

Digital logic Design

8 Bit Calculator

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Objectives

Input any two numbers A and B from 0 to 15

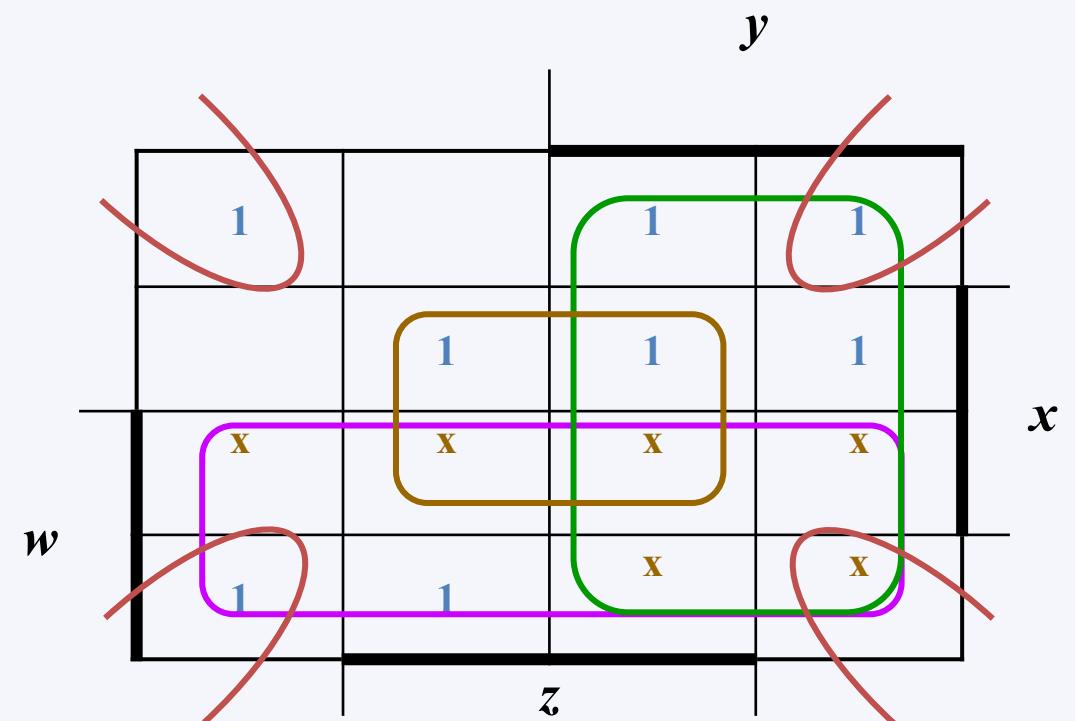
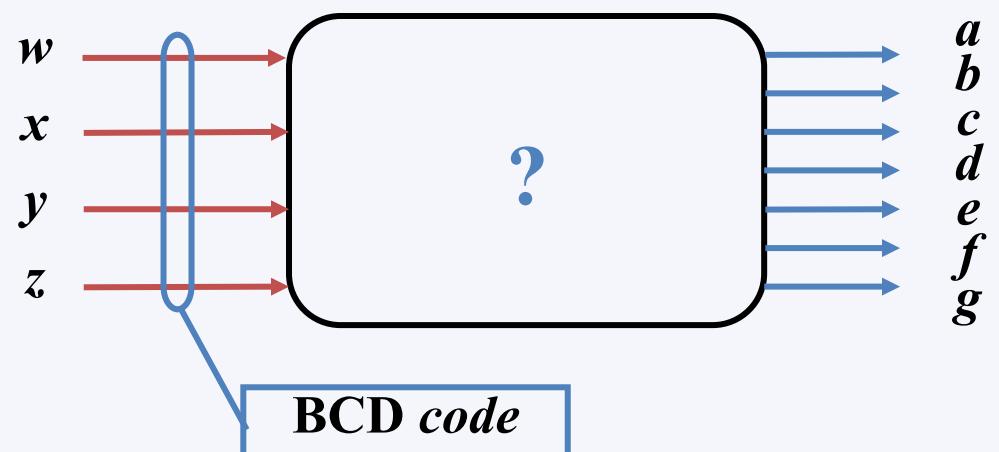
Choose any operation between addition subtraction* and multiplication

Convert 8 bits binary to decimal coded binary

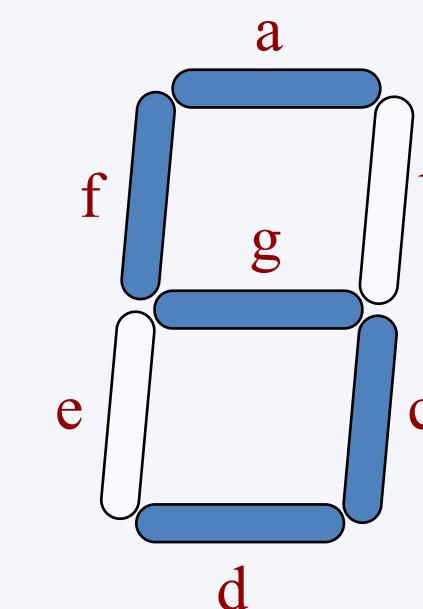
Display A and B and the result of the operation between them

#	W	X	Y	Z	a	b	c	d	e	f	g
0	0	0	0	0	1	1	1	1	1	1	0
1	0	0	0	1	0	1	1	0	0	0	0
2	0	0	1	0	1	1	0	1	1	0	1
3	0	0	1	1	1	1	1	1	0	0	1
4	0	1	0	0	0	1	1	0	0	1	1
5	0	1	0	1	1	0	1	1	0	1	1
6	0	1	1	0	1	0	1	1	1	1	1
7	0	1	1	1	1	1	1	0	0	0	0
8	1	0	0	0	1	1	1	1	1	1	1
9	1	0	0	1	1	1	1	1	0	1	1
10	1	0	1	0	X	X	X	X	X	X	X
11	1	0	1	1	X	X	X	X	X	X	X
12	1	1	0	0	X	X	X	X	X	X	X
13	1	1	0	1	X	X	X	X	X	X	X
14	1	1	1	0	X	X	X	X	X	X	X
15	1	1	1	1	X	X	X	X	X	X	X

