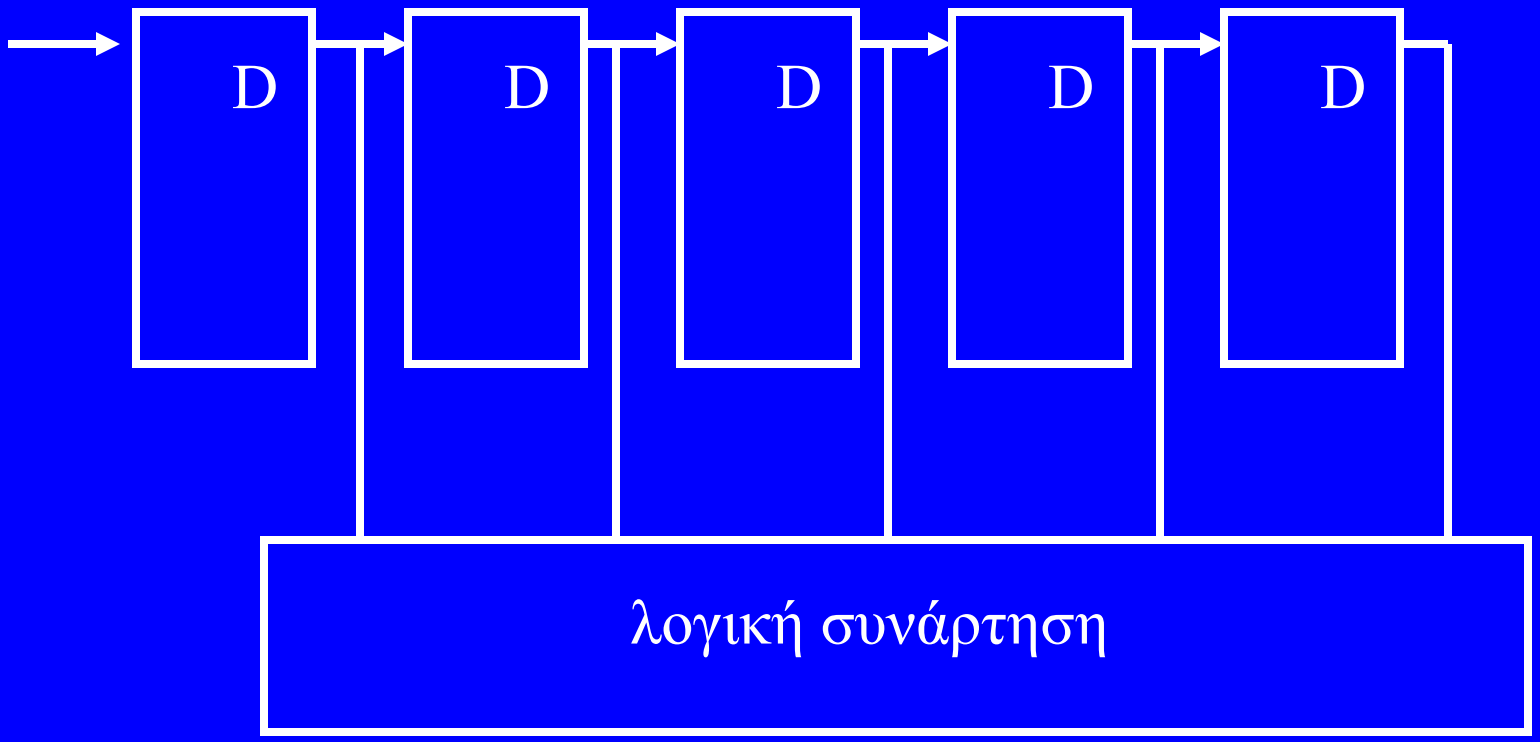
Καταχωρητές ολίσθησης



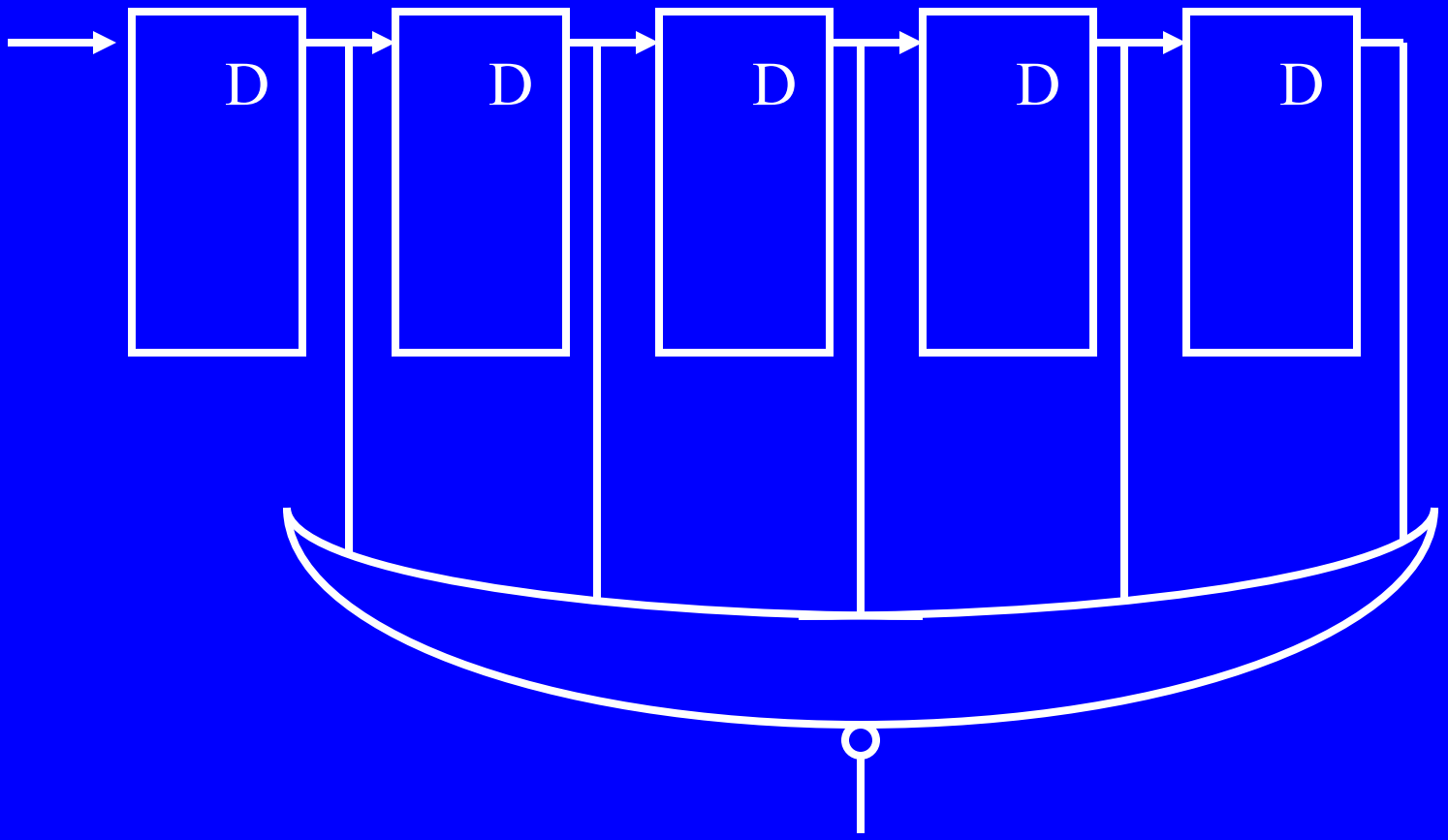
Καταχωρητές ολίσθησης



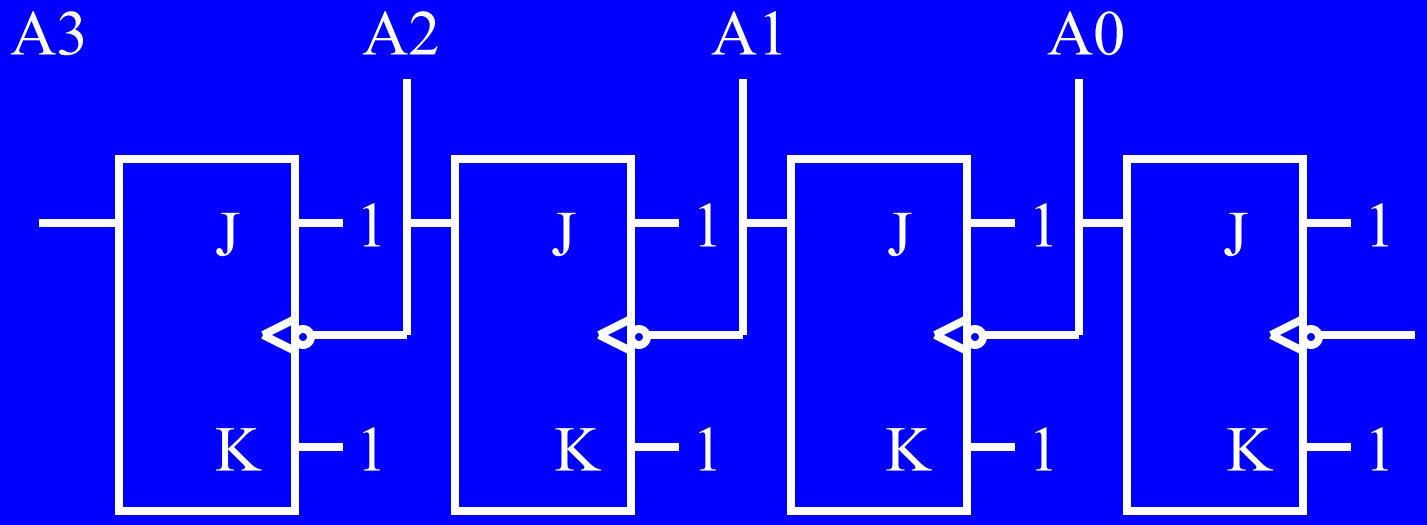
Κυκλώματα πεπερασμένης μνήμης

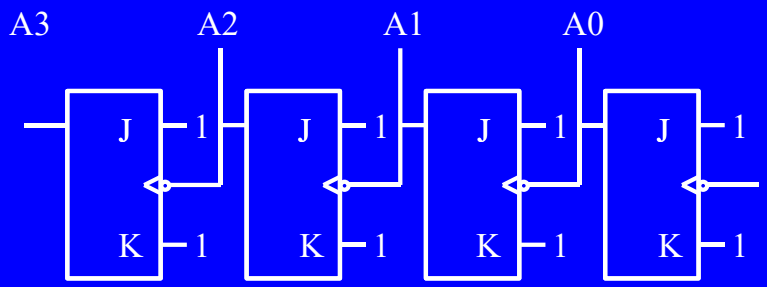


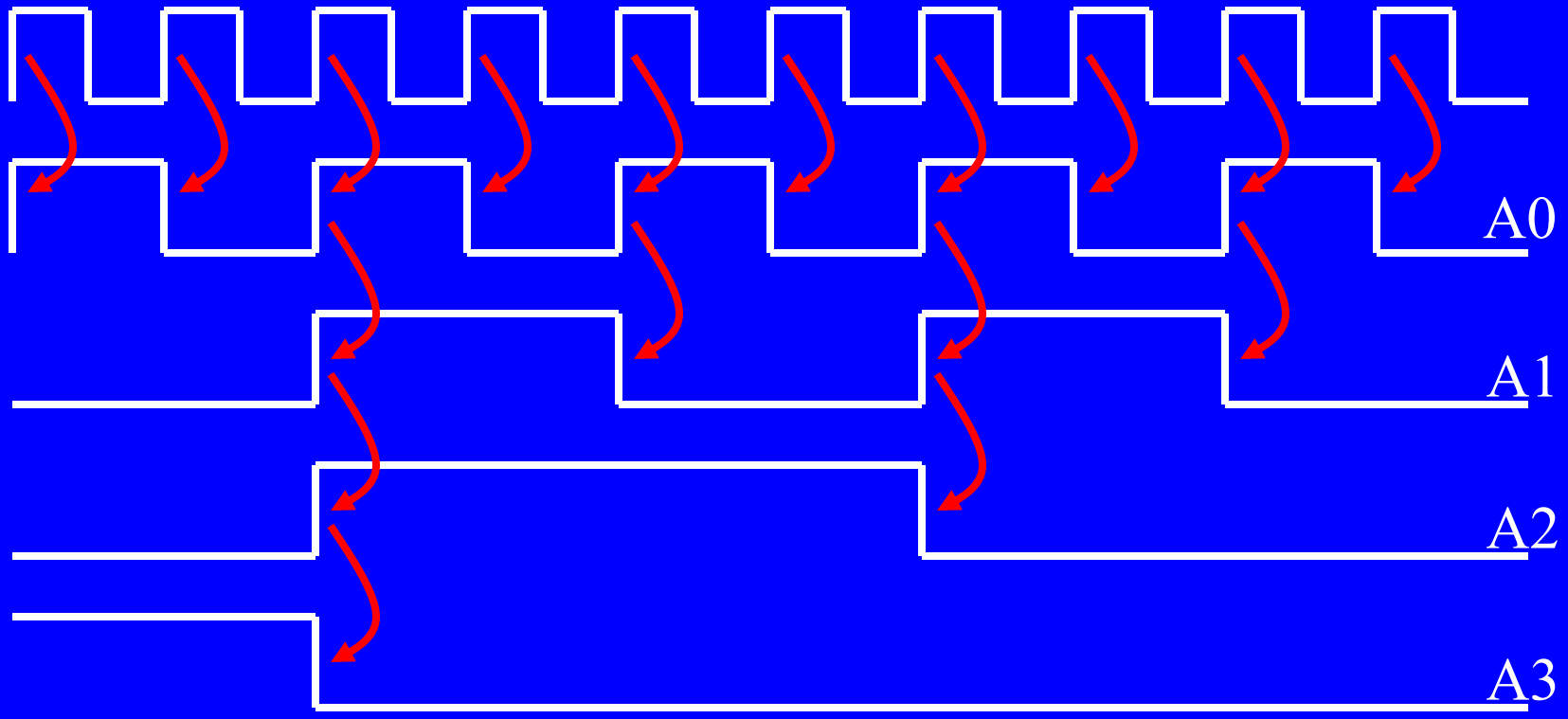
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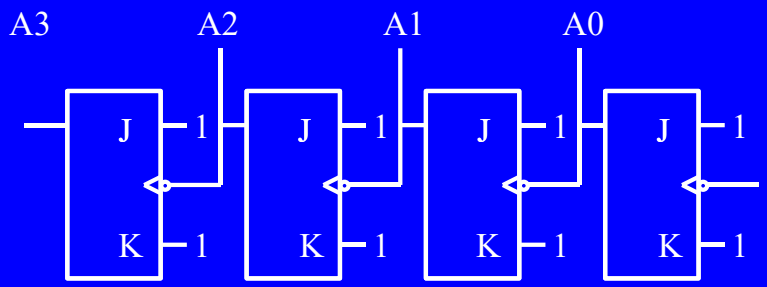


