

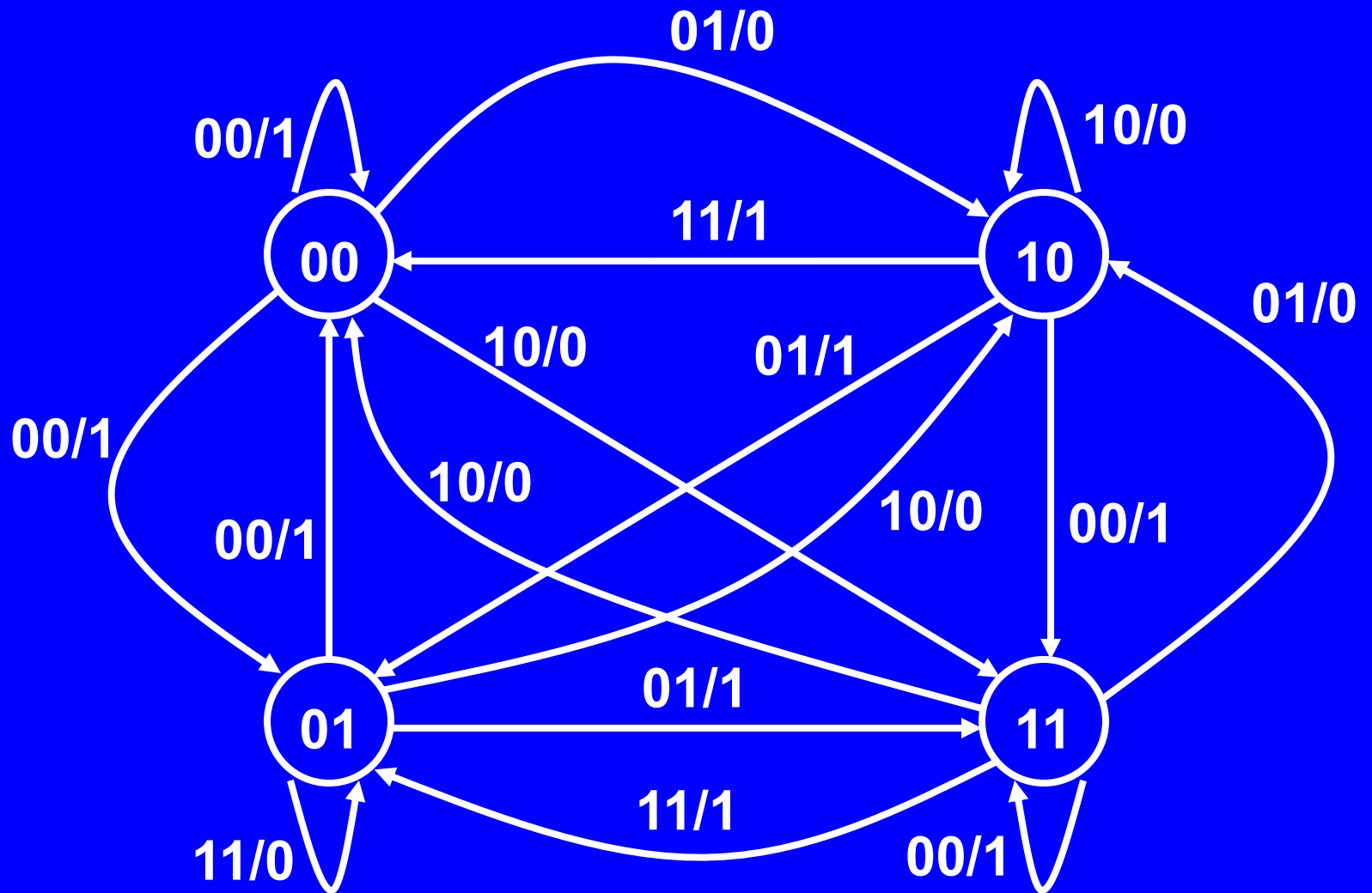
Πίνακες διέγερσης

<u>Q(t)</u>	<u>Q(t+1)</u>	<u>S</u>	<u>R</u>
0	0	0	X
0	1	1	0
1	0	0	1
1	1	X	0

<u>Q(t)</u>	<u>Q(t+1)</u>	<u>J</u>	<u>K</u>
0	0	0	X
0	1	1	X
1	0	X	1
1	1	X	0

<u>Q(t)</u>	<u>Q(t+1)</u>	<u>D</u>
0	0	0
0	1	1
1	0	0
1	1	1

<u>Q(t)</u>	<u>Q(t+1)</u>	<u>T</u>
0	0	0
0	1	1
1	0	1
1	1	0



<u>A</u>	<u>B</u>	<u>X</u>	<u>Y</u>	<u>A</u>	<u>B</u>	<u>Z</u>
0	0	0	0	0	1	1
0	0	0	1	1	0	0
0	0	1	0	1	1	0
0	0	1	1	0	0	1
0	1	0	0	0	0	1
0	1	0	1	1	1	1
0	1	1	0	1	0	0
0	1	1	1	0	1	0
1	0	0	0	1	1	1
1	0	0	1	0	1	1
1	0	1	0	1	0	0
1	0	1	1	0	0	1
1	1	0	0	1	1	1
1	1	0	1	1	0	0
1	1	1	0	0	0	0
1	1	1	1	0	1	1

<u>A</u>	<u>B</u>	<u>X</u>	<u>Y</u>	<u>DA</u>	<u>DB</u>	<u>Z</u>
0	0	0	0	0	1	1
0	0	0	1	1	0	0
0	0	1	0	1	1	0
0	0	1	1	0	0	1
0	1	0	0	0	0	1
0	1	0	1	1	1	1
0	1	1	0	1	0	0
0	1	1	1	0	1	0
1	0	0	0	1	1	1
1	0	0	1	0	1	1
1	0	1	0	1	0	0
1	0	1	1	0	0	1
1	1	0	0	1	1	1
1	1	0	1	1	0	0
1	1	1	0	0	0	0
1	1	1	1	0	1	1

XY AB		XY			
		00	01	11	10
AB	00	0	1	0	1
	01	0	1	0	1
	11	1	1	0	0
	10	1	0	0	1

$$DA = AX'Y' + BX'Y + A'X'Y + A'XY' + B'XY'$$

AB \ XY		XY			
		00	01	11	10
AB	00	0	1	0	1
	01	0	1	0	1
	11	1	1	0	0
	10	1	0	0	1

XY AB		XY			
		00	01	11	10
AB	00	1	0	0	1
	01	0	1	1	0
	11	1	0	1	0
	10	1	1	0	0

$$DB = AX'Y' + B'X'Y' + A'BY + BXY + A'B'Y'$$

AB \ XY		XY			
		00	01	11	10
AB	00	1	0	0	1
	01	0	1	1	0
	11	1	0	1	0
	10	1	1	0	0

XY AB		XY			
		00	01	11	10
AB	00	1	0	1	0
	01	1	1	0	0
	11	1	0	1	0
	10	1	1	1	0

$$Z = X'Y' + AB'X' + AB'Y + AXY + B'XY$$

AB \ XY		XY			
		00	01	11	10
AB	00	1	0	1	0
	01	1	1	0	0
	11	1	0	1	0
	10	1	1	1	0

<u>A</u>	<u>B</u>	<u>X</u>	<u>Y</u>	<u>A</u>	<u>B</u>	<u>JA</u>	<u>KA</u>	<u>JB</u>	<u>KB</u>	<u>Z</u>
0	0	0	0	0	1	0	X	1	X	1
0	0	0	1	1	0	1	X	0	X	0
0	0	1	0	1	1	1	X	1	X	0
0	0	1	1	0	0	0	X	0	X	1
0	1	0	0	0	0	0	X	X	1	1
0	1	0	1	1	1	1	X	X	0	1
0	1	1	0	1	0	1	X	X	1	0
0	1	1	1	0	1	0	X	X	0	0
1	0	0	0	1	1	X	0	1	X	1
1	0	0	1	0	1	X	1	1	X	1
1	0	1	0	1	0	X	0	0	X	0
1	0	1	1	0	0	X	1	0	X	1
1	1	0	0	1	1	X	0	X	0	1
1	1	0	1	1	0	X	0	X	1	0
1	1	1	0	0	0	X	1	X	1	0
1	1	1	1	0	1	X	1	X	0	1