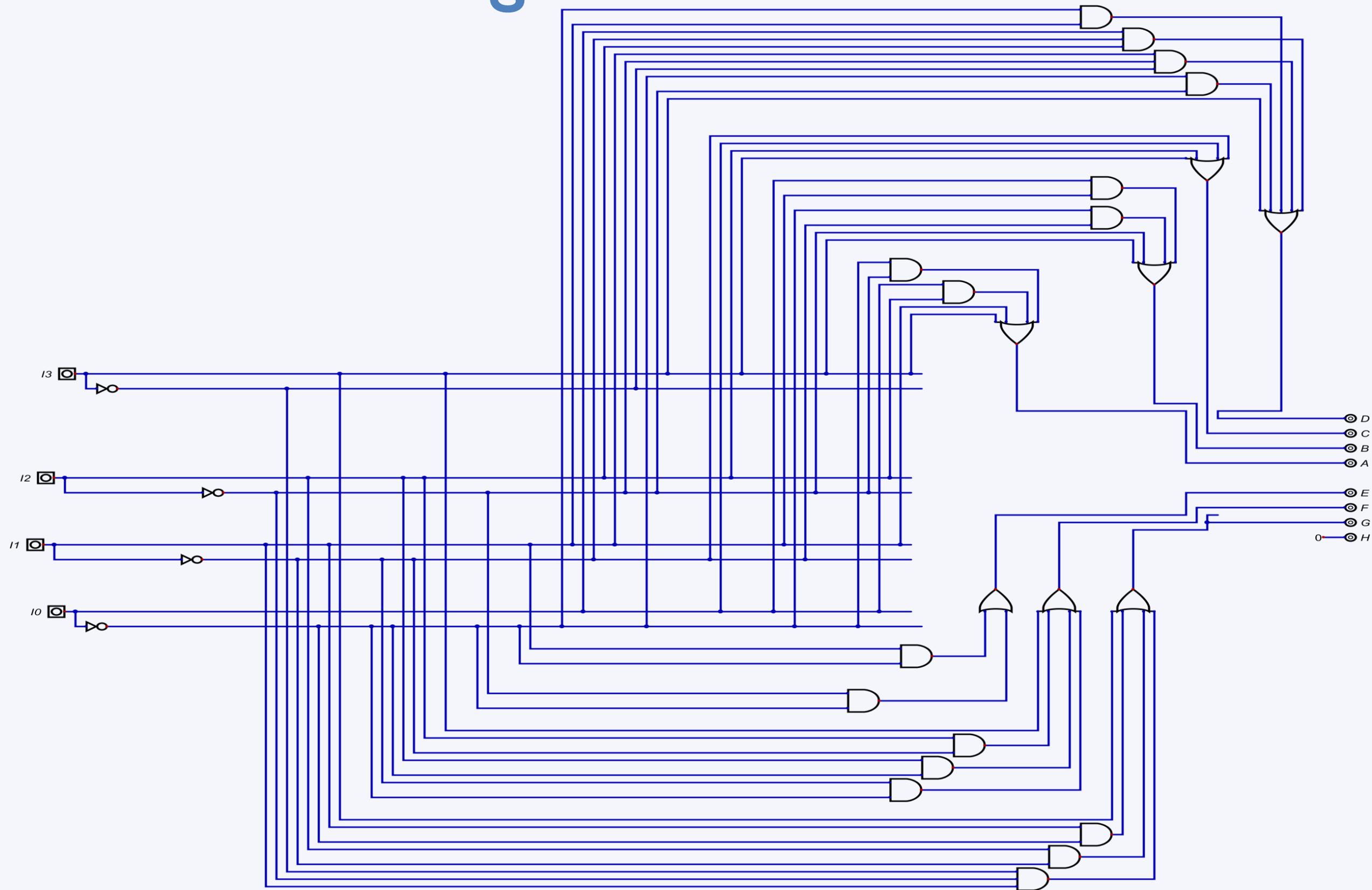
Seven-Segment Driver



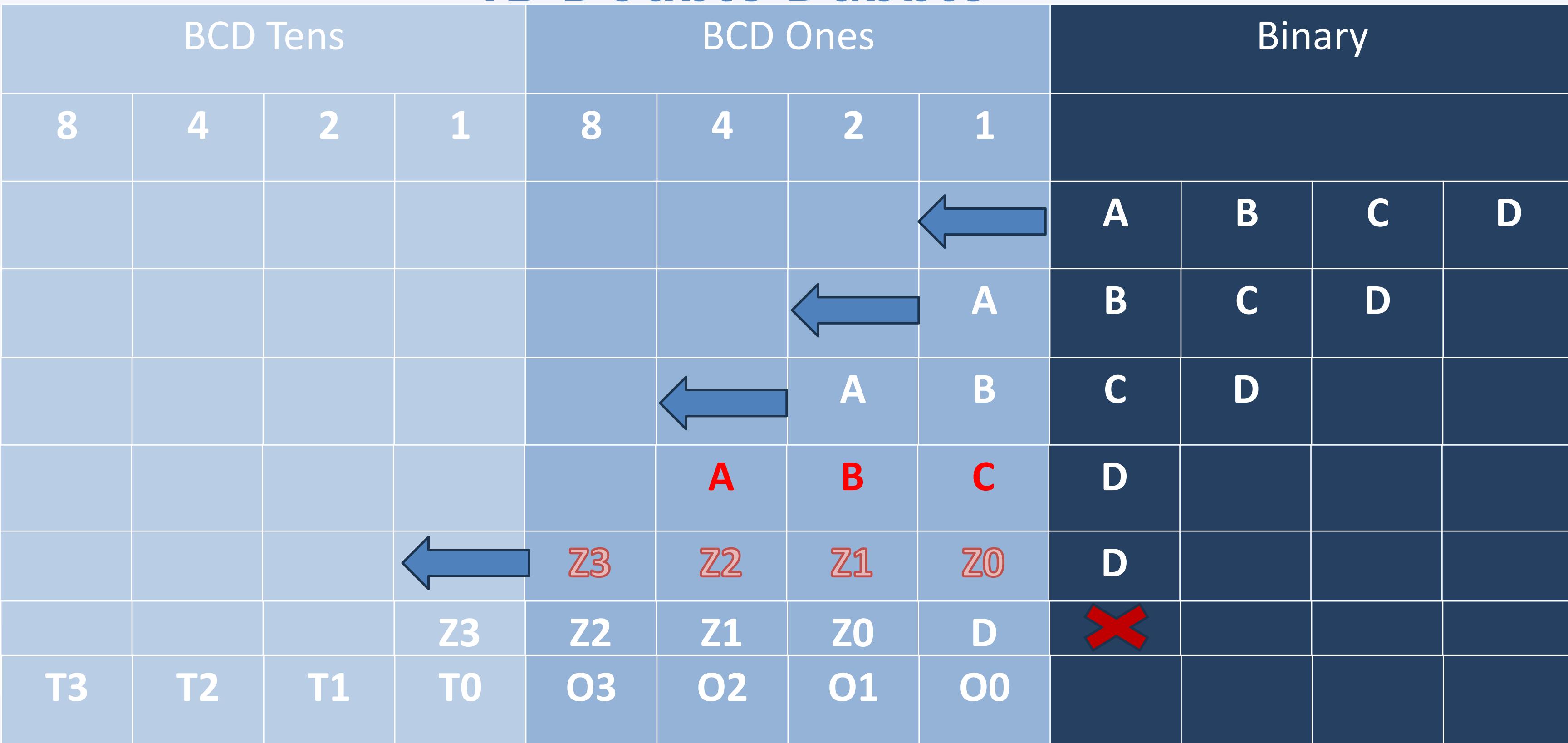
$$a = w + y + xz + x'z'$$



7-Segment driver



4B Double Dabble



8B Double Dabble

Double Dabble

- 1) Shift binary number 1 space to the left
- 2) IF the binary number can be greater than or equal to 5 we add 3