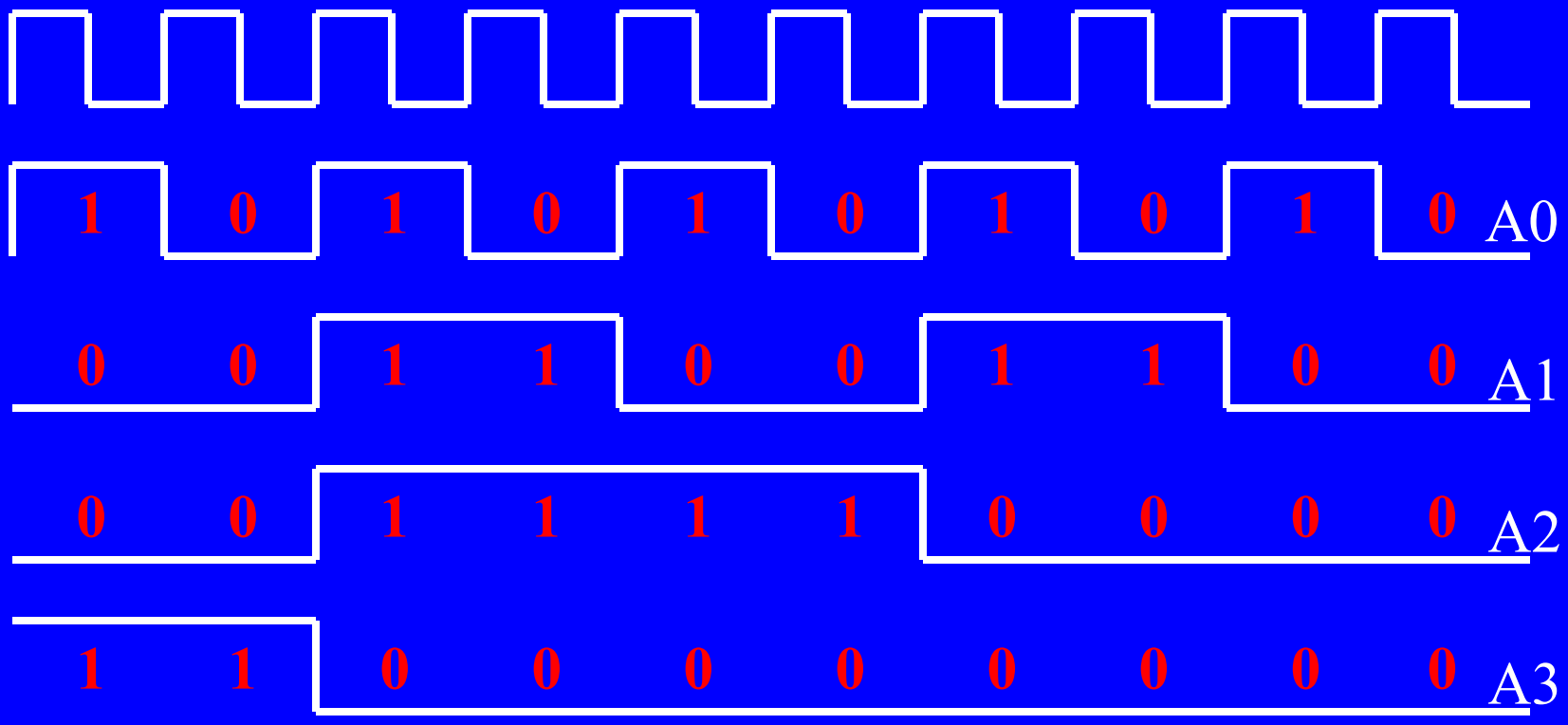
Μετρητής ριπής



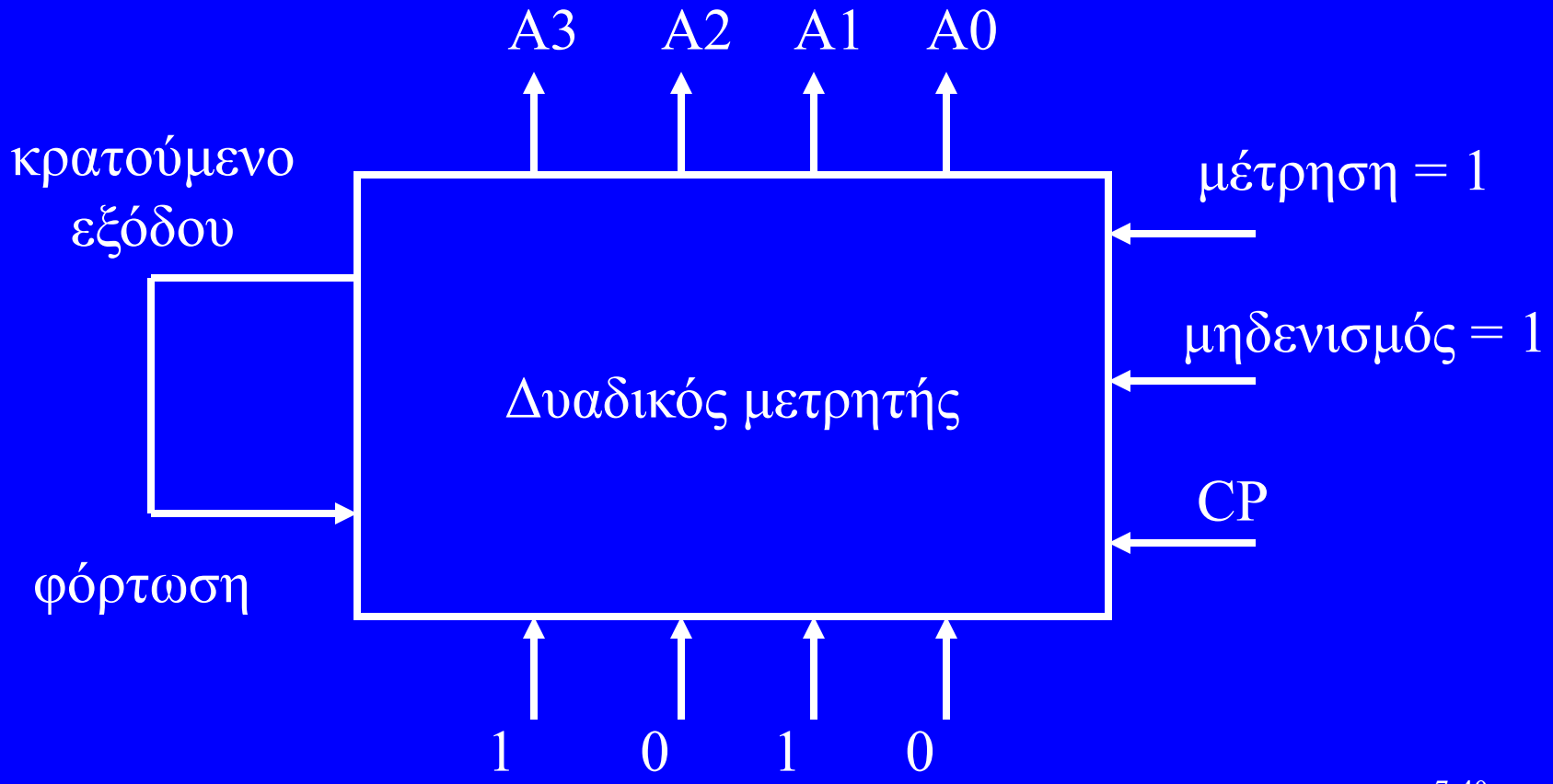

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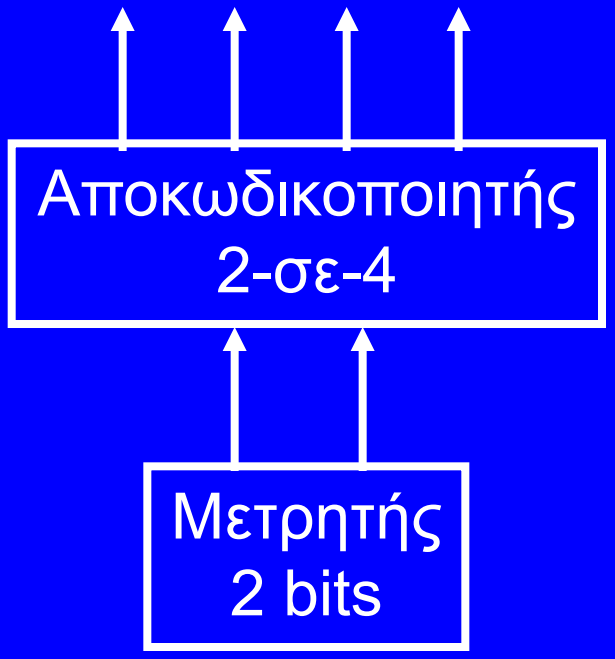

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Υλοποίηση μετρητών με δυαδικούς μετρητές παράλληλης φόρτωσης