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

$$JA = X'Y + XY'$$

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

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

$$KA = B'Y + BX$$

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

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

$$JB = AX' + A'Y'$$

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

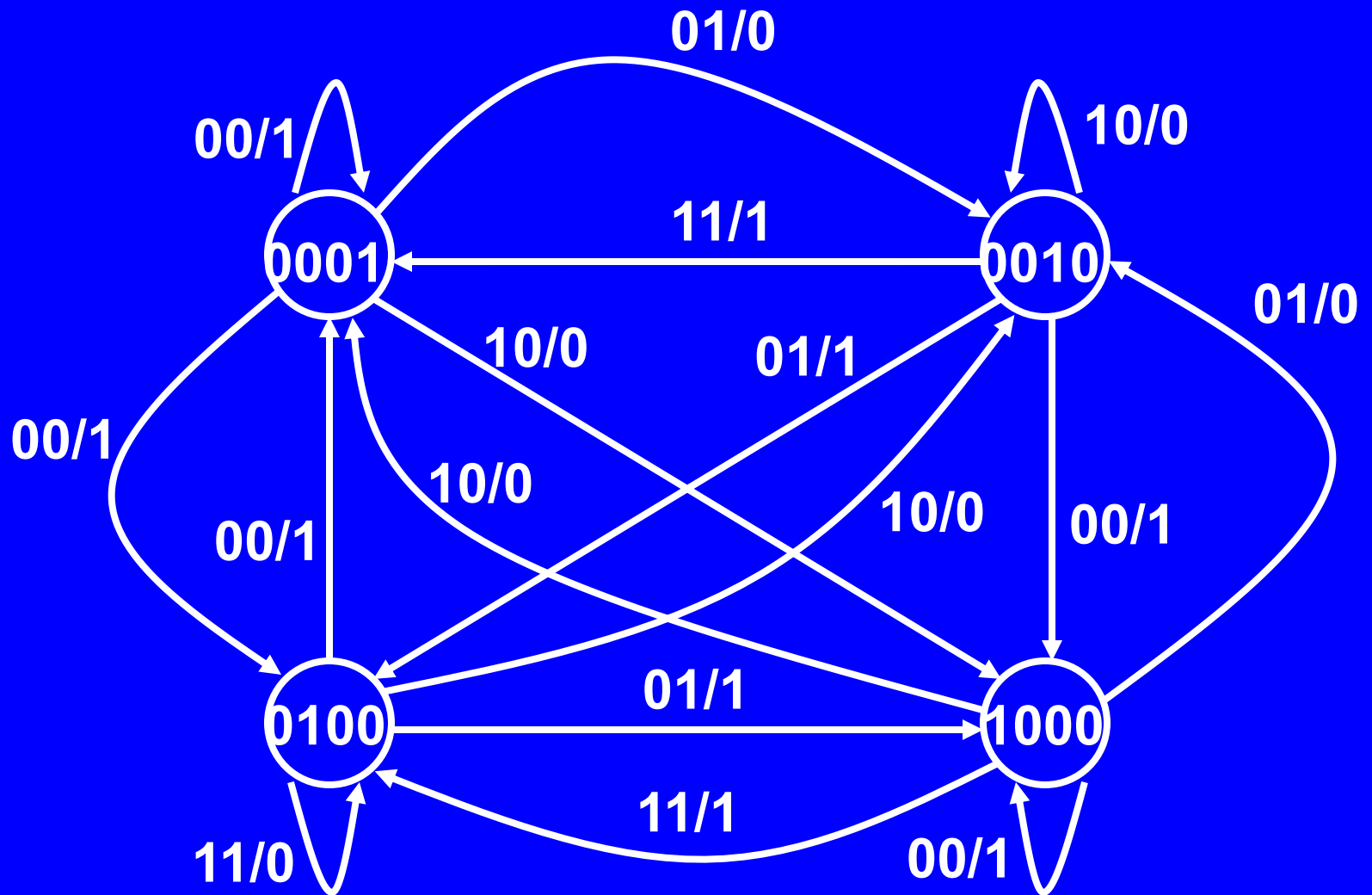
XY AB		XY			
		00	01	11	10
AB	00	X	X	X	X
	01	1	0	0	1
	11	0	1	0	1
	10	X	X	X	X

$$KB = XY' + A'Y' + AX'Y$$

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

$$Z = X'Y' + AB'X' + AB'Y + AXY + B'XY$$

AB \ XY		XY			
		00	01	11	10
AB	00	1	0	1	0
	01	1	1	0	0
	11	1	0	1	0
	10	1	1	1	0



<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>	<u>X</u>	<u>Y</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>	<u>Z</u>
0	0	0	1	0	0	0	1	0	0	1
0	0	0	1	0	1	0	0	1	0	0
0	0	0	1	1	0	1	0	0	0	0
0	0	0	1	1	1	0	0	0	1	1
0	1	0	0	0	0	0	0	0	1	1
0	1	0	0	0	1	1	0	0	0	1
0	1	0	0	1	0	0	0	1	0	0
0	1	0	0	1	1	0	1	0	0	0
0	0	1	0	0	0	1	0	0	0	1
0	0	1	0	0	1	0	1	0	0	1
0	0	1	0	1	0	0	0	1	0	0
0	0	1	0	1	1	0	0	0	1	1
1	0	0	0	0	0	1	0	0	0	1
1	0	0	0	0	1	0	0	1	0	0
1	0	0	0	1	0	0	0	0	1	0
1	0	0	0	1	1	0	1	0	0	1

<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>	<u>X</u>	<u>Y</u>	<u>DA</u>	<u>DB</u>	<u>DC</u>	<u>DD</u>	<u>Z</u>
0	0	0	1	0	0	0	1	0	0	1
0	0	0	1	0	1	0	0	1	0	0
0	0	0	1	1	0	1	0	0	0	0
0	0	0	1	1	1	0	0	0	1	1
0	1	0	0	0	0	0	0	0	1	1
0	1	0	0	0	1	1	0	0	0	1
0	1	0	0	1	0	0	0	1	0	0
0	1	0	0	1	1	0	1	0	0	0
0	0	1	0	0	0	1	0	0	0	1
0	0	1	0	0	1	0	1	0	0	1
0	0	1	0	1	0	0	0	1	0	0
0	0	1	0	1	1	0	0	0	1	1
1	0	0	0	0	0	1	0	0	0	1
1	0	0	0	0	1	0	0	1	0	0
1	0	0	0	1	0	0	0	0	1	0
1	0	0	0	1	1	0	1	0	0	1