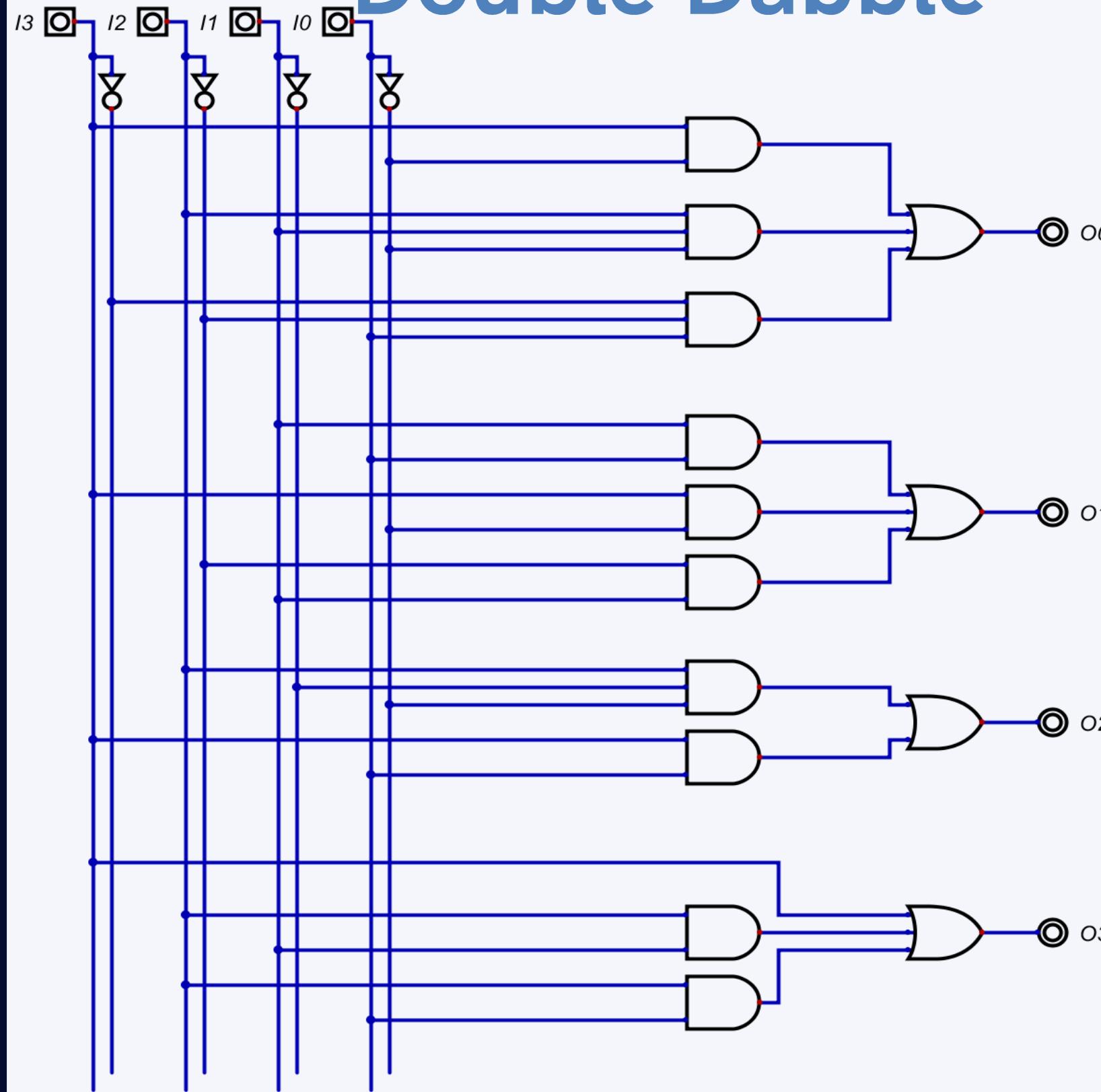
IF Binary number ≥ 10 add 6

IF Binary number $\geq 10 \div 2$ add $6 \div 2$

IF Binary number ≥ 5 add 3

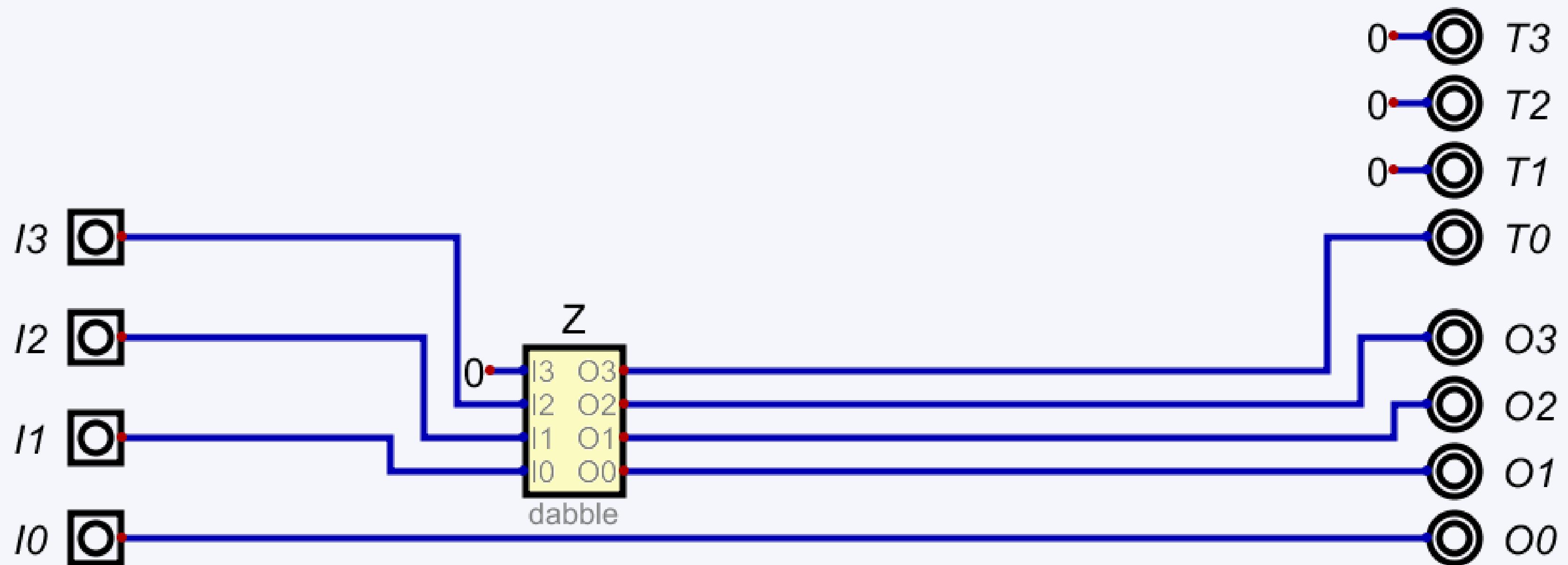
#	W	X	Y	Z	A	B	C	D
0	0	0	0	0	0	0	0	0
1	0	0	0	1	0	0	0	1
2	0	0	1	0	0	0	1	0
3	0	0	1	1	0	0	1	1
4	0	1	0	0	0	1	0	0
5	0	1	0	1	1	0	0	0
6	0	1	1	0	1	0	0	1
7	0	1	1	1	1	0	1	0
8	1	0	0	0	1	0	1	1
9	1	0	0	1	1	1	0	0
10	XXXX				X	X	X	X
11	XXXX				X	X	X	X
12	XXXX				X	X	X	X
13	XXXX				X	X	X	X
14	XXXX				X	X	X	X
15	XXXX				X	X	X	X

Double Dabble

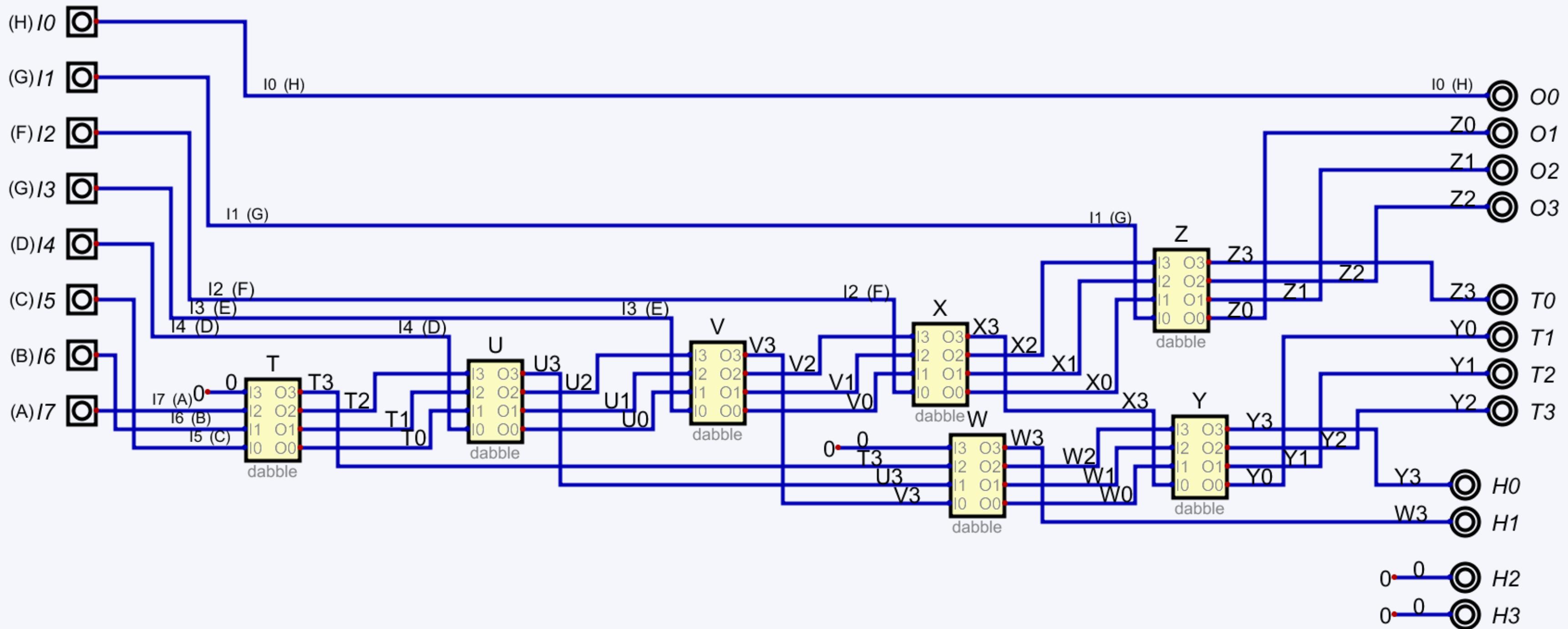


#	W	X	Y	Z	A	B	C	D
0	0	0	0	0	0	0	0	0
1	0	0	0	1	0	0	0	1
2	0	0	1	0	0	0	1	0
3	0	0	1	1	0	0	1	1
4	0	1	0	0	0	1	0	0
5	0	1	0	1	1	0	0	0
6	0	1	1	0	1	0	0	1
7	0	1	1	1	1	0	1	0
8	1	0	0	0	1	0	1	1
9	1	0	0	1	1	1	0	0
10	XXXX				X	X	X	X
11	XXXX				X	X	X	X
12	XXXX				X	X	X	X
13	XXXX				X	X	X	X
14	XXXX				X	X	X	X
15	XXXX				X	X	X	X

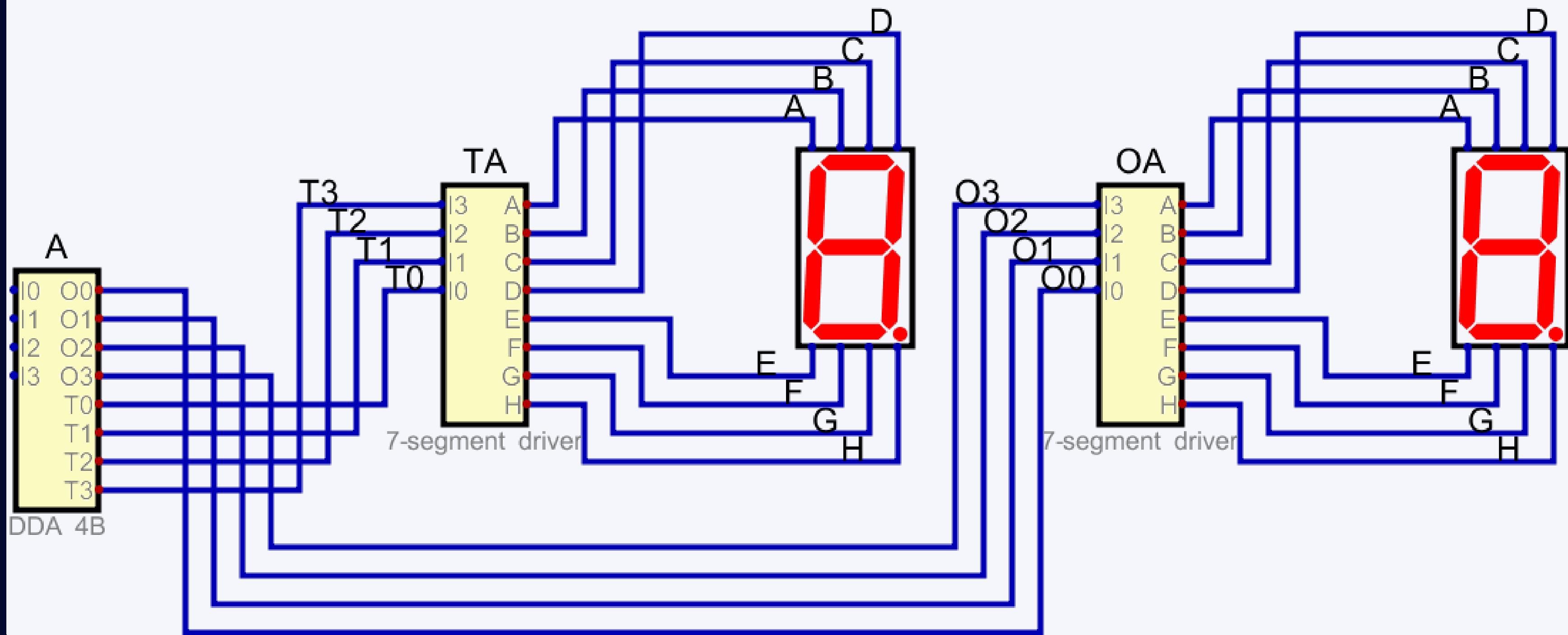
4B Double Dabble (DDA 45B)