Μετρητής Johnson



Μετρητής Johnson



Μετρητής Johnson



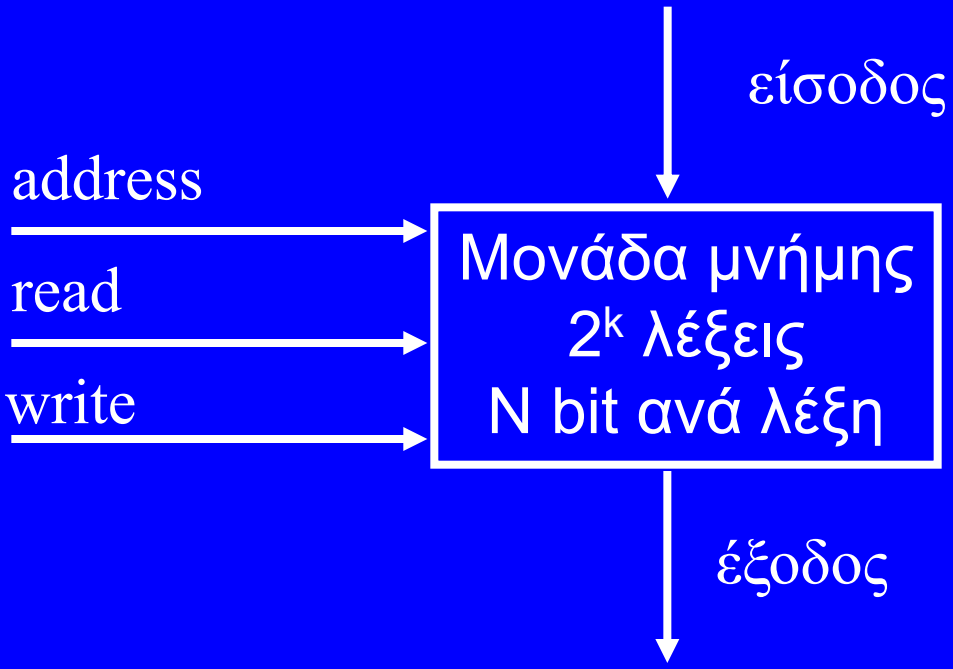
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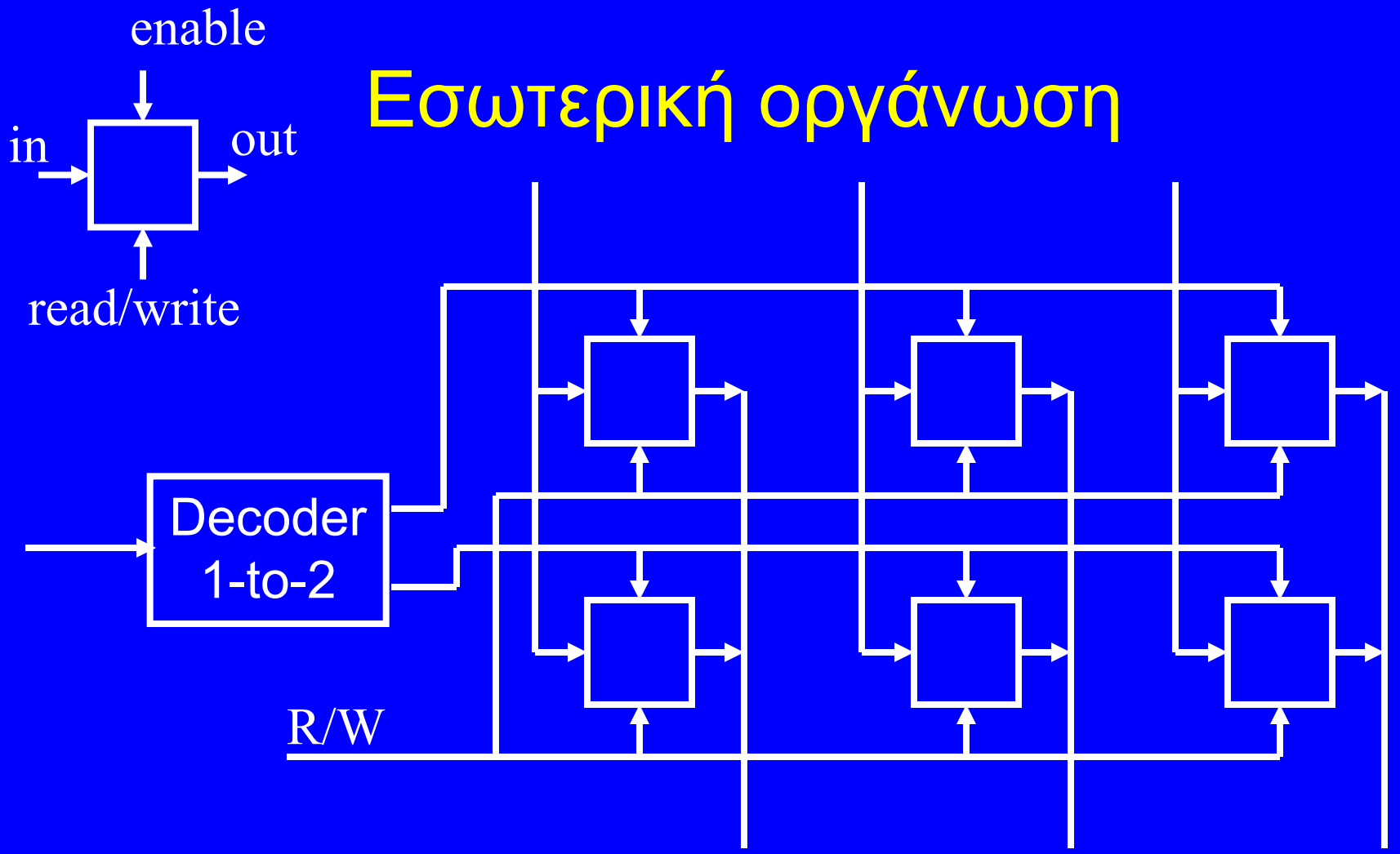
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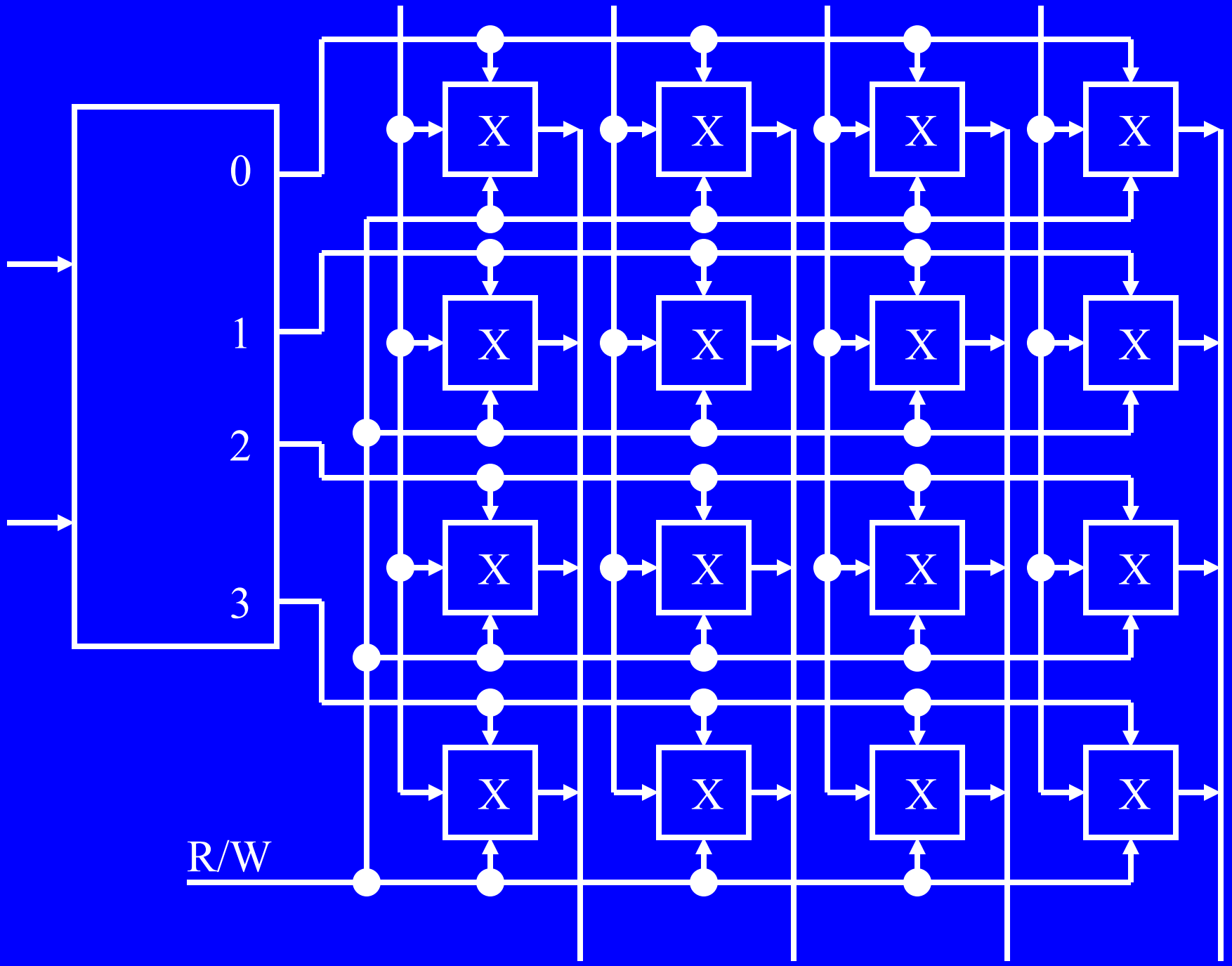