A	B	C	D	X	Y	DA	DB	DC	DD	Z
0	0	0	1	0	0	0	1	0	0	1
0	0	0	1	0	1	0	0	1	0	0
0	0	0	1	1	0	1	0	0	0	0
0	0	0	1	1	1	0	0	0	1	1
0	1	0	0	0	0	0	0	0	1	1
0	1	0	0	0	1	1	0	0	0	1
0	1	0	0	1	0	0	0	1	0	0
0	1	0	0	1	1	0	1	0	0	0
0	0	1	0	0	0	1	0	0	0	1
0	0	1	0	0	1	0	1	0	0	1
0	0	1	0	1	0	0	0	1	0	0
0	0	1	0	1	1	0	0	0	1	1
1	0	0	0	0	0	1	0	0	0	1
1	0	0	0	0	1	0	0	1	0	0
1	0	0	0	1	0	0	0	0	1	0
1	0	0	0	1	1	0	1	0	0	1

$$DA = DXY' + BX'Y + CX'Y' + AX'Y'$$

$$DB = DX'Y' + BXY + CX'Y + AXY$$

$$DC = DX'Y + BXY' + CXY' + AX'Y$$

$$DD = DXY + BX'Y' + CXY + AXY'$$

$$Z = DX'Y' + DXY + BX'Y' + BXY + CX'Y' + CXY + AX'Y' + AXY$$

A	B	C	D	X	Y	DA	DB	DC	DD	Z
0	0	0	1	0	0	0	1	0	0	1
0	0	0	1	0	1	0	0	1	0	0
0	0	0	1	1	0	1	0	0	0	0
0	0	0	1	1	1	0	0	0	1	1
0	1	0	0	0	0	0	0	0	1	1
0	1	0	0	0	1	1	0	0	0	1
0	1	0	0	1	0	0	0	1	0	0
0	1	0	0	1	1	0	1	0	0	0
0	0	1	0	0	0	1	0	0	0	1
0	0	1	0	0	1	0	1	0	0	1
0	0	1	0	1	0	0	0	1	0	0
0	0	1	0	1	1	0	0	0	1	1
1	0	0	0	0	0	1	0	0	0	1
1	0	0	0	0	1	0	0	1	0	0
1	0	0	0	1	0	0	0	0	1	0
1	0	0	0	1	1	0	1	0	0	1

$$DA = DXY' + BX'Y + CX'Y' + AX'Y'$$

$$DB = DX'Y' + BXY + CX'Y + AXY$$

$$DC = DX'Y + BXY' + CXY' + AX'Y$$

$$DD = DXY + BX'Y' + CXY + AXY'$$

$$Z = DX'Y' + CX'Y' + BX'Y' + AX'Y' + DXY + CXY + AXY + BX'Y + CX'Y$$

A	B	C	D	X	Y	DA	DB	DC	DD	Z
0	0	0	1	0	0	0	1	0	0	1
0	0	0	1	0	1	0	0	1	0	0
0	0	0	1	1	0	1	0	0	0	0
0	0	0	1	1	1	0	0	0	1	1
0	1	0	0	0	0	0	0	0	1	1
0	1	0	0	0	1	1	0	0	0	1
0	1	0	0	1	0	0	0	1	0	0
0	1	0	0	1	1	0	1	0	0	0
0	0	1	0	0	0	1	0	0	0	1
0	0	1	0	0	1	0	1	0	0	1
0	0	1	0	1	0	0	0	1	0	0
0	0	1	0	1	1	0	0	0	1	1
1	0	0	0	0	0	1	0	0	0	1
1	0	0	0	0	1	0	0	1	0	0
1	0	0	0	1	0	0	0	0	1	0
1	0	0	0	1	1	0	1	0	0	1

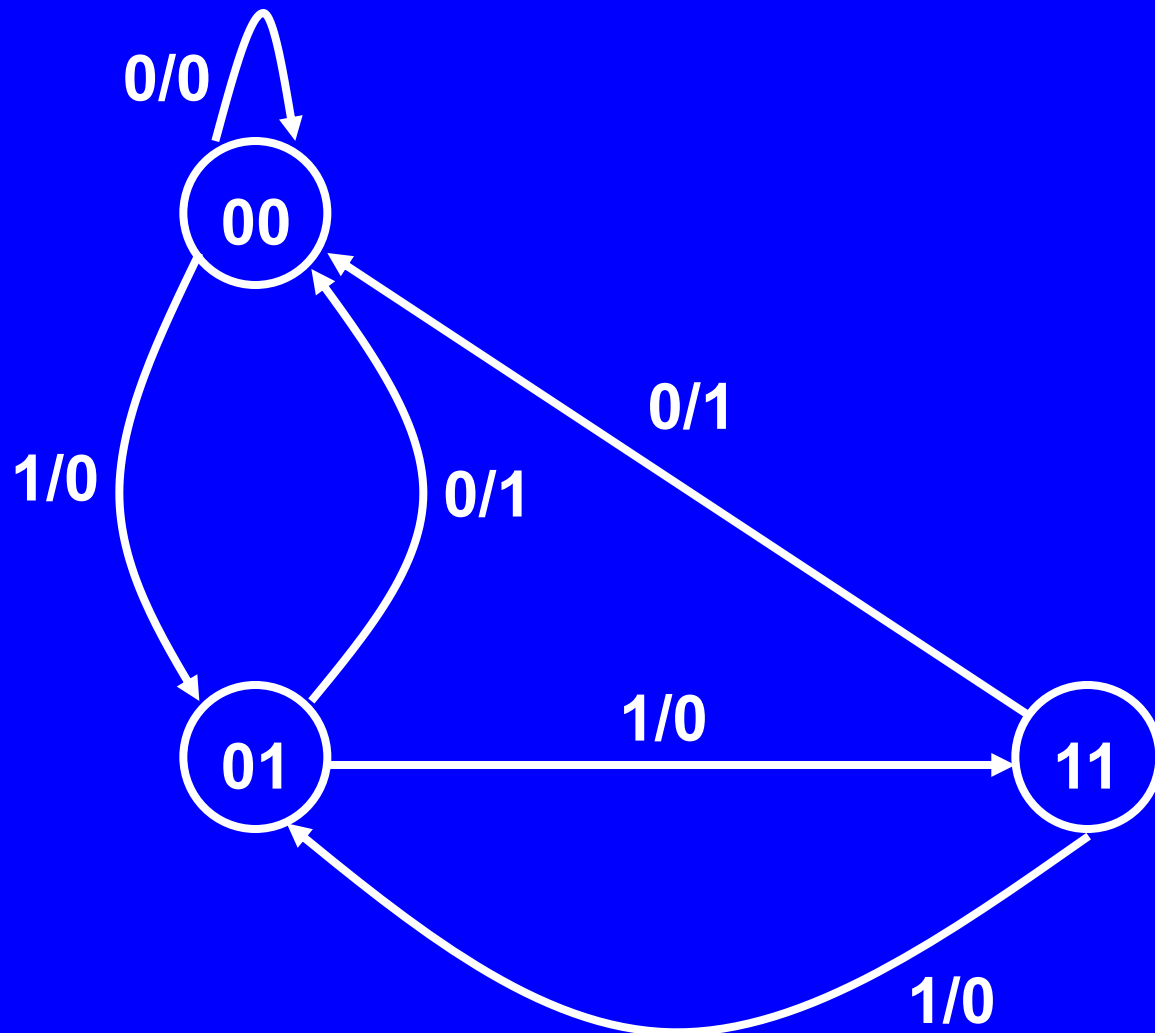
$$DA = DXY' + BX'Y + CX'Y' + AX'Y'$$

$$DB = DX'Y' + BXY + CX'Y + AXY$$

$$DC = DX'Y + BXY' + CXY' + AX'Y$$

$$DD = DXY + BX'Y' + CXY + AXY'$$

$$Z = X'Y' + B'XY + BX'Y + CX'Y$$



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	X	X	X
1	0	1	X	X	X
1	1	0	0	0	1
1	1	1	0	1	0