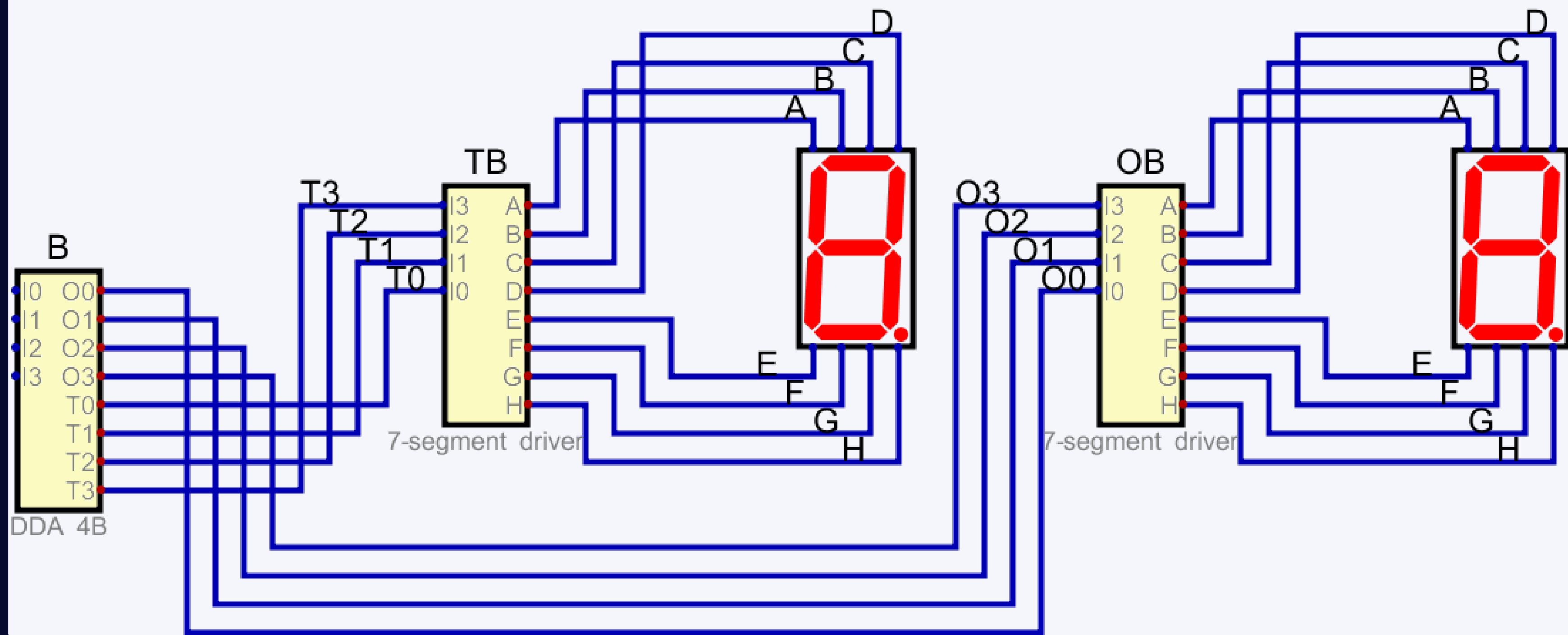
8B Double Dabble (DDA 8B)