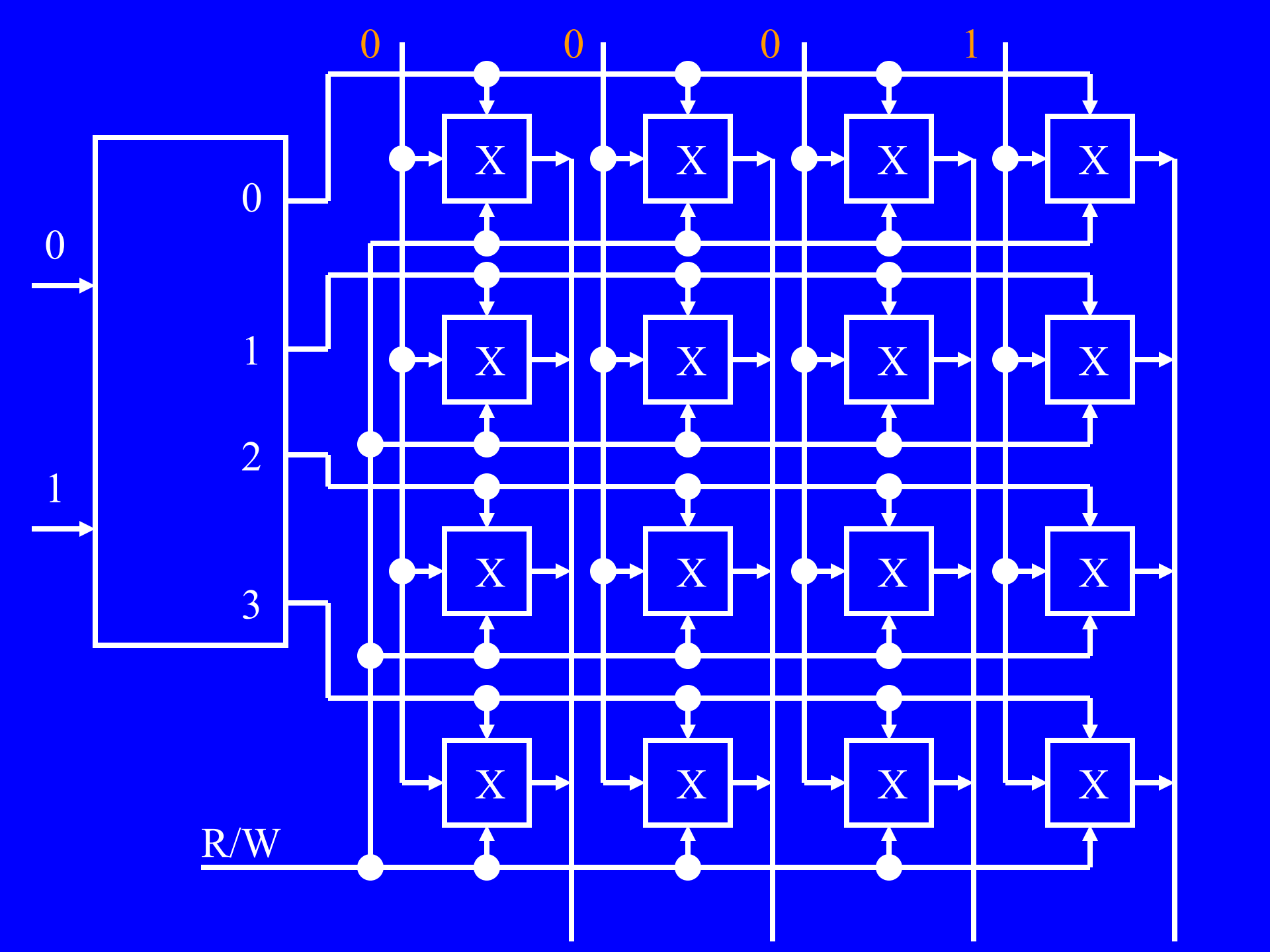
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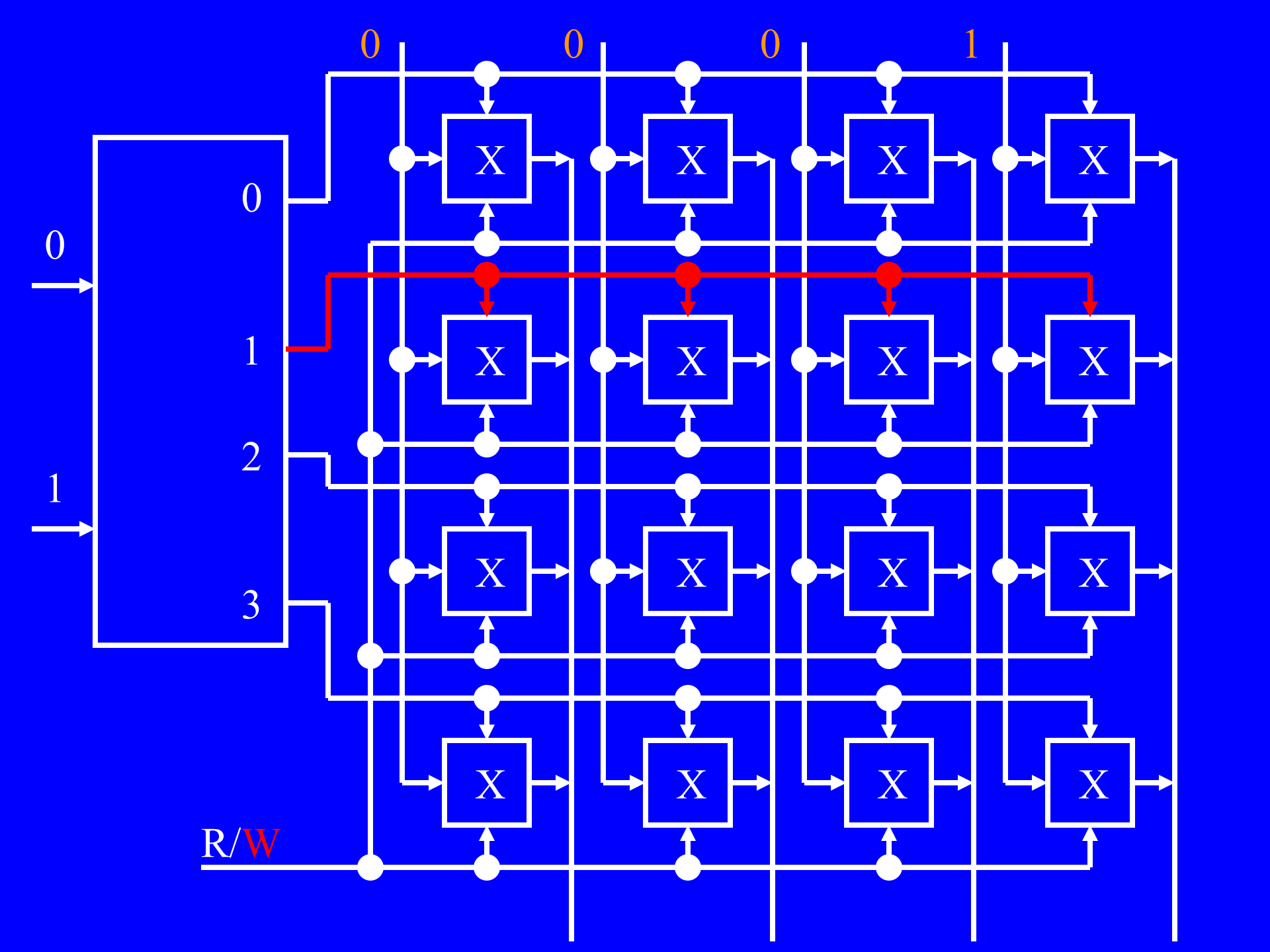