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

Y

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

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

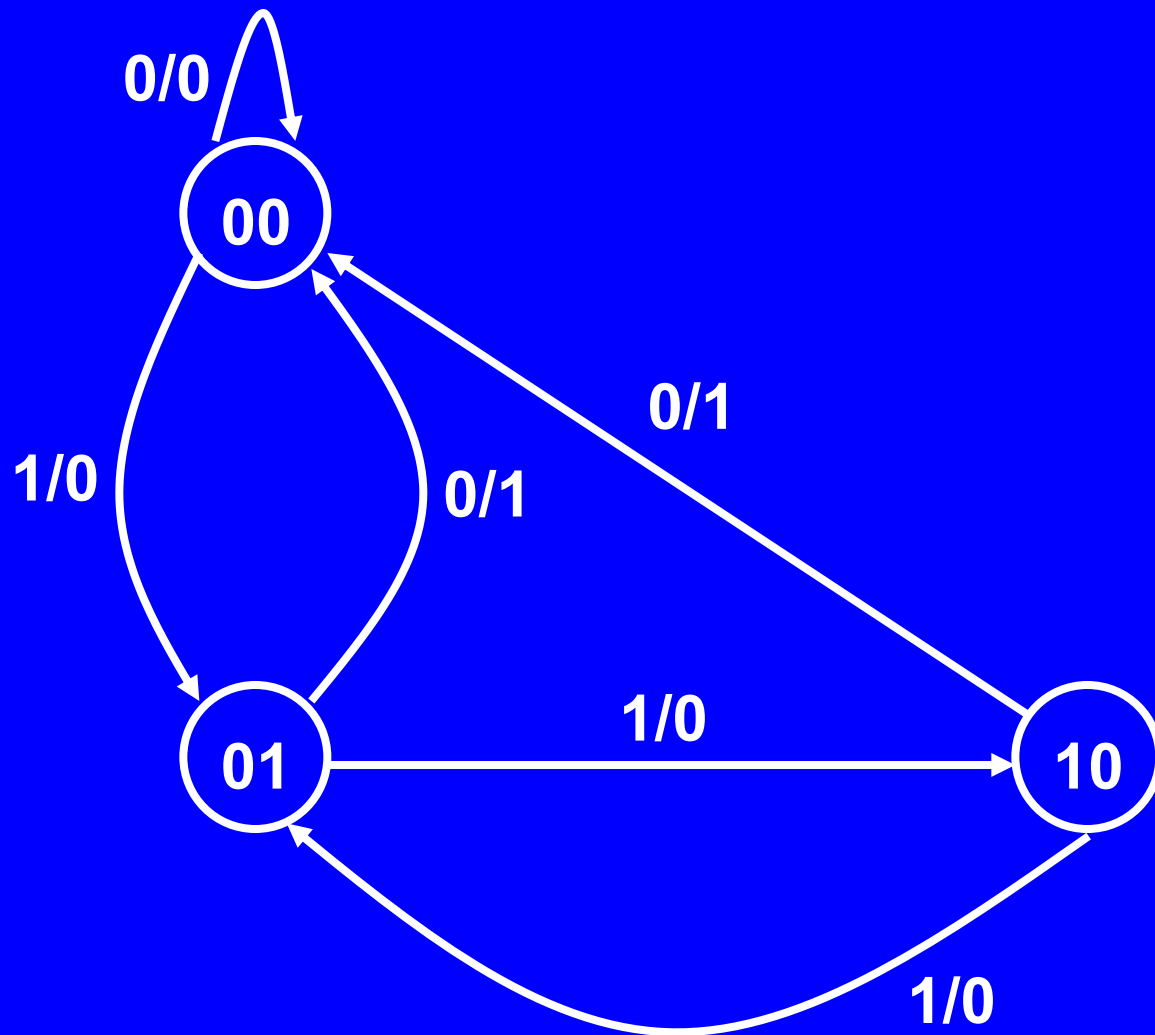
DA \ BX		00	01	11	10
A	0	0	0	1	0
	1	X	X	0	0

$DA = A'BX$
 $DB = X$
 $Y = BX'$

Y

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

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



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	0	0
1	0	0	0	0	1
1	0	1	0	1	0
1	1	0	X	X	X
1	1	1	X	X	X