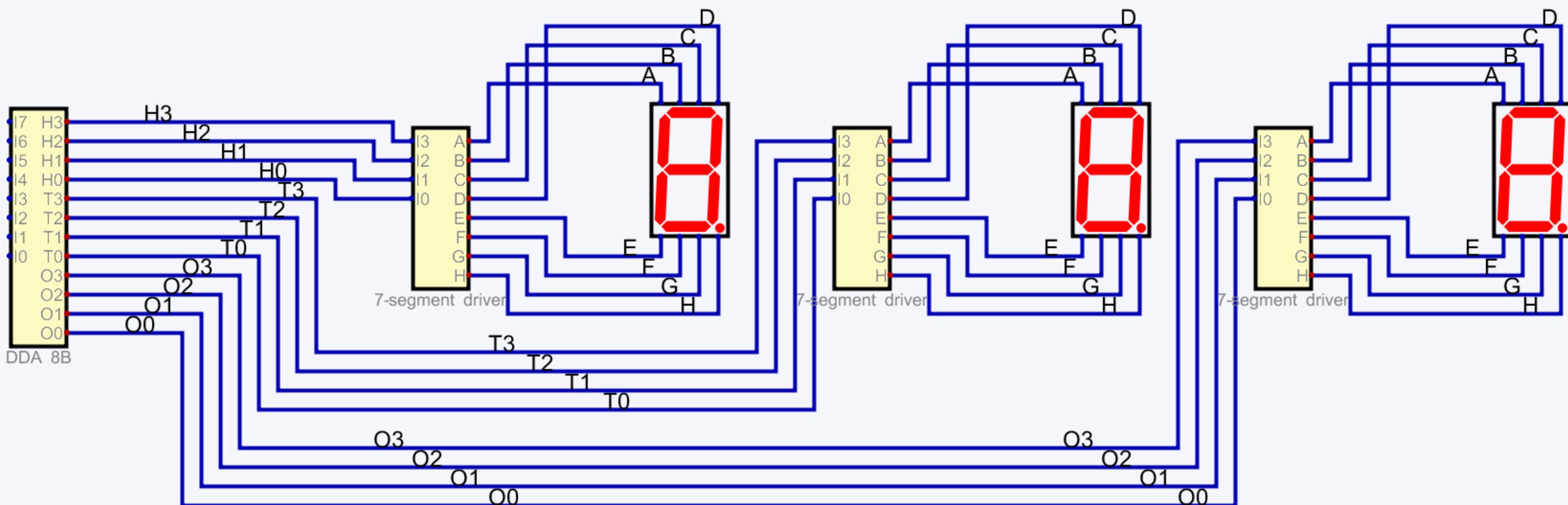
Output 1

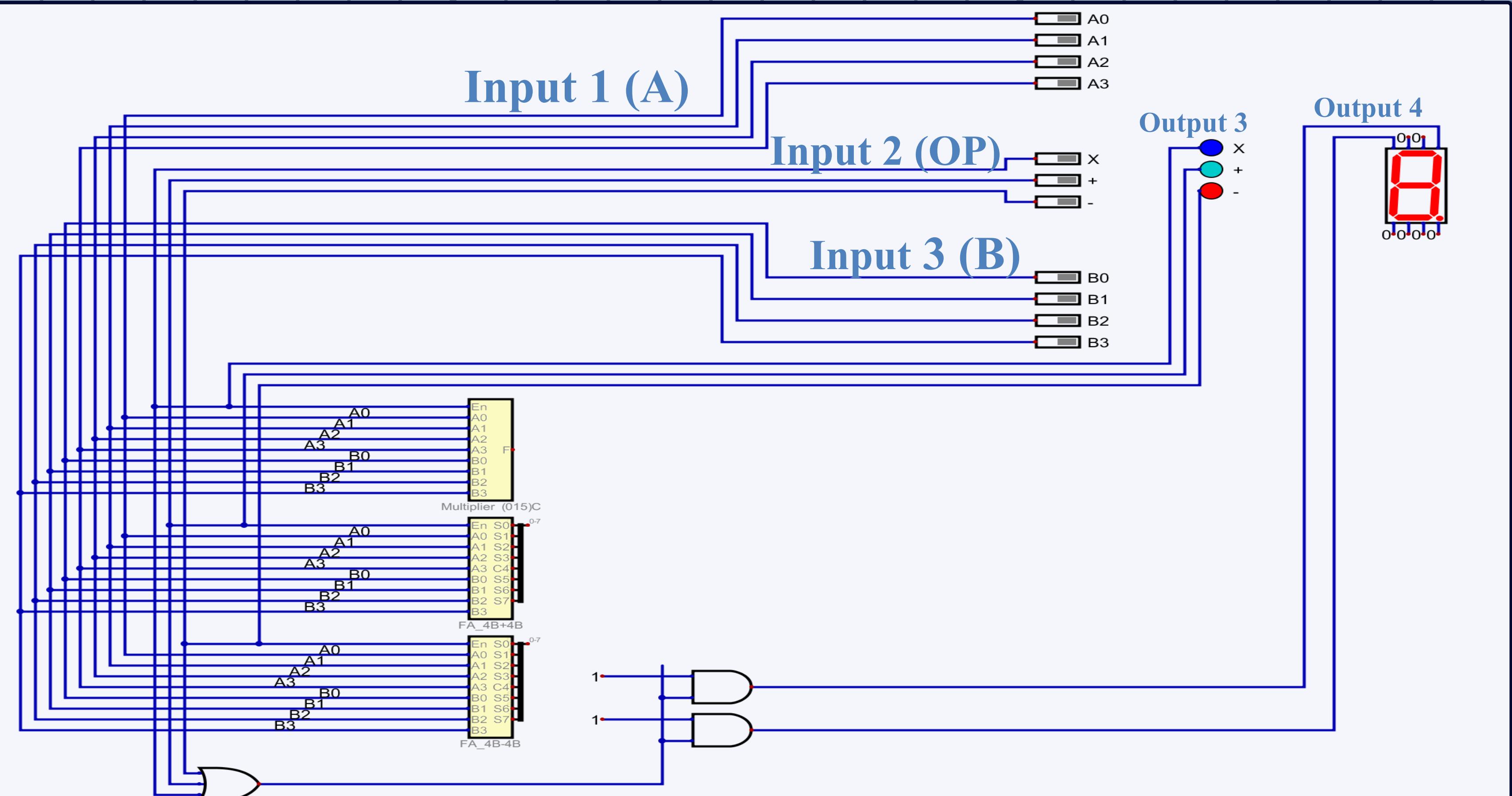


Output 2

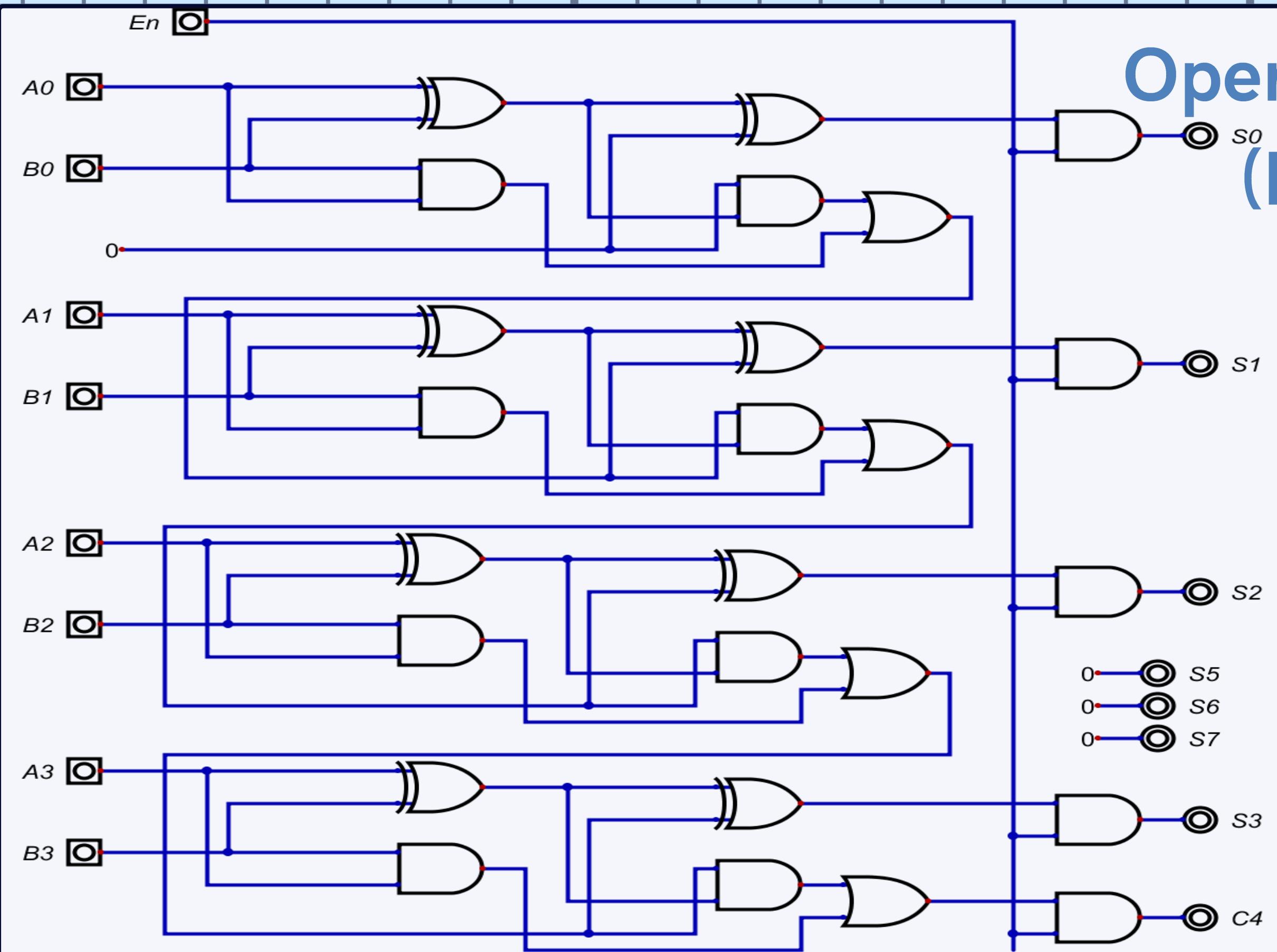


Output 5