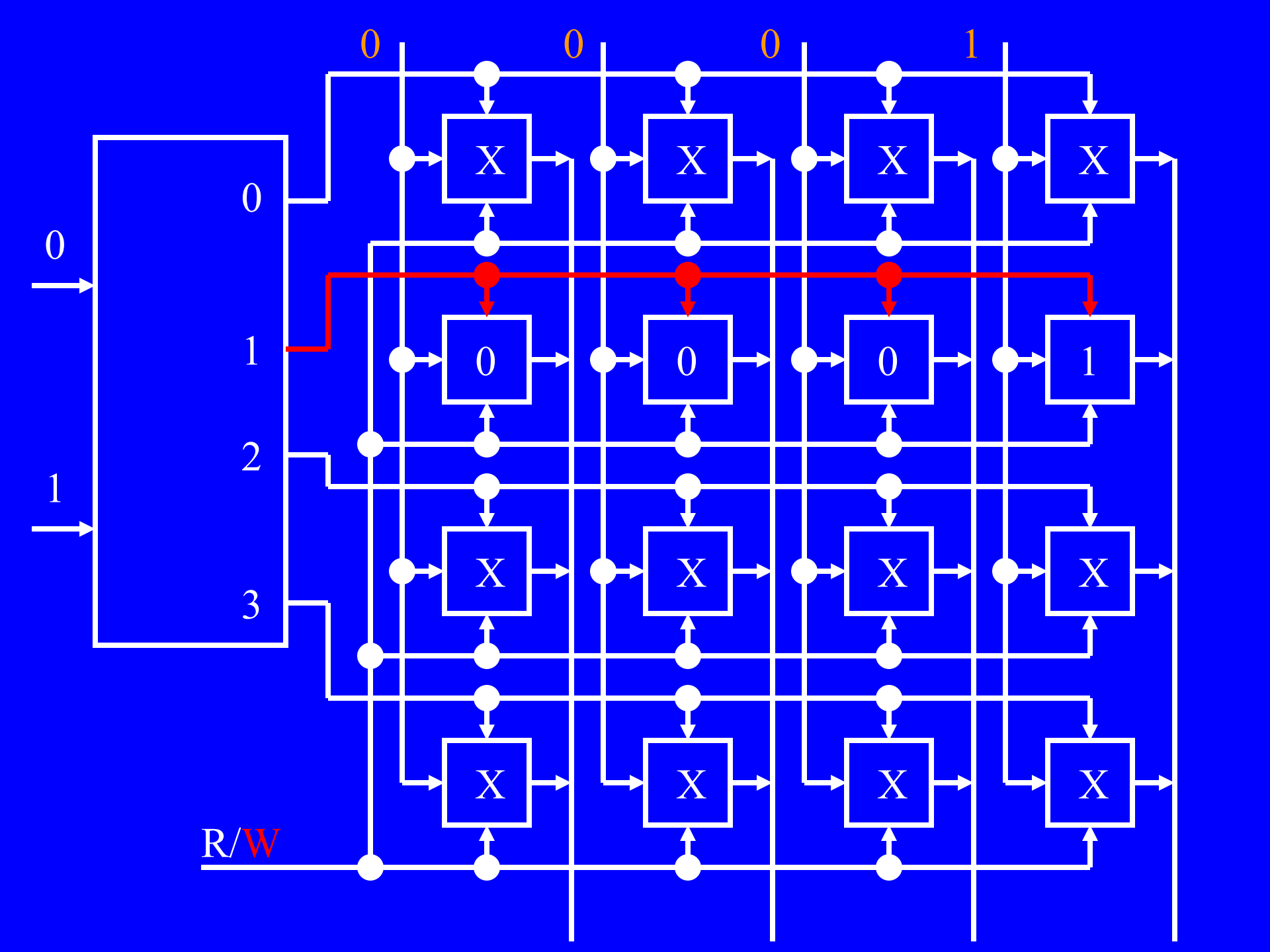
Εσωτερική οργάνωση

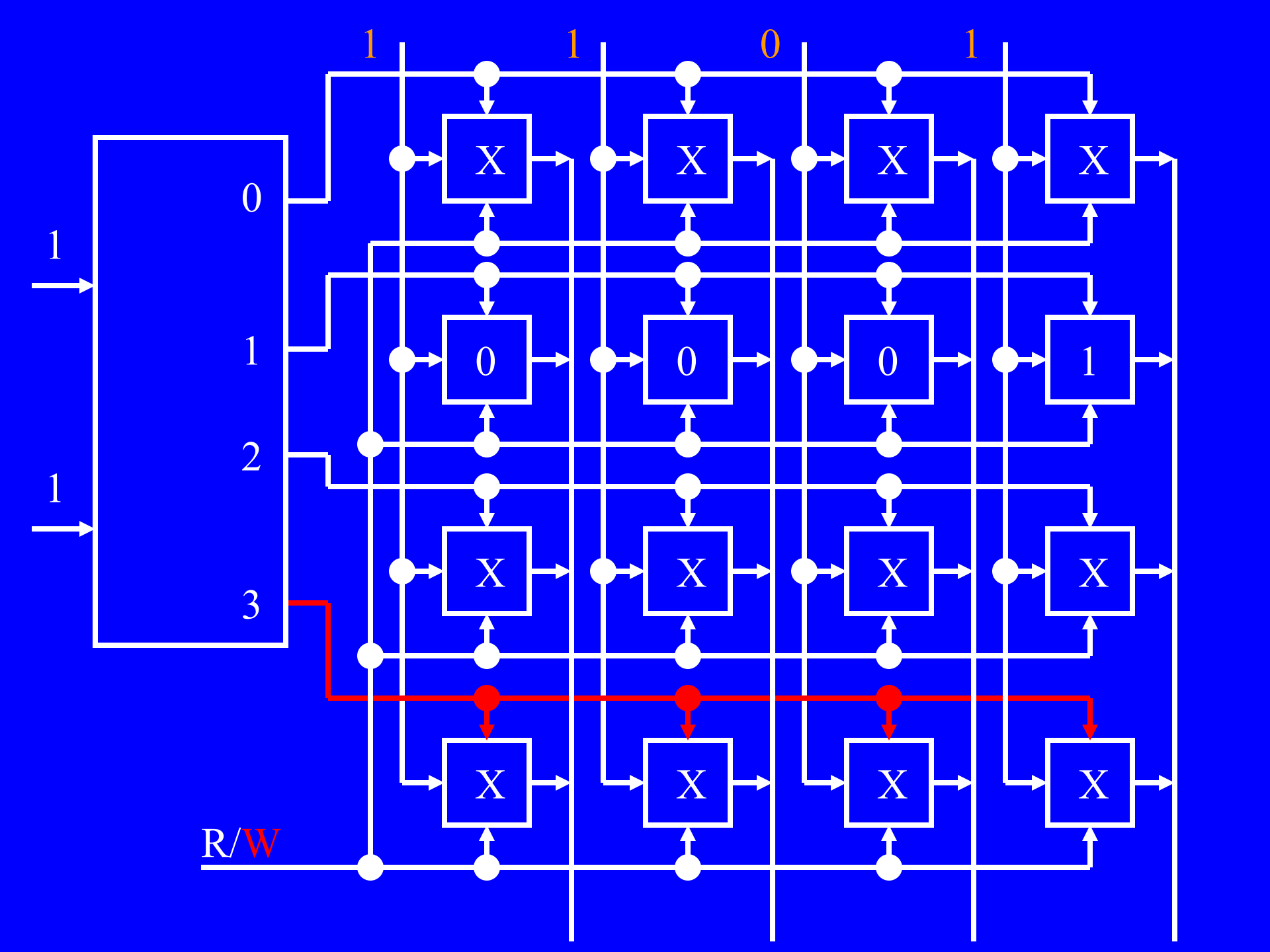


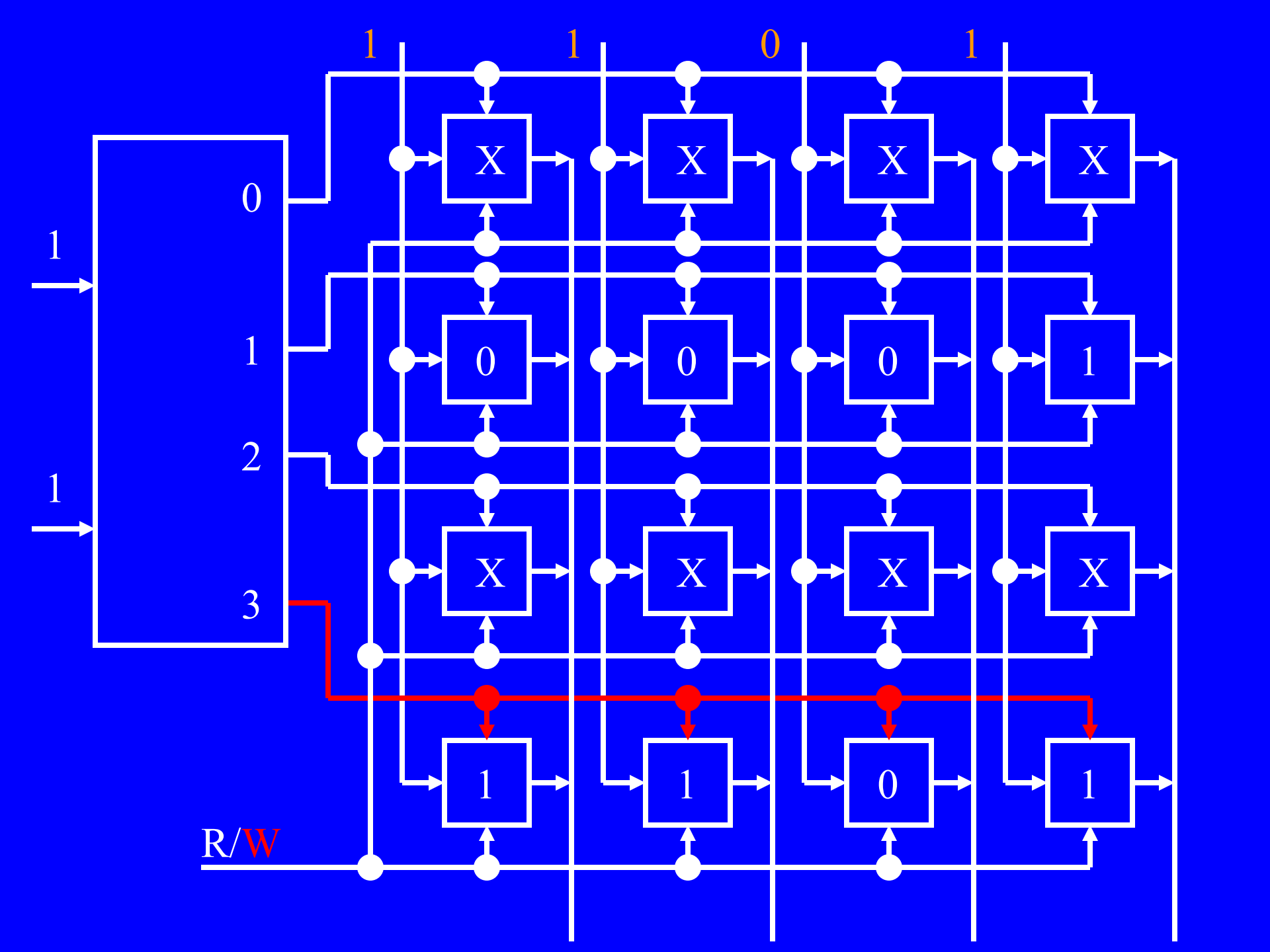