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

Y

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

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

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

$$DA = BX$$

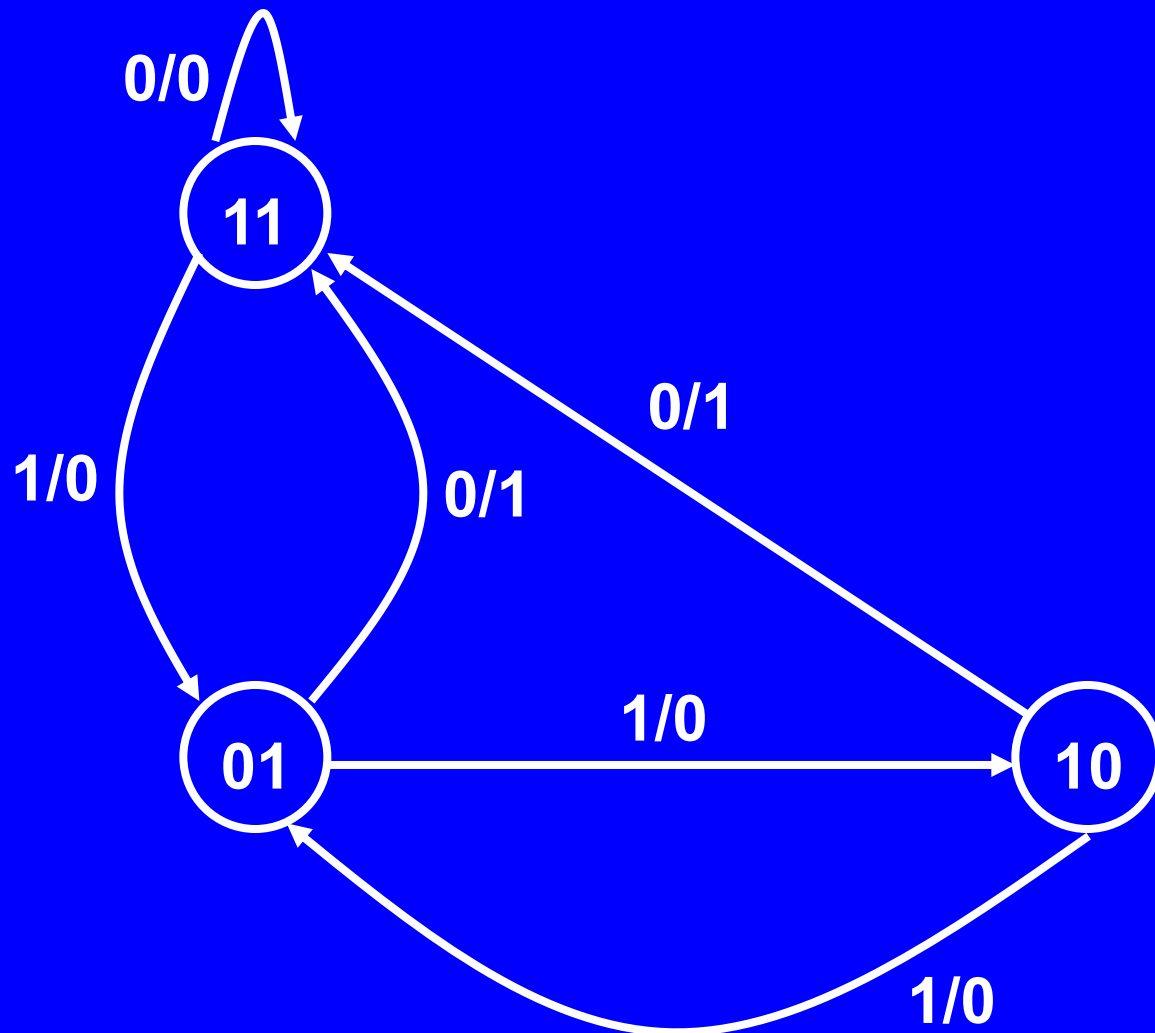
$$DB = B'X$$

$$Y = BX' + AX'$$

Y

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

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



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

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

Y

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

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

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

$$DA = A' + X'$$

$$DB = A + X'$$

$$Y = A'X' + B'X'$$

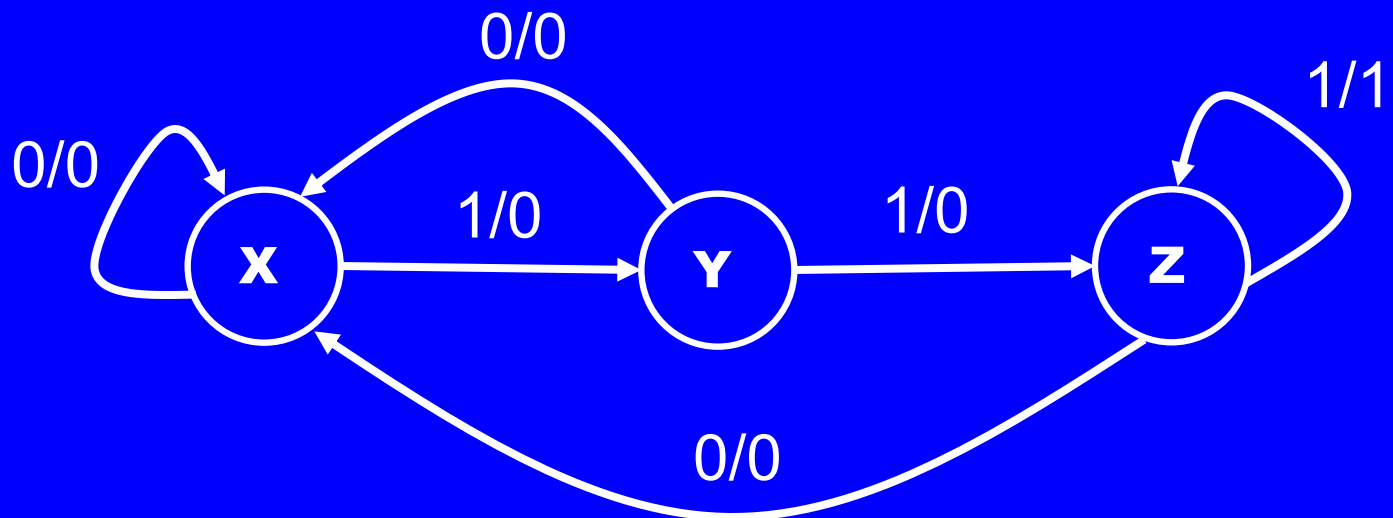
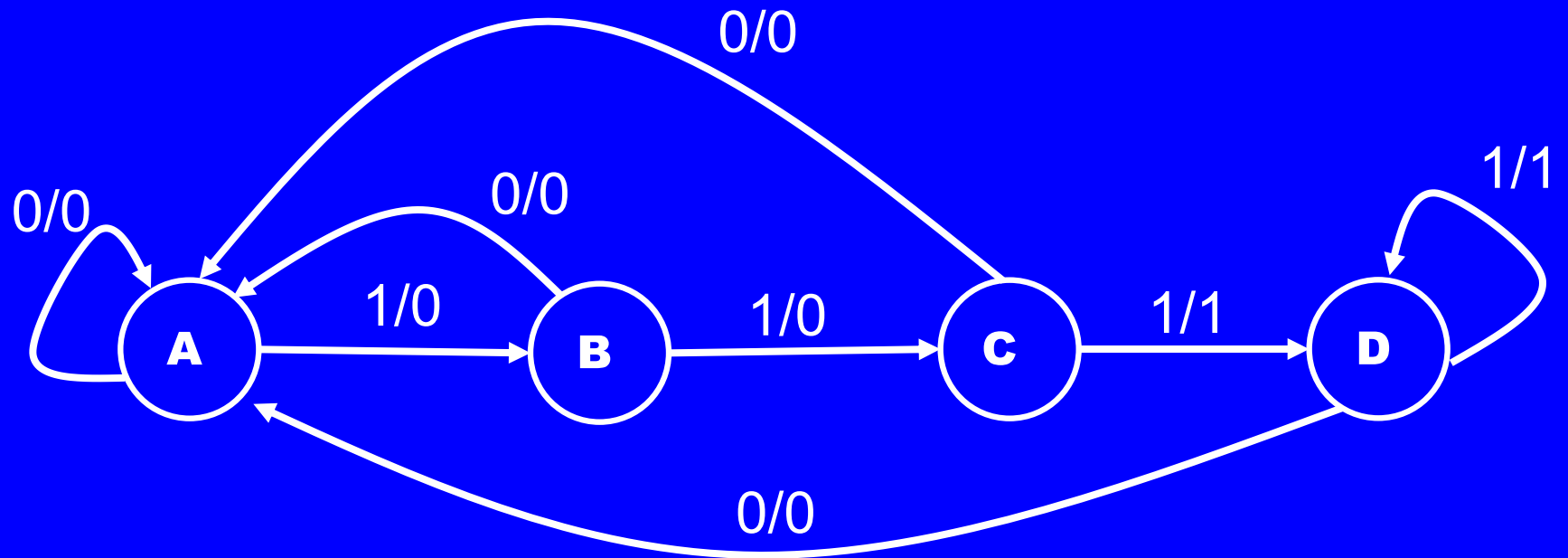
Y

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

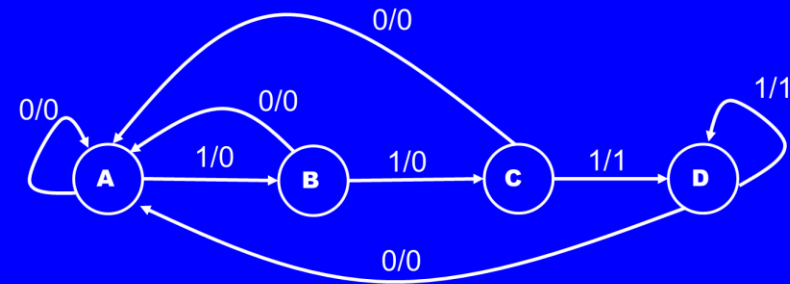
BX \ A		00	01	11	10
A	0	X	X	0	1
	1	1	0	0	0

Ισοδύναμες καταστάσεις

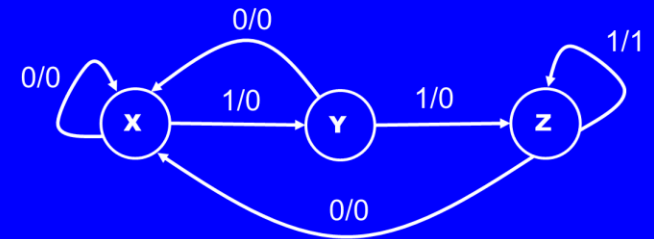
Όταν δύο καταστάσεις για κάθε είσοδο έχουν την ίδια έξοδο και την ίδια επόμενη κατάσταση λέγονται ισοδύναμες



Pres	in=0	in=1
A	A,0	B,0
B	A,0	C,0
C	A,0	D,1
D	A,0	D,1



Pres	in=0	in=1
X	X,0	Y,0
Y	X,0	Z,0
Z	X,0	Z,1



pres state	in=0	in=1
1	2,0	3,0
2	4,0	5,0
3	6,0	7,0
4	8,0	9,0
5	10,0	11,0
6	4,0	12,0
7	10,0	12,0
8	8,0	1,0
9	10,1	1,0
10	4,0	1,0
11	2,0	1,0
12	2,0	1,0

pres state	in=0	in=1
1	2,0	3,0
2	4,0	5,0
3	6,0	7,0
4	8,0	9,0
5	10,0	11,0
6	4,0	12,0
7	10,0	12,0
8	8,0	1,0
9	10,1	1,0
10	4,0	1,0
11	2,0	1,0
12	2,0	1,0

pres state	in=0	in=1
1	2,0	3,0
2	4,0	5,0
3	6,0	7,0
4	8,0	9,0
5	10,0	11,0
6	4,0	12,0
7	10,0	12,0
8	8,0	1,0
9	10,1	1,0
10	4,0	1,0
11	2,0	1,0
12	2,0	1,0