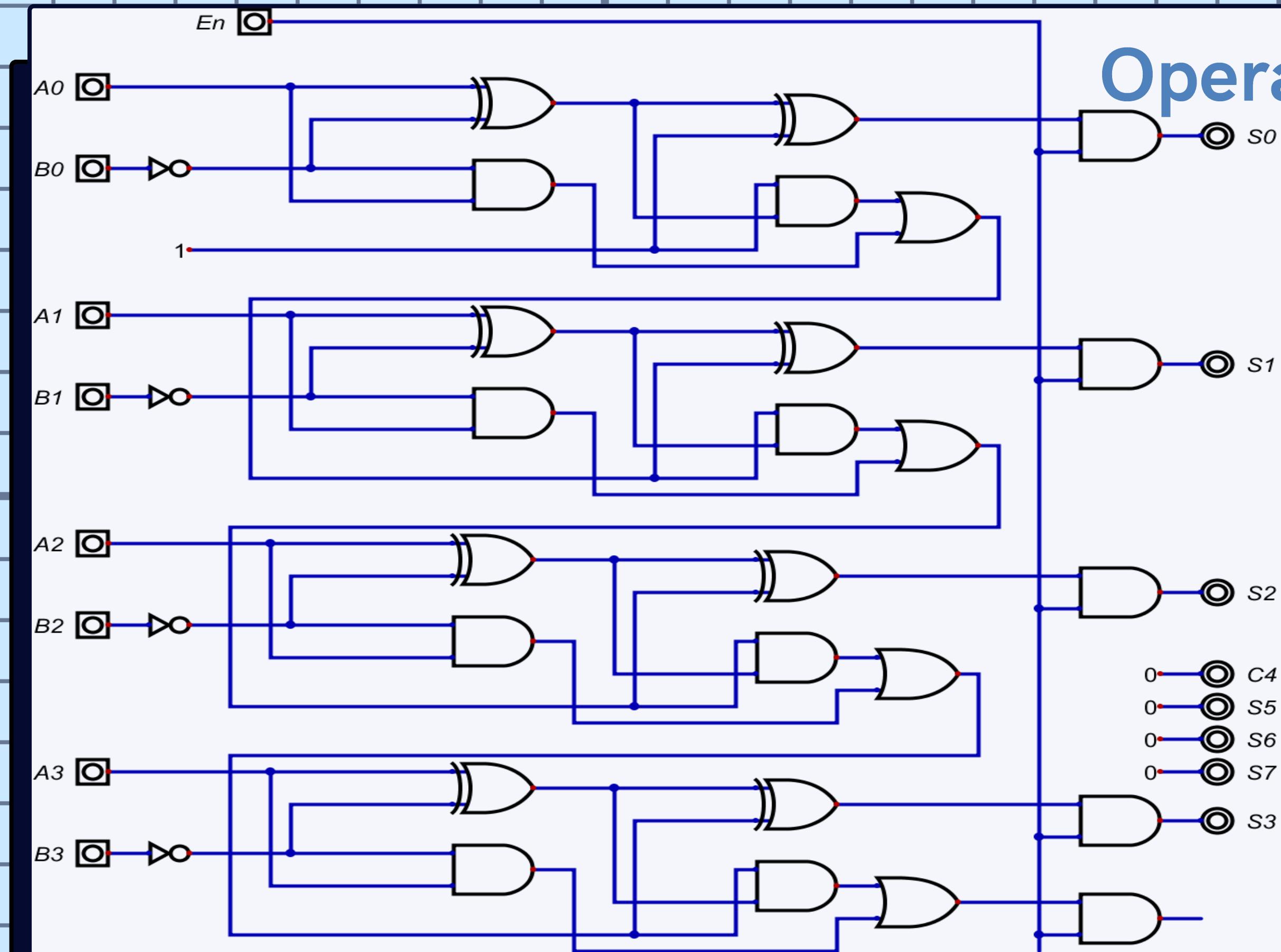




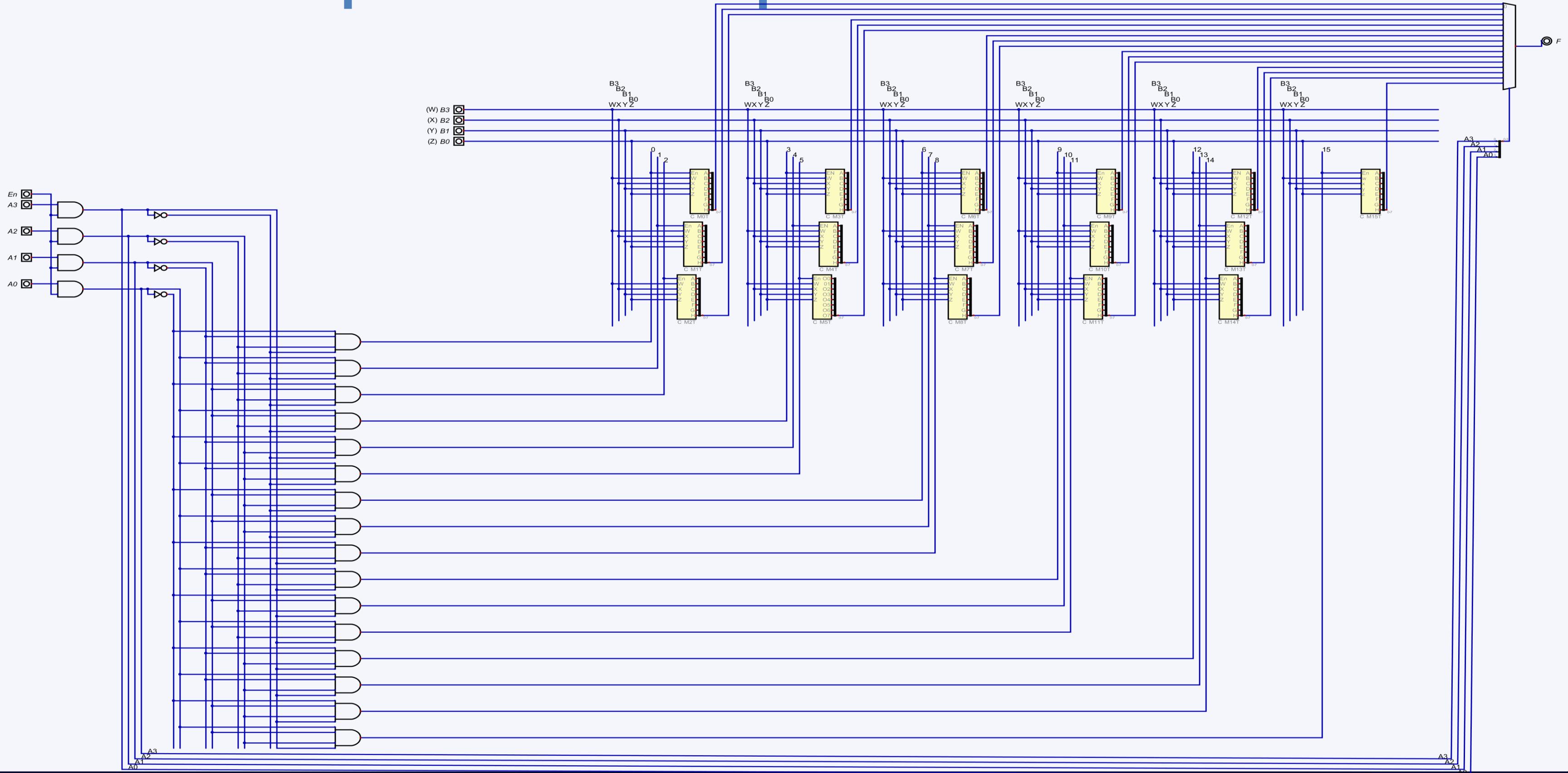
Operation Addition (FA_4B+4B)



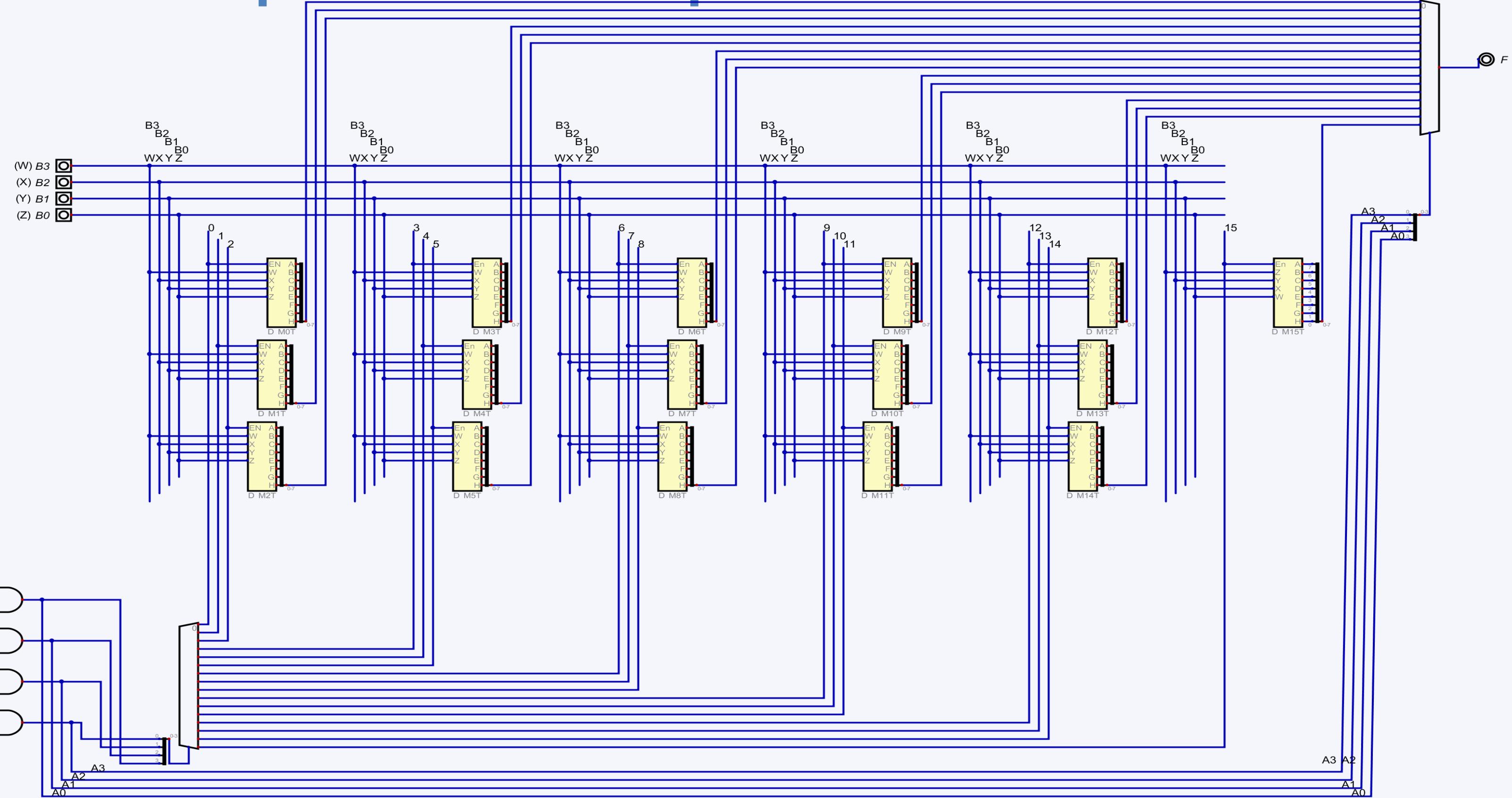
Operation Subtraction (FA_4B-4B)