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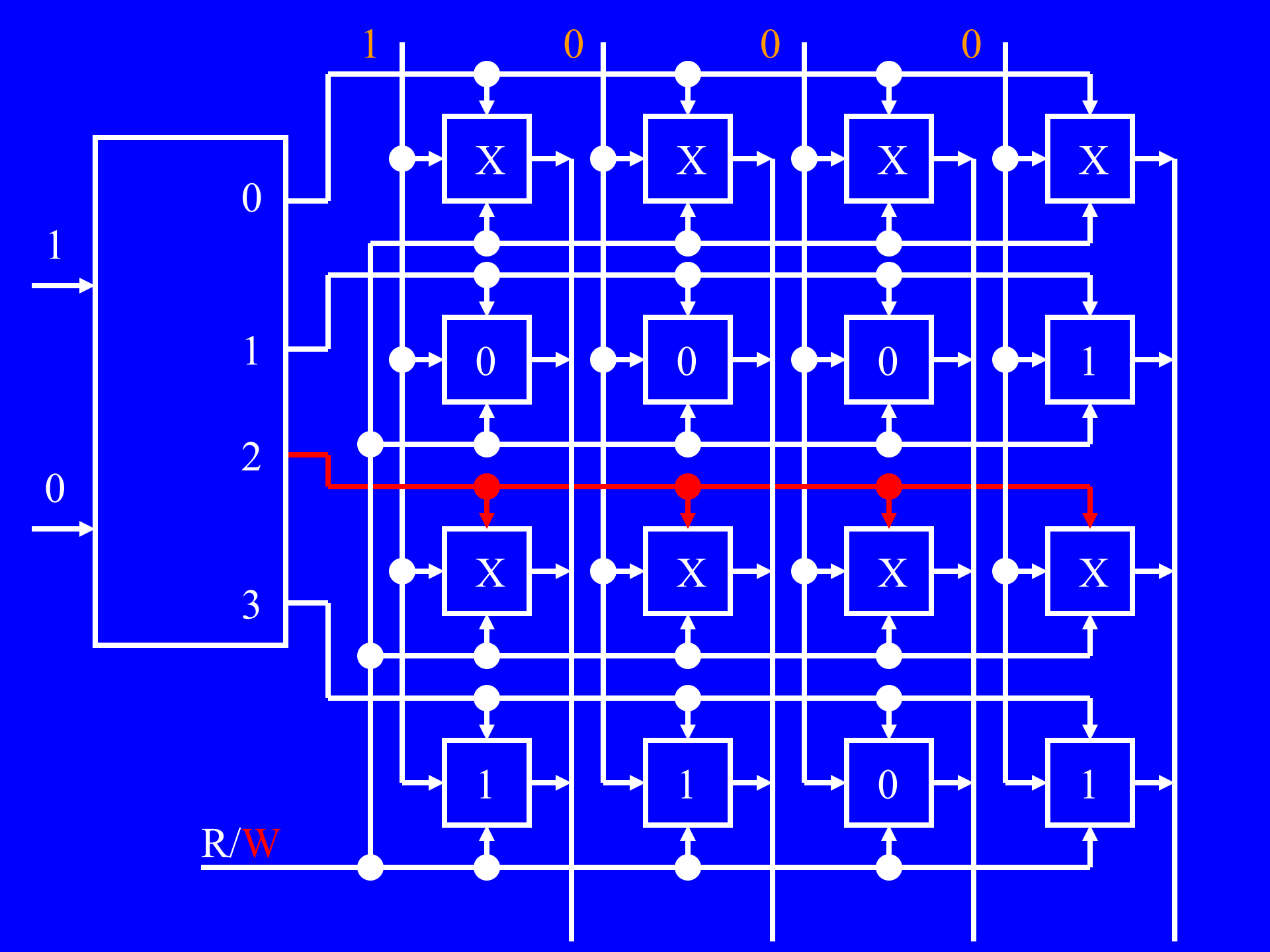

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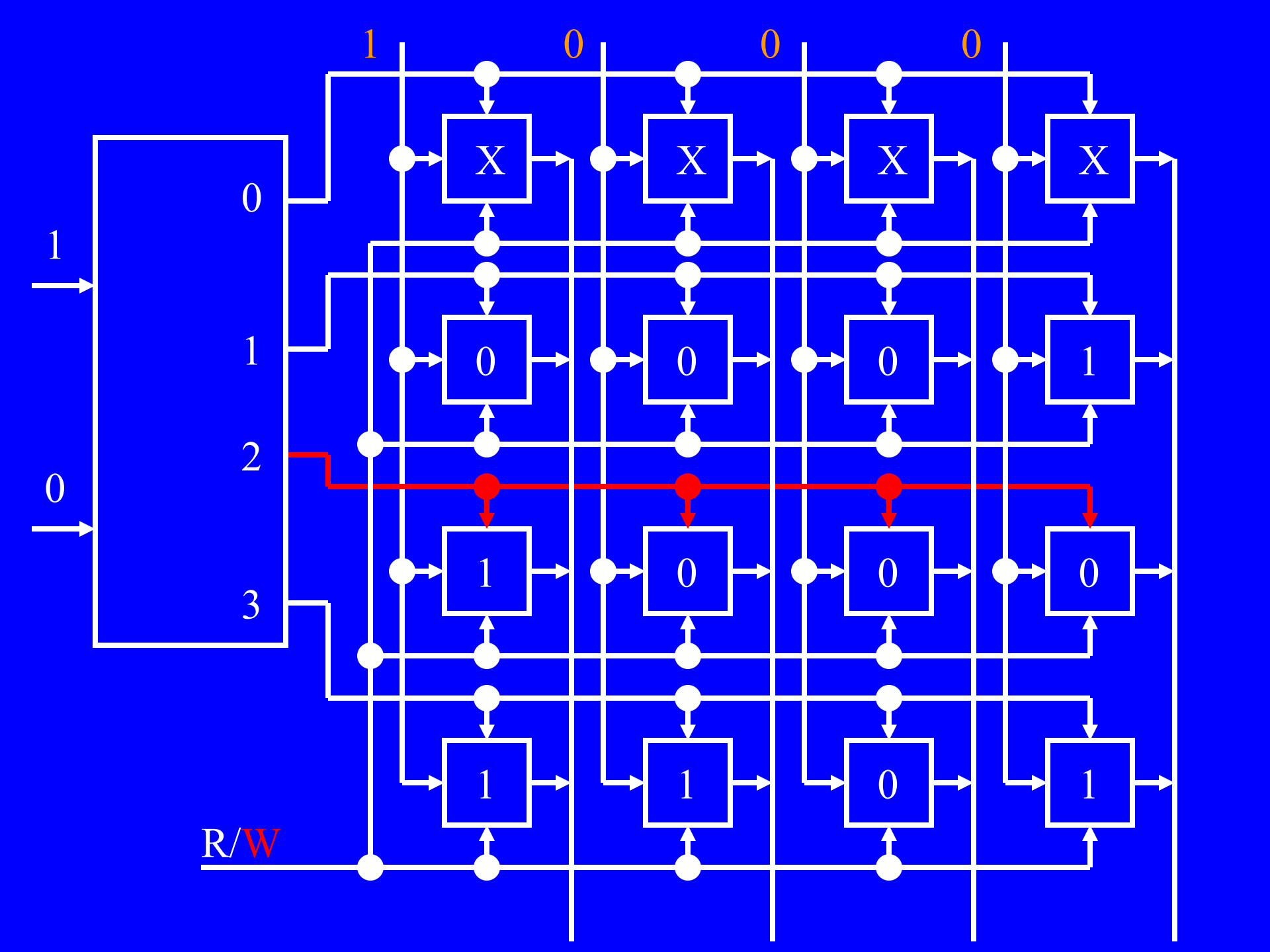