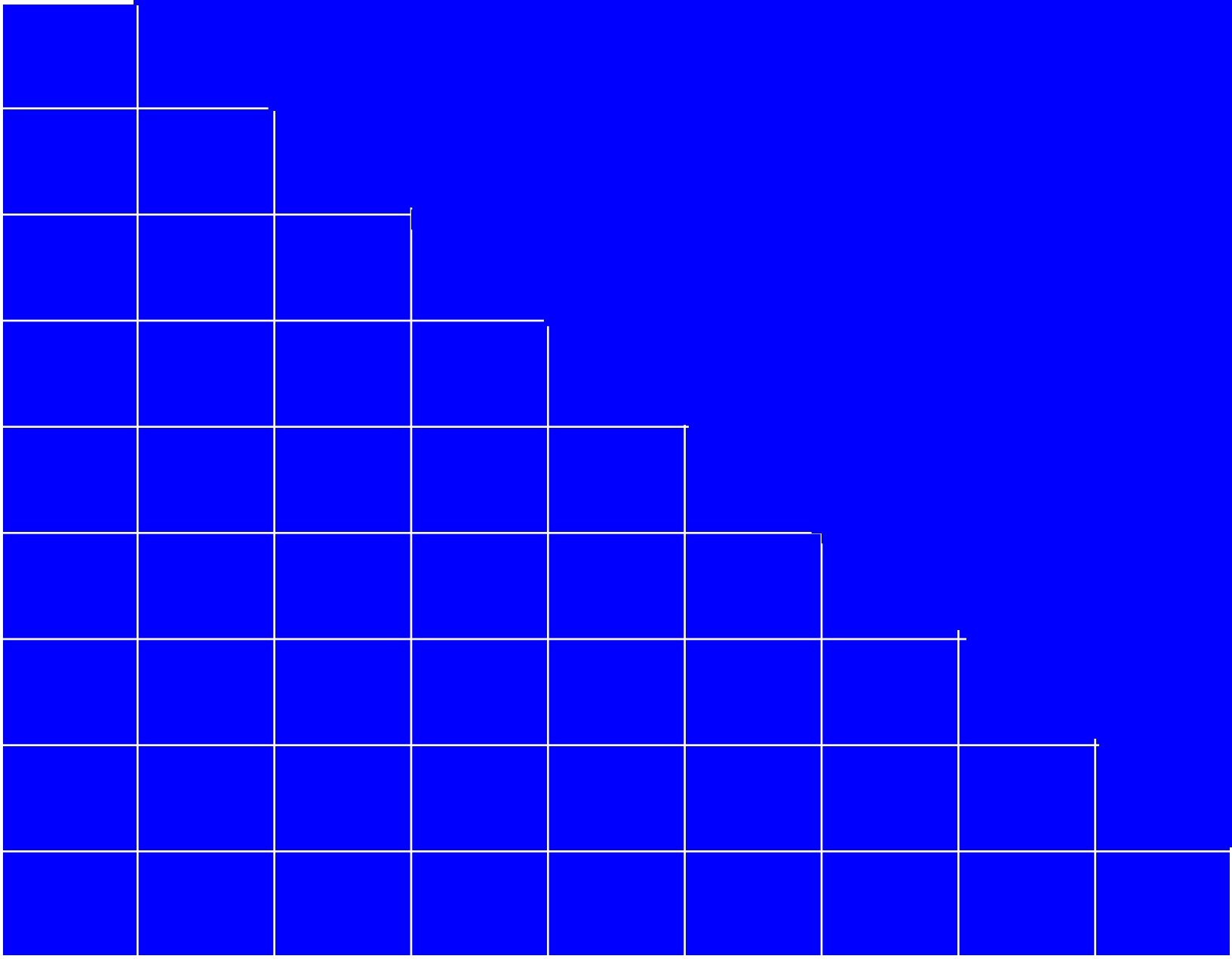
pres state	in=0	in=1
1	2,0	3,0
2	4,0	5,0
3	6,0	7,0
4	8,0	9,0
5	10,0	11,0
6	4,0	11,0
7	10,0	11,0
8	8,0	1,0
9	10,1	1,0
10	4,0	1,0
11	2,0	1,0
12	2,0	1,0

pres state	in=0	in=1
1	2,0	3,0
2	4,0	5,0
3	6,0	7,0
4	8,0	9,0
5	10,0	11,0
6	4,0	11,0
7	10,0	11,0
8	8,0	1,0
9	10,1	1,0
10	4,0	1,0
11	2,0	1,0
12	2,0	1,0

pres state	in=0	in=1
1	2,0	3,0
2	4,0	5,0
3	6,0	7,0
4	8,0	9,0
5	10,0	11,0
6	4,0	11,0
7	10,0	11,0
8	8,0	1,0
9	10,1	1,0
10	4,0	1,0
11	2,0	1,0
12	2,0	1,0

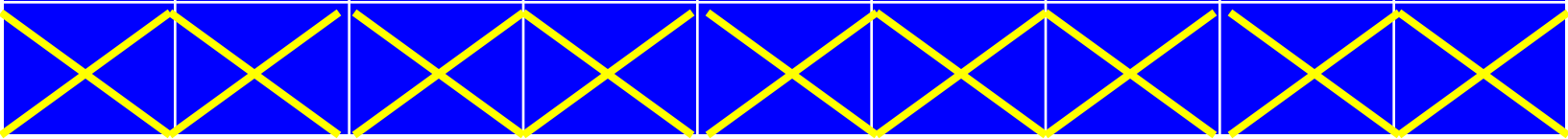
pres state	in=0	in=1
1	2,0	3,0
2	4,0	5,0
3	6,0	5,0
4	8,0	9,0
5	10,0	11,0
6	4,0	11,0
7	10,0	11,0
8	8,0	1,0
9	10,1	1,0
10	4,0	1,0
11	2,0	1,0
12	2,0	1,0

pres state	in=0	in=1
1	2,0	3,0
2	4,0	5,0
3	6,0	5,0
4	8,0	9,0
5	10,0	11,0
6	4,0	11,0
8	8,0	1,0
10	4,0	1,0
11	2,0	1,0
9	10,1	1,0



2	2 – 4 3 – 5								
3	2 – 6 3 – 5	4 – 6							
4	2 – 8 3 – 9	4 – 8 5 – 9	6 – 8 5 – 9						
5	2 – 10 3 – 11	4 – 10 5 – 11	6 – 10 5 – 11	8 – 10 9 – 11					
6	2 – 4 3 – 11	5 – 11	4 – 6 5 – 11	4 – 8 9 – 11	4 – 10				
8	2 – 8 1 – 3	4 – 8 1 – 5	6 – 8 1 – 5	1 – 9	8 – 10 1 – 11	4 – 8 1 – 11			
10	2 – 4 1 – 3	1 – 5	4 – 6 1 – 5	4 – 8 1 – 9	4 – 10 1 – 11	1 – 11	4 – 8		
11	1 – 3	2 – 4 1 – 5	2 – 6 1 – 5	2 – 8 1 – 9	2 – 10 1 – 11	2 – 4 1 – 11	2 – 8	2 – 4	
9									
	1	2	3	4	5	6	8	10	11

Διώχνουμε την κατάσταση 9

2	2-4 3-5											
3	2-6 3-5	4-6										
4	2-8 3-9	4-8 5-9	6-8 5-9									
5	2-10 3-11	4-10 5-11	6-10 5-11	8-10 9-11								
6	2-4 3-11	5-11	4-6 5-11	4-8 9-11	4-10							
8	2-8 1-3	4-8 1-5	6-8 1-5	1-9	8-10 1-11	4-8 1-11						
10	2-4 1-3	1-5	4-6 1-5	4-8 1-9	4-10 1-11	1-11	4-8					
11	1-3	2-4 1-5	2-6 1-5	2-8 1-9	2-10 1-11	2-4 1-11	2-8	2-4				
9												
	1	2	3	4	5	6	8	10	11			