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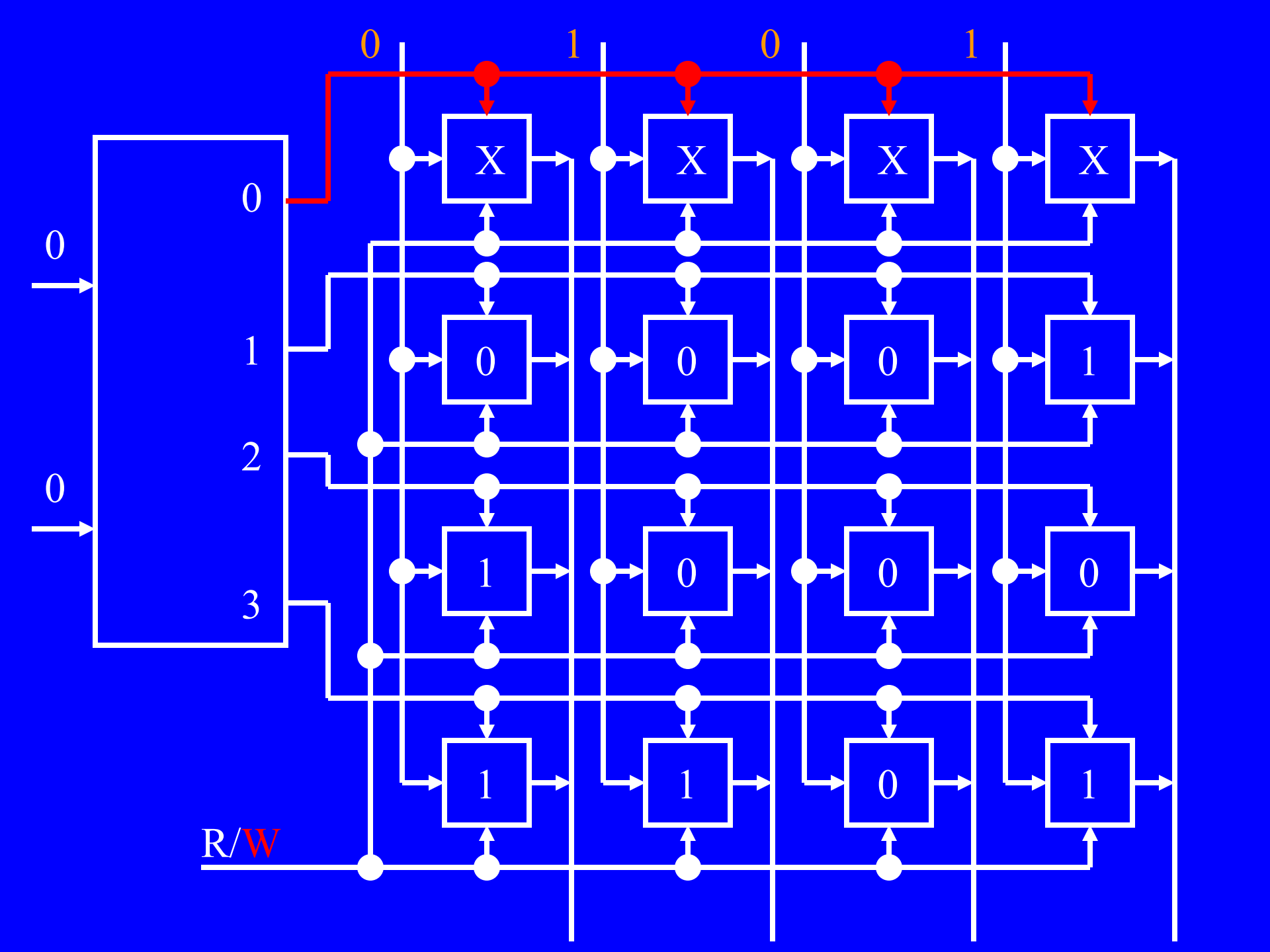

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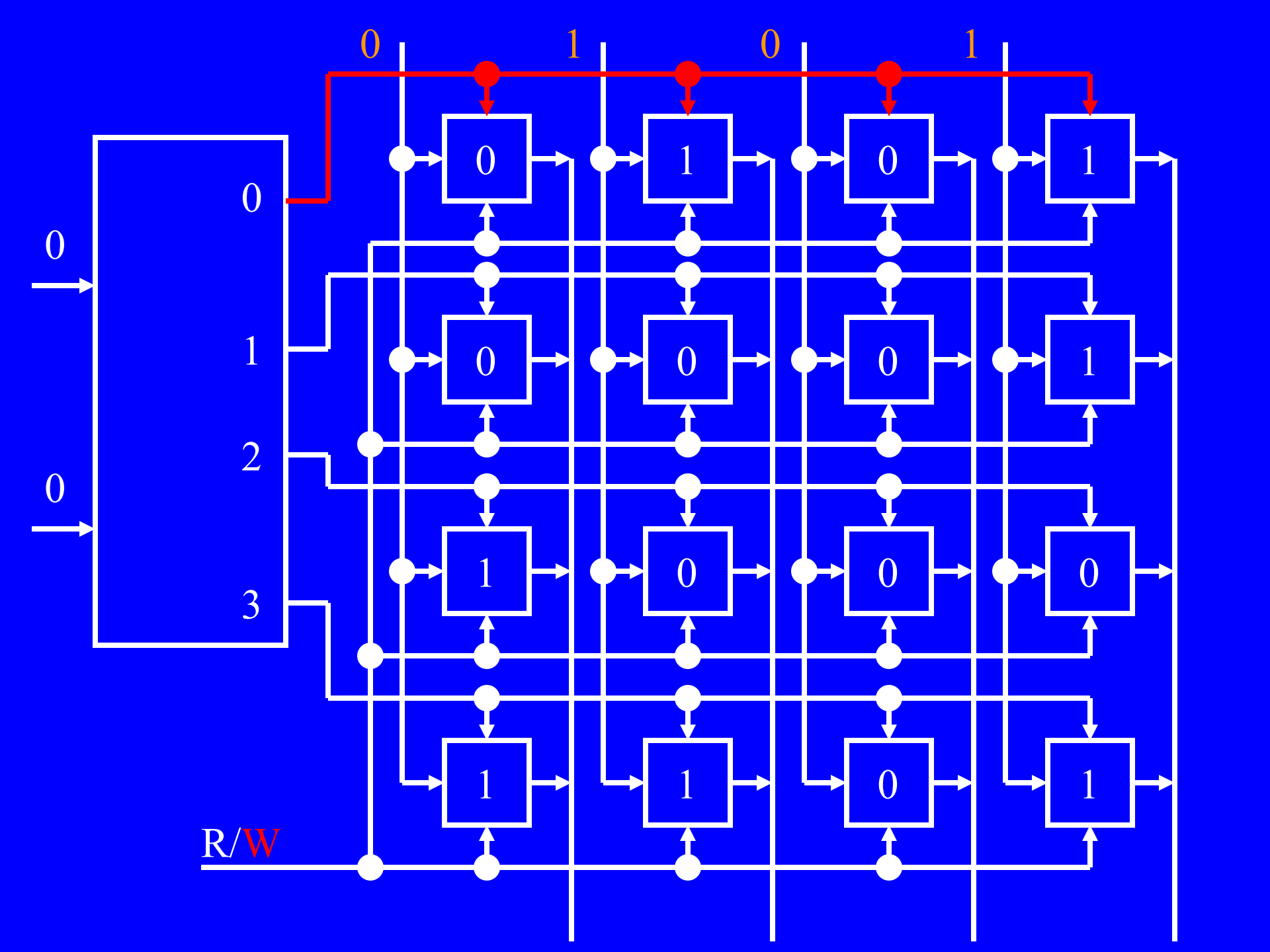

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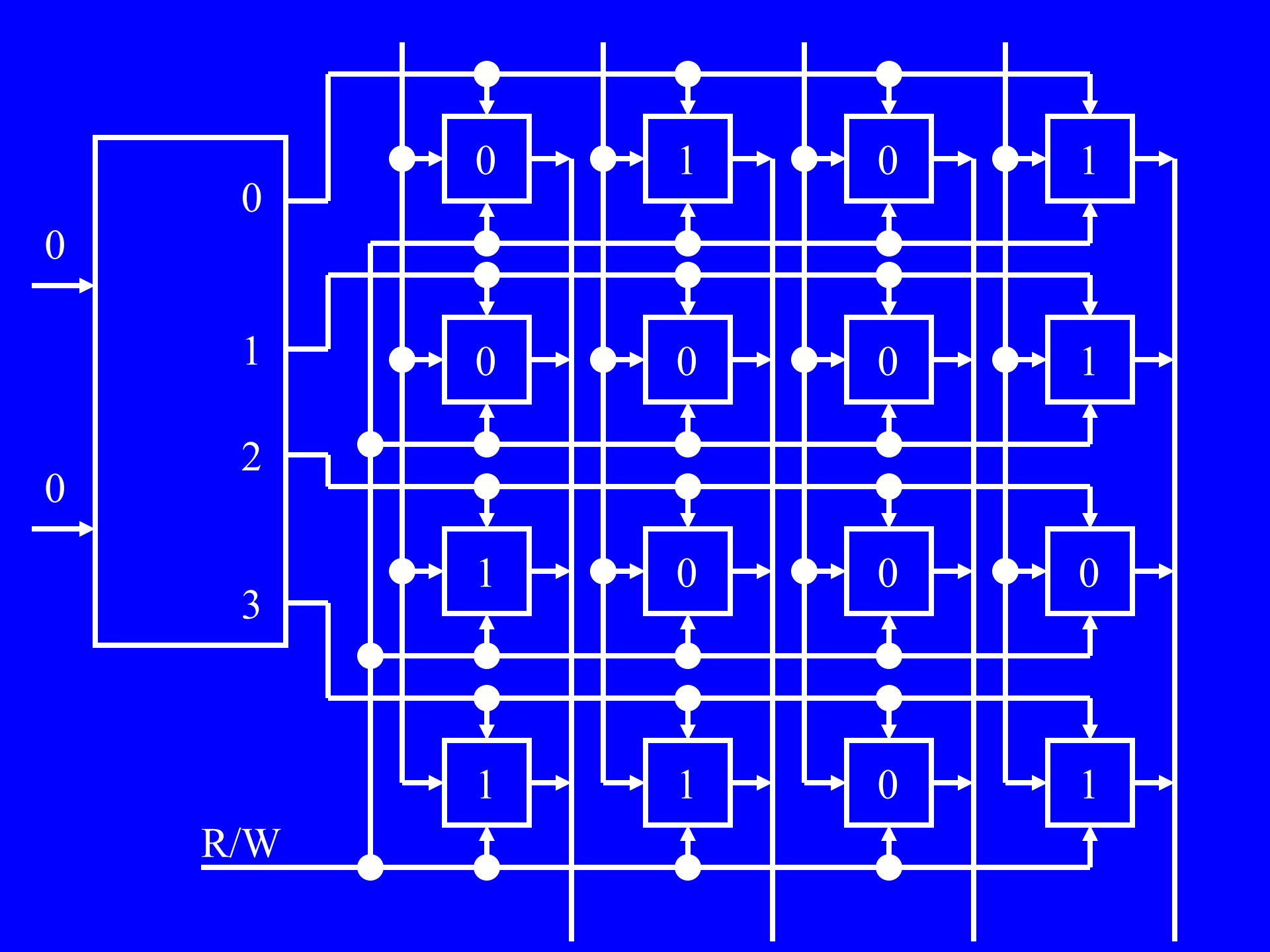

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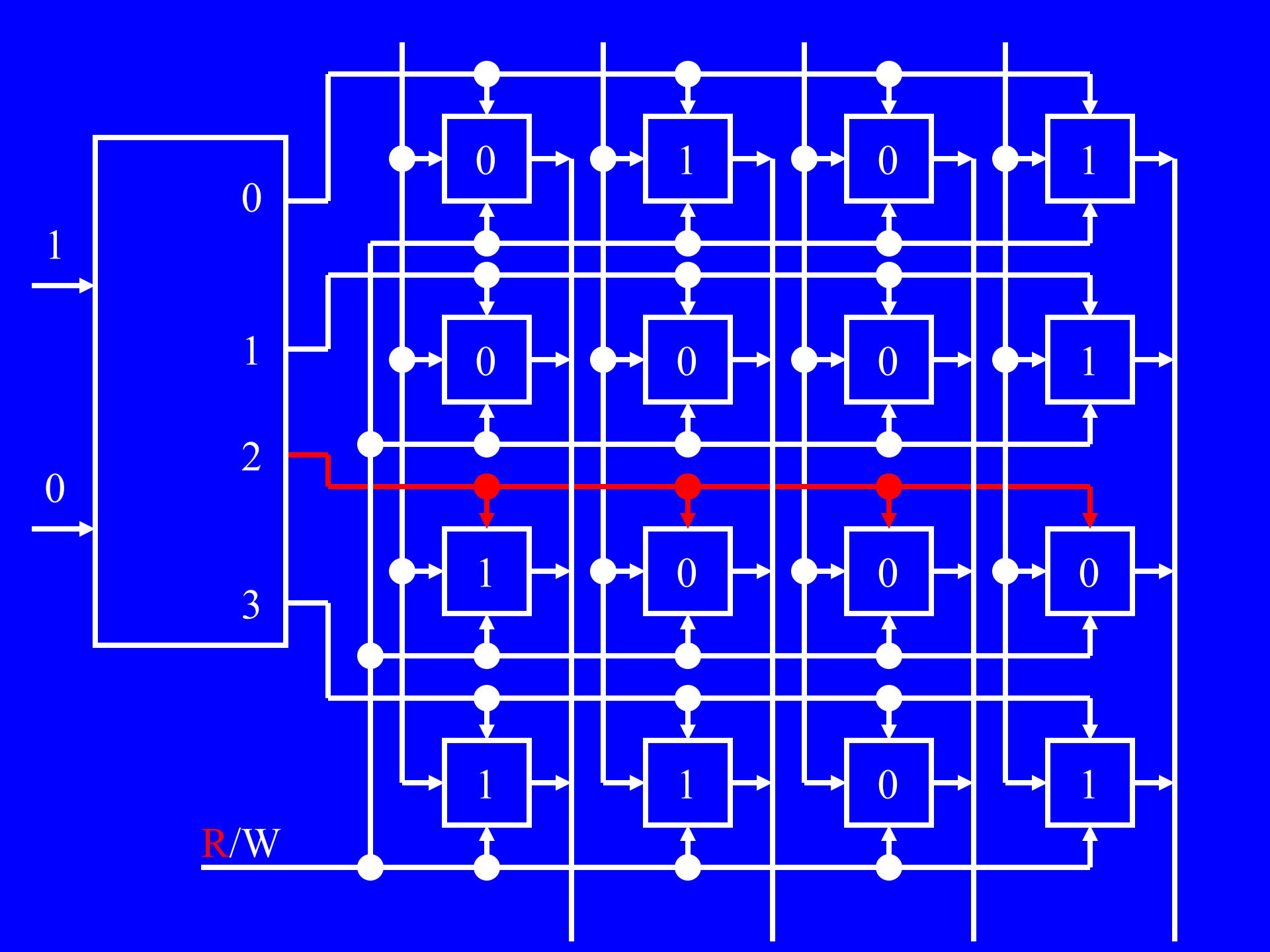

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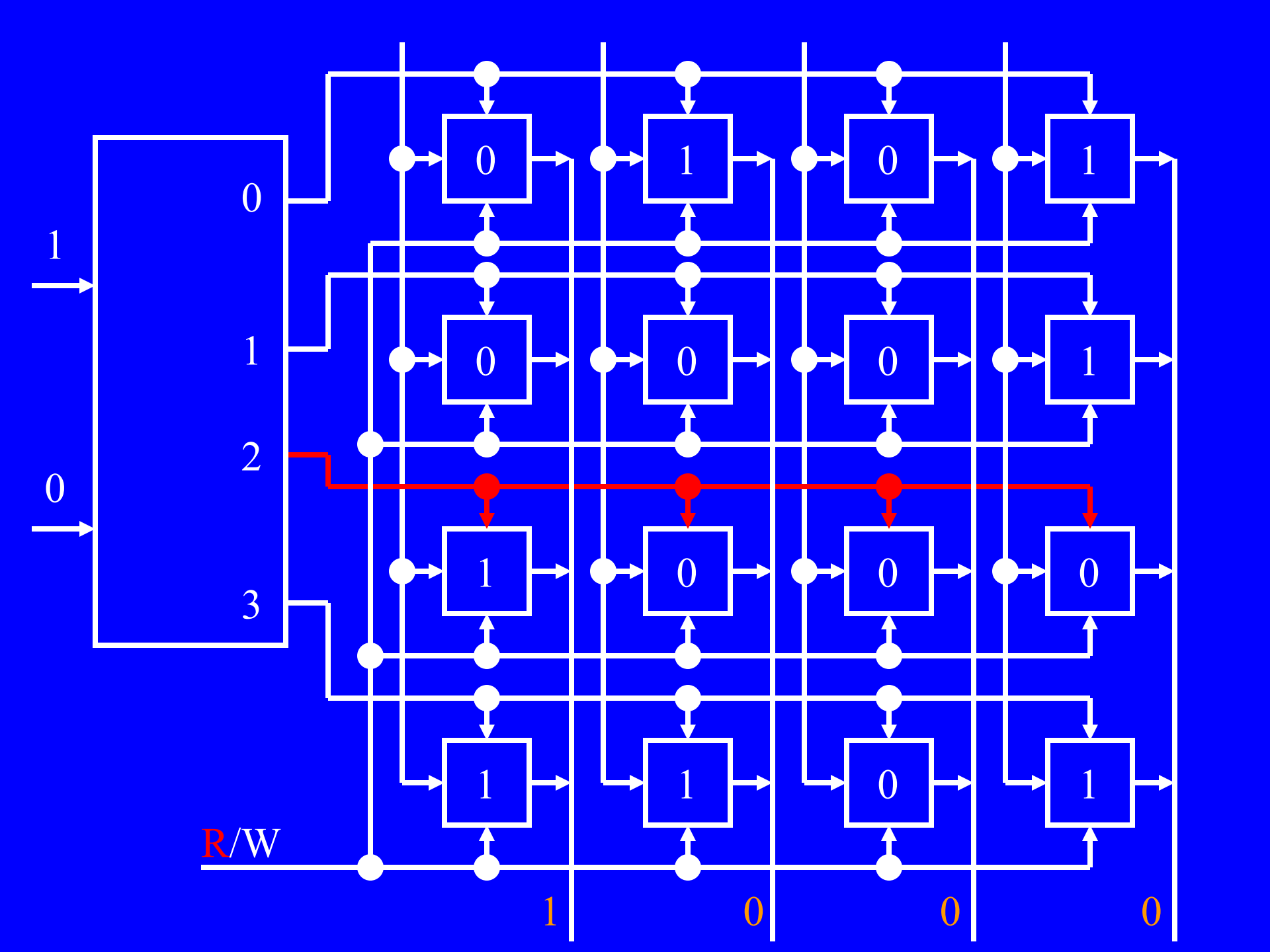

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