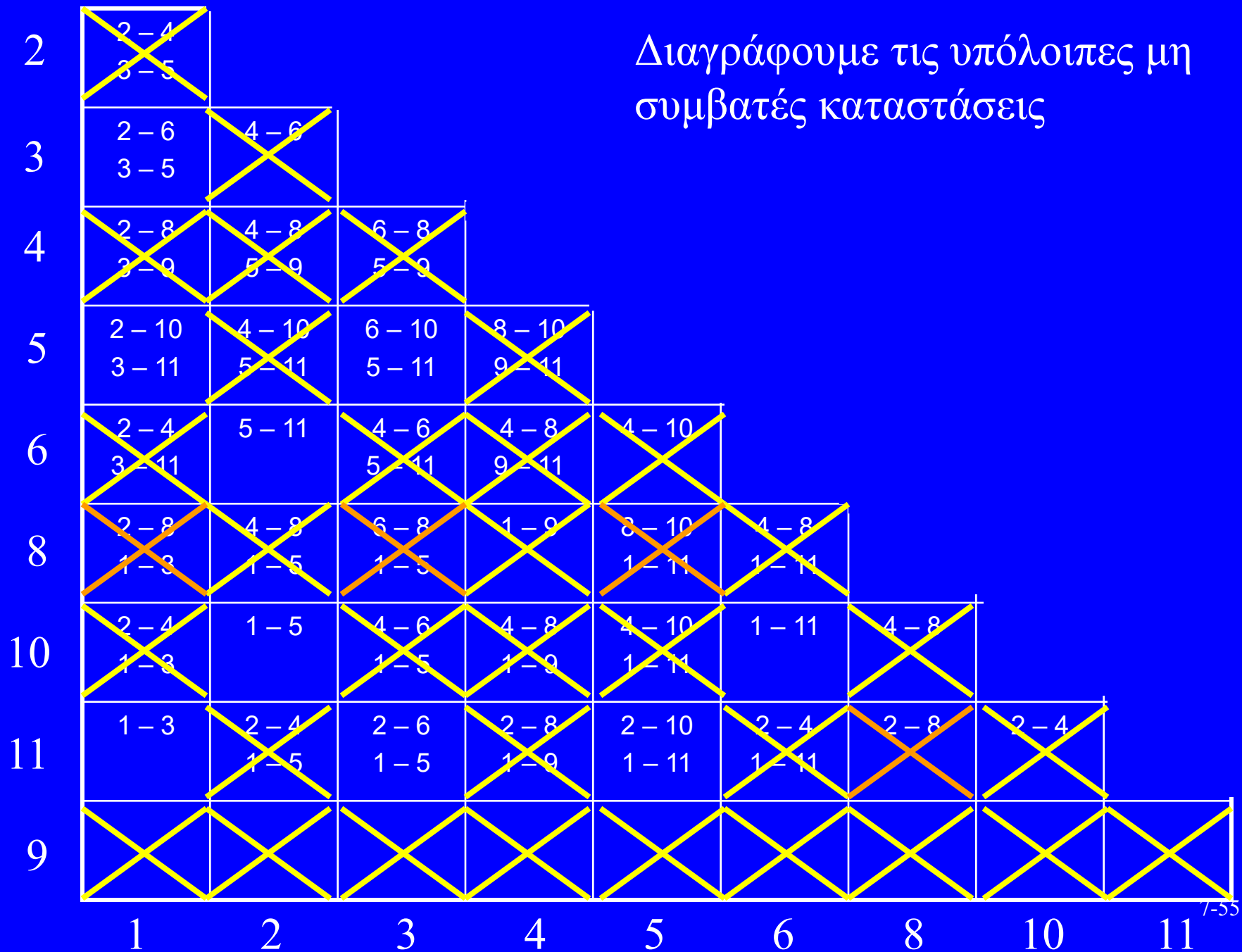
Διαγράφουμε όπου υπάρχει
η 9 σαν επόμενη κατάσταση

2	2-4 3-5											
3	2-6 3-5	4-6										
4	2-8 3-9	4-8 5-9	6-8 5-9									
5	2-10 3-11	4-10 5-11	6-10 5-11	8-10 9-11								
6	2-4 3-11	5-11	4-6 5-11	4-8 9-11	4-10							
8	2-8 1-3	4-8 1-5	6-8 1-5	1-9	8-10 1-11	4-8 1-11						
10	2-4 1-3	1-5	4-6 1-5	4-8 1-9	4-10 1-11	1-11	4-8					
11	1-3	2-4 1-5	2-6 1-5	2-8 1-9	2-10 1-11	2-4 1-11	2-8	2-4				
9												
	1	2	3	4	5	6	8	10	11			

Διαγράφουμε όπου υπάρχει
η 4 σαν επόμενη κατάσταση

2	2-4 3-5											
3	2-6 3-5	4-6										
4	2-8 3-9	4-8 5-9	6-8 5-9									
5	2-10 3-11	4-10 5-11	6-10 5-11	8-10 9-11								
6	2-4 3-11	5-11	4-6 5-11	4-8 9-11	4-10							
8	2-8 1-3	4-8 1-5	6-8 1-5	1-9	8-10 1-11	4-8 1-11						
10	2-4 1-3	1-5	4-6 1-5	4-8 1-9	4-10 1-11	1-11	4-8					
11	1-3	2-4 1-5	2-6 1-5	2-8 1-9	2-10 1-11	2-4 1-11	2-8	2-4				
9												
	1	2	3	4	5	6	8	10	11			

Διαγράφουμε τις υπόλοιπες μη
συμβατές καταστάσεις



Ελέγχουμε τις στήλες και έχουμε:

9 (9)

11 (9) (11)

10 (9) (11) (10)

8 (9) (11) (10) (8)

6 (9) (11) (6,10) (8)

5 (9) (5,11) (6,10) (8)

4 (9) (5,11) (6,10) (8) (4)

3 (9) (3,5,11) (6,10) (8) (4)

2 (9) (3,5,11) (2,6,10) (8) (4)

1 (9) (1,3,5,11) (2,6,10) (8) (4)

pres state	in=0	in=1
1	2,0	1,0
2	4,0	1,0
4	8,0	9,0
8	8,0	1,0
9	2,1	1,0

Παρούσα κατάσταση	Επόμενη κατάσταση, έξοδος Είσοδος = 0	Επόμενη κατάσταση, έξοδος Είσοδος = 1
A	K,1	B,1
B	C,0	D,1
C	D,0	O,1
D	G,1	A,0
E	J,1	A,0
F	M,0	K,1
G	G,1	L,0
H	H,1	F,0
I	I,1	N,0
J	J,1	C,0
K	L,0	M,1
L	D,0	K,1
M	I,1	A,0
N	E,0	B,1
O	F,0	E,1

B 0,1

C 0,1

F 0,1

K 0,1

L 0,1

N 0,1

O 0,1

D 1,0

E 1,0

G 1,0

H 1,0

I 1,0

J 1,0

M 1,0

A 1,1

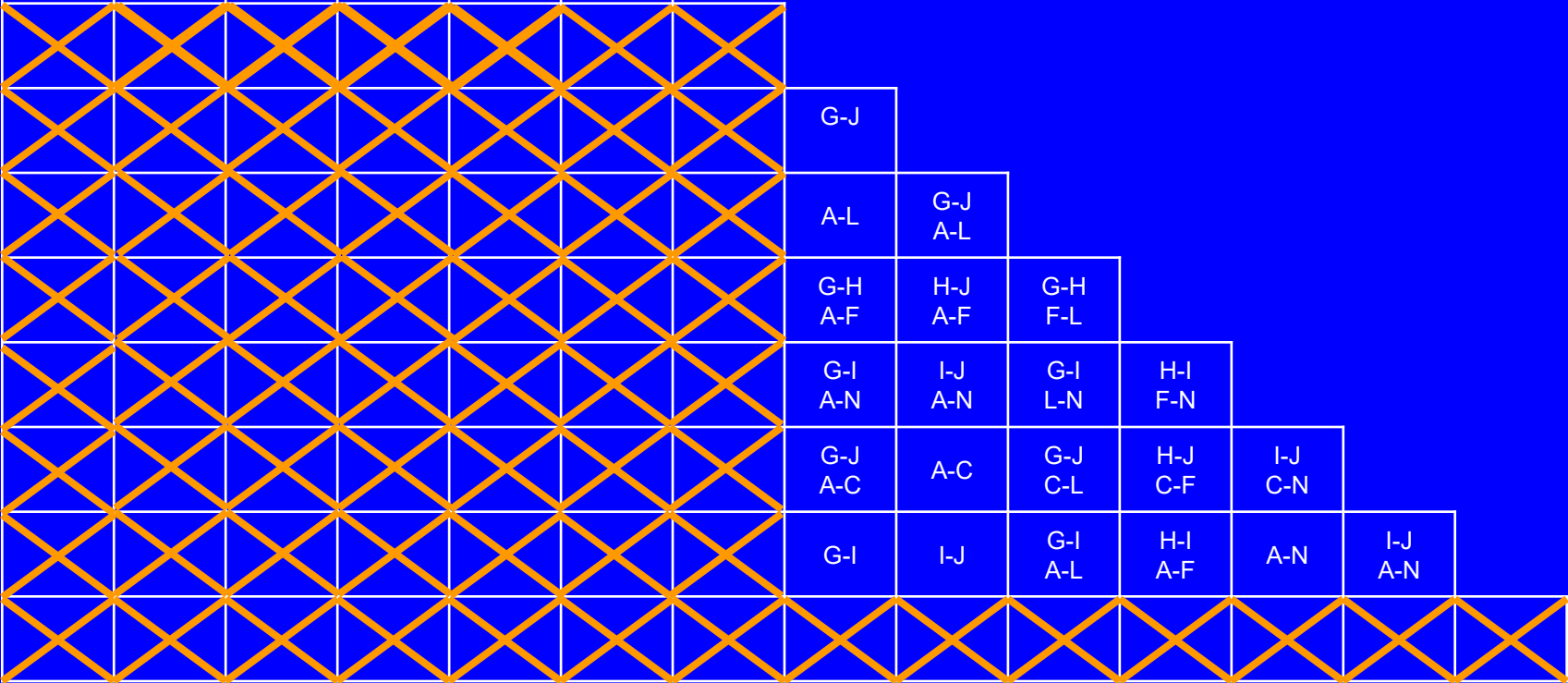
ΠΡΩΤΗ ΟΜΑΔΑ

ΔΕΥΤΕΡΗ ΟΜΑΔΑ

ΤΡΙΤΗ ΟΜΑΔΑ

C
F
K
L
N
O
D
E
G
H
I
J
M
A

C-D D-O						
C-M D-K	D-M K-O					
C-L D-M	D-L M-O	L-M K-M				
C-D D-K	K-O	D-M	D-L K-M			
C-E B-D	D-E B-O	E-M B-K	E-L B-M	D-E B-K		
C-F D-E	D-F E-O	F-M E-K	F-L E-M	D-F E-K	E-F B-E	



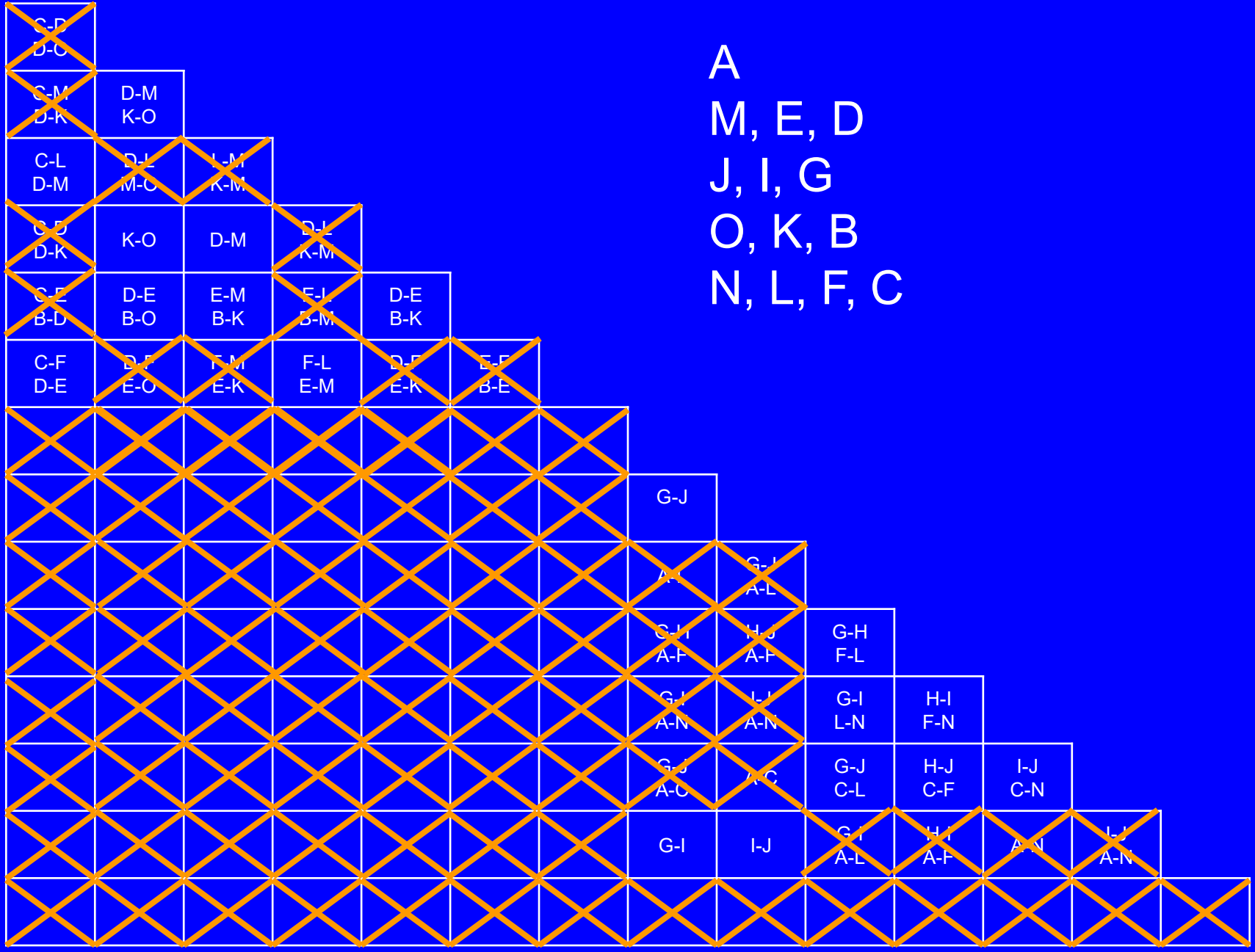
B C F K L N O D E G H I J M

Παρούσα κατάσταση	Επόμενη κατάσταση, έξοδος Είσοδος = 0	Επόμενη κατάσταση, έξοδος Είσοδος = 1
A	K,1	B,1
B	C,0	D,1
C	D,0	O,1
D	G,1	A,0
E	J,1	A,0
F	M,0	K,1
G	G,1	L,0
H	H,1	F,0
I	I,1	N,0
J	J,1	C,0
K	L,0	M,1
L	D,0	K,1
M	I,1	A,0
N	E,0	B,1
O	F,0	E,1

B C F K L N O D E G H I J M

Παρούσα κατάσταση	Επόμενη κατάσταση, έξοδος Είσοδος = 0	Επόμενη κατάσταση, έξοδος Είσοδος = 1
A	K,1	B,1
B	C,0	D,1
C	D,0	O,1
D	G,1	A,0
E	J,1	A,0
F	M,0	K,1
G	G,1	L,0
H	H,1	F,0
I	I,1	N,0
J	J,1	C,0
K	L,0	M,1
L	D,0	K,1
M	I,1	A,0
N	E,0	B,1
O	F,0	E,1

C
F
K
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G
H
I
J
M
A



B C F K L N O D E G H I J M

A
M, E, D
J, I, G
O, K, B
N, L, F, C