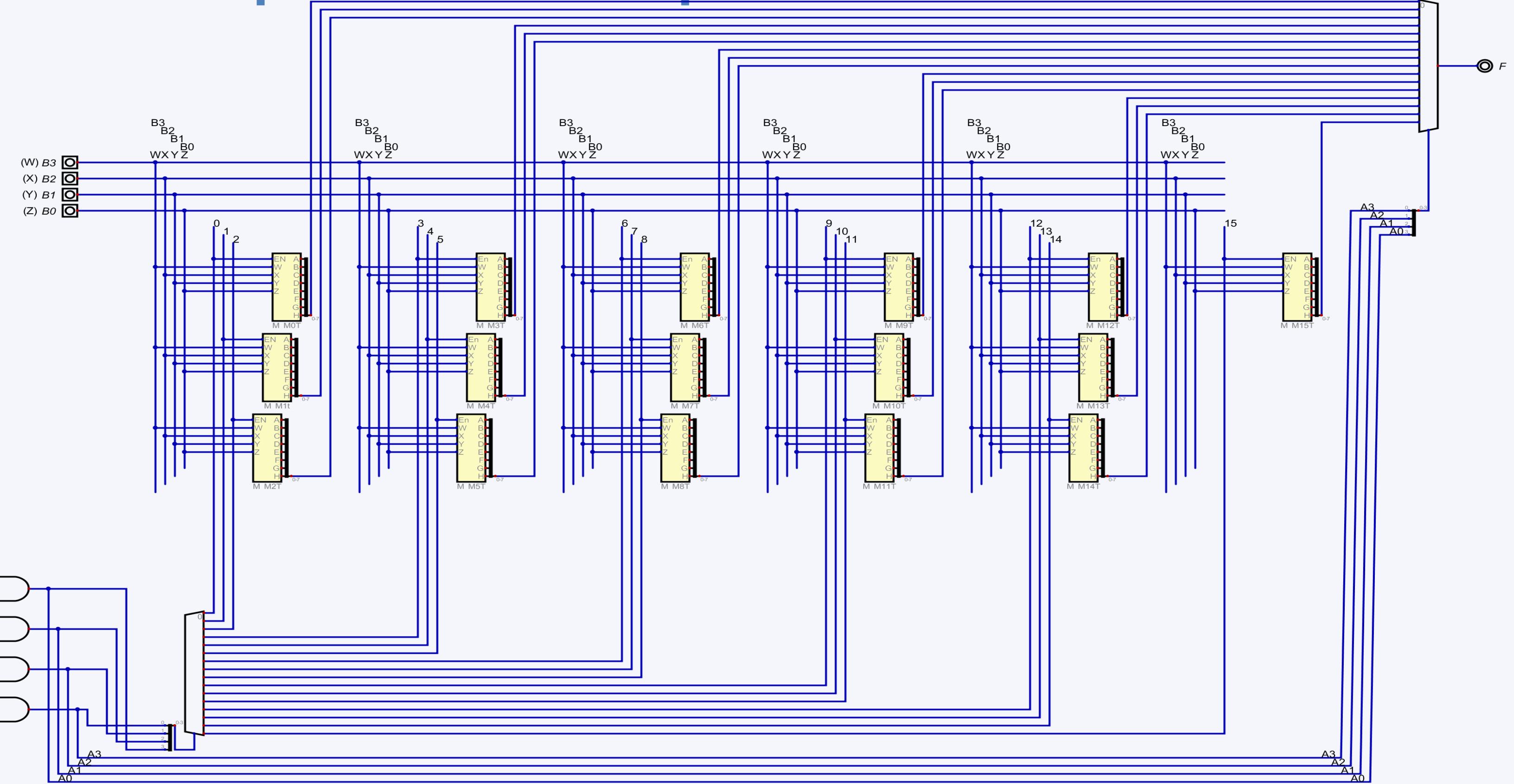
Operation Multiplication (015)C



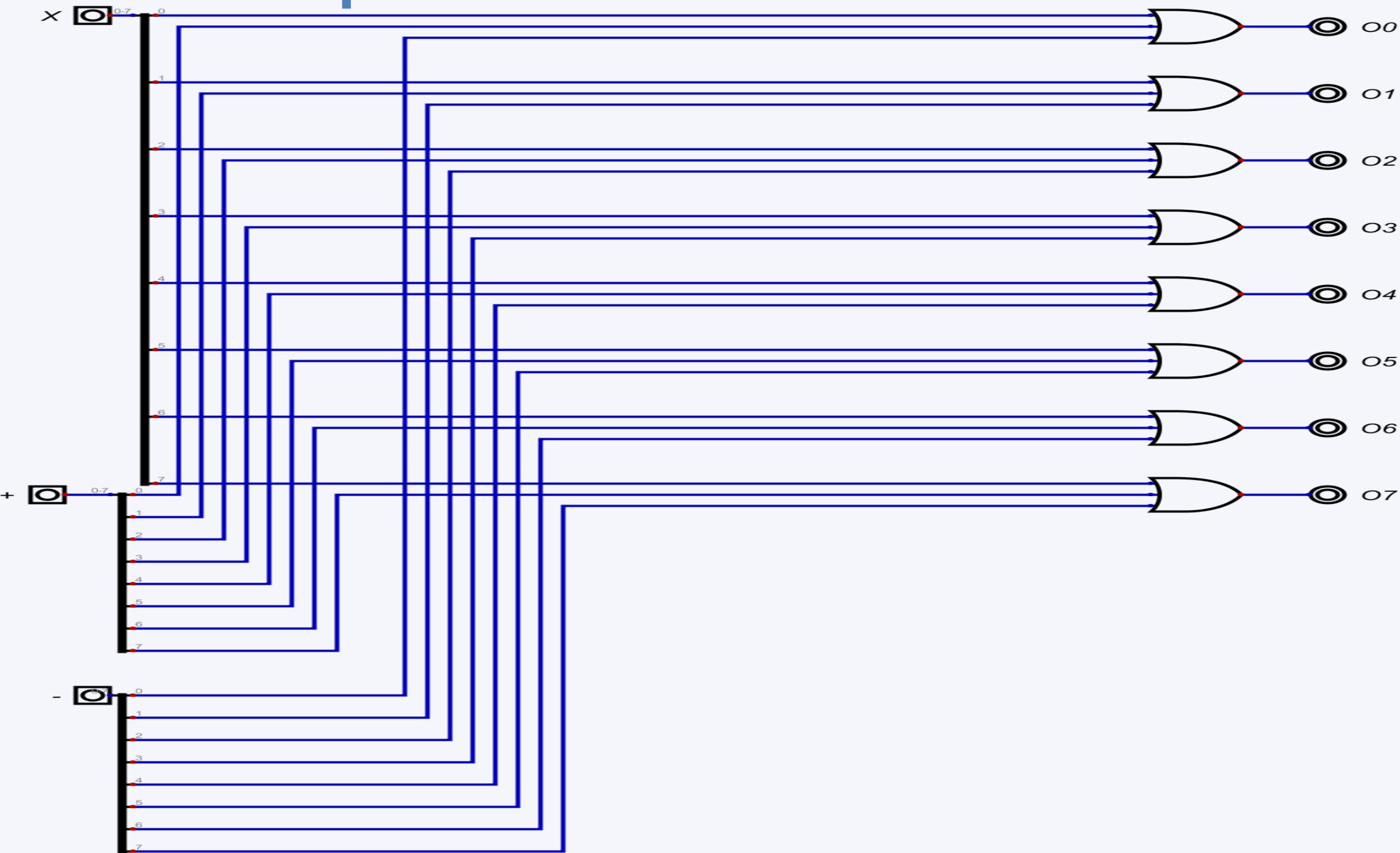
Operation Multiplication (015)D

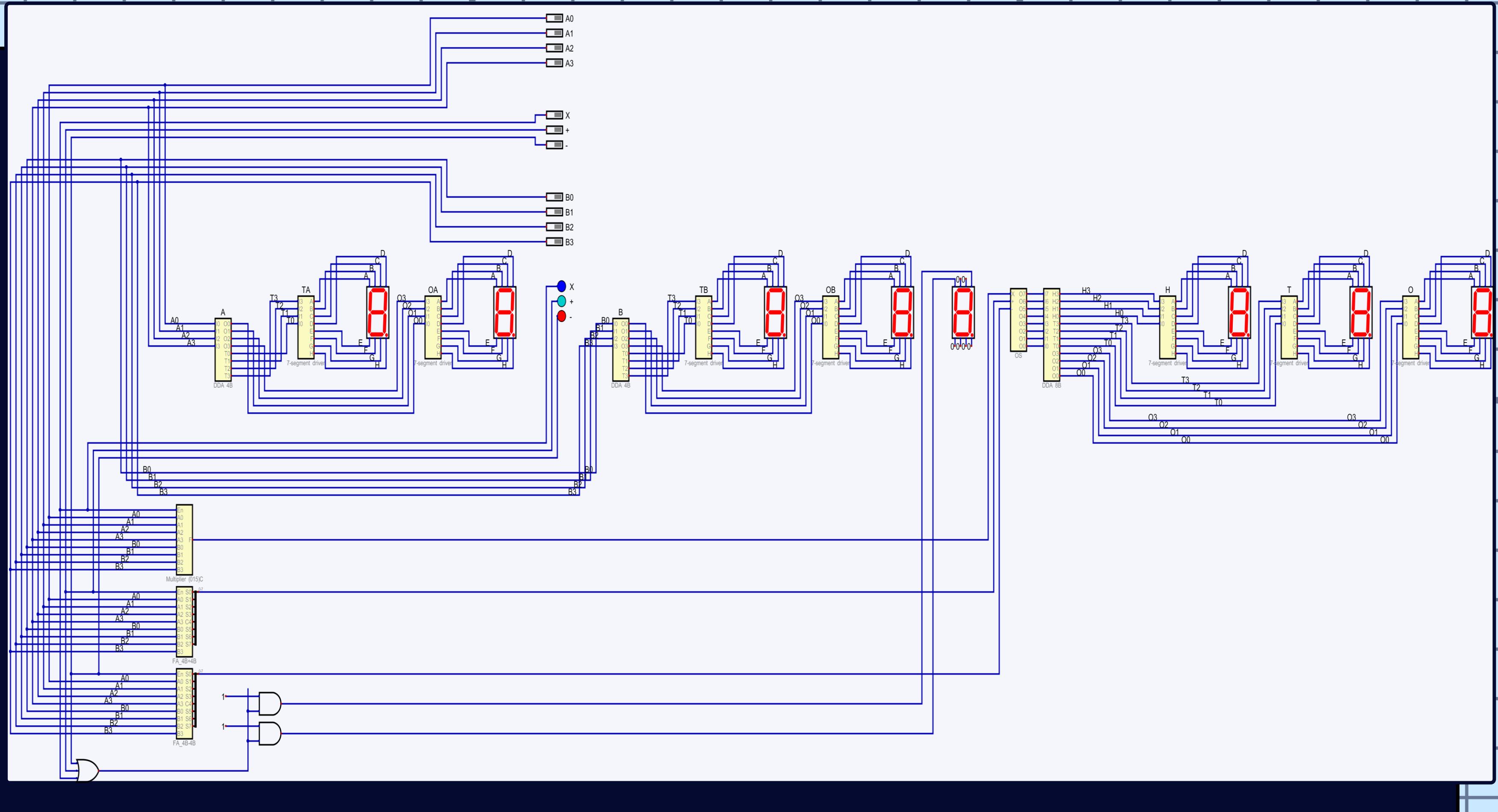


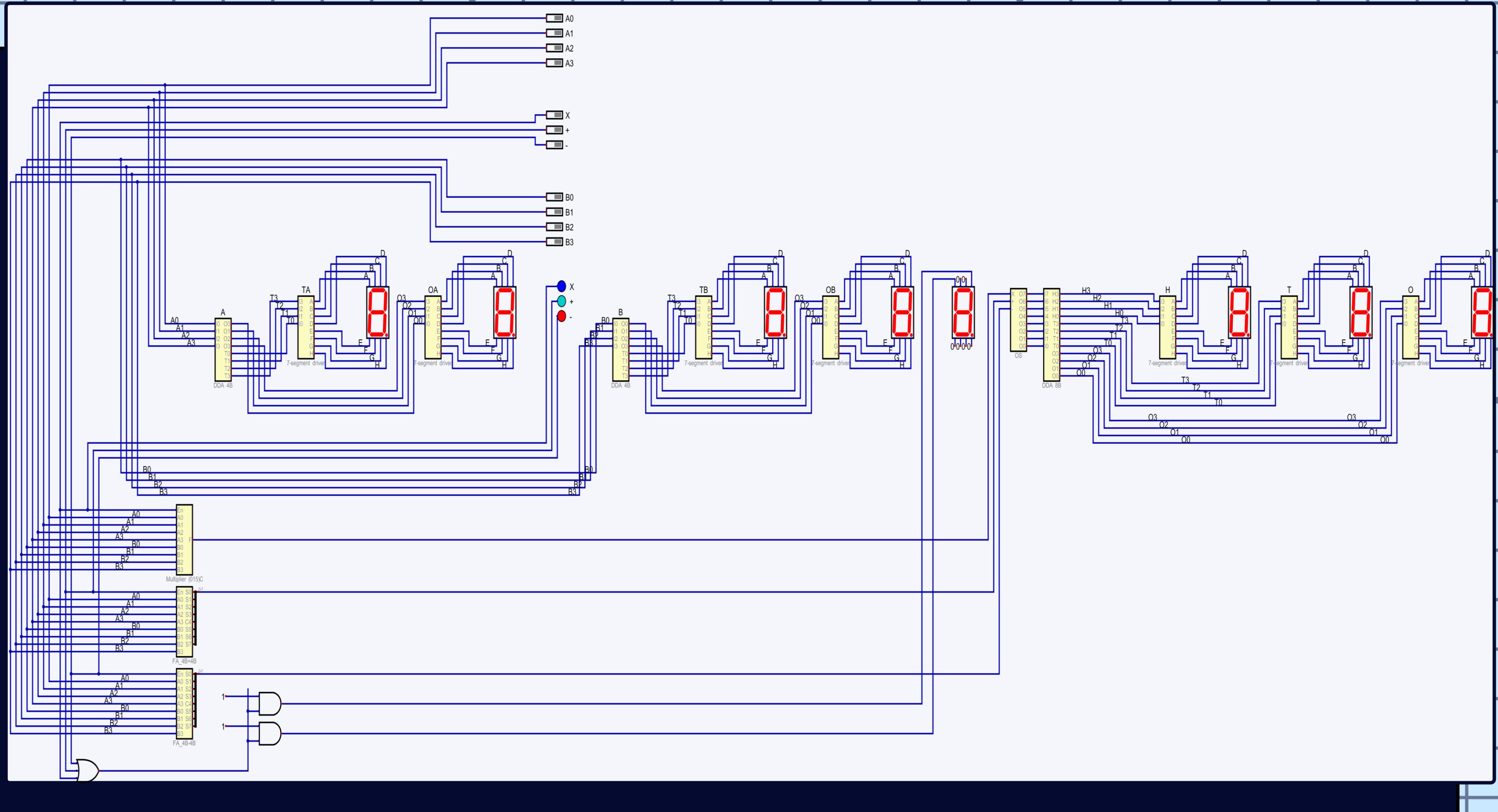
Operation Multiplication (015)M

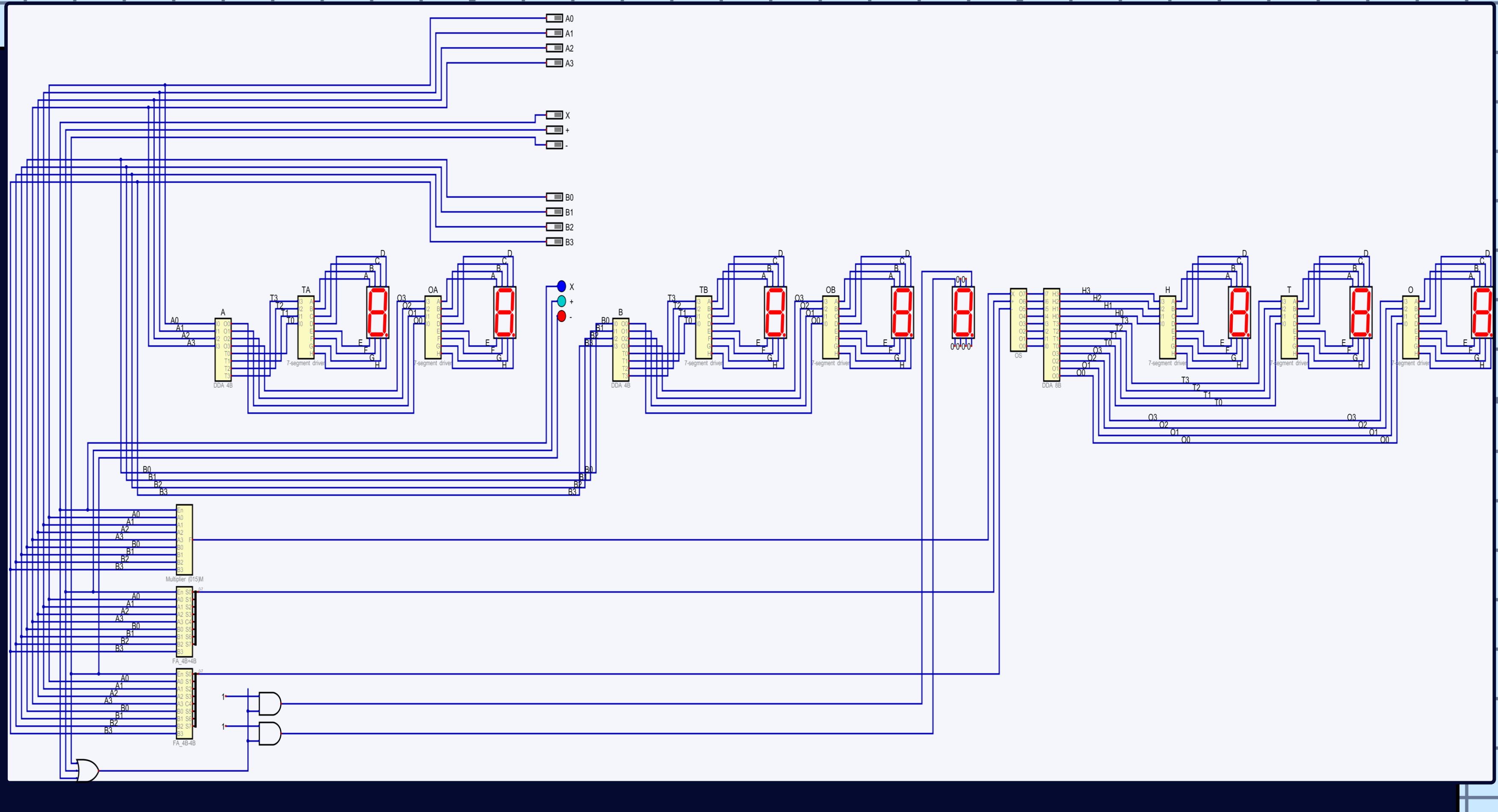


Operation Selector (OS)









Multiplication table of Zero

		E=0					
W X		Y Z	0 0	0 1	1 1	1 0	
0 0	0	0	0	1	0	3	0
	0			1			

		F=0						M0
	XW	Y _Z	0 0	0 1	1 1	1 0		
2	0 0	0 0	0 0	0 1	0 3	0 2		

W	X	Y	Z	0	0	0	1	1	1	0
0	0	0	0	0	0	0	1	0	3	0
0	1	0	4	0	0	5	0	7	0	0
1	1	0	12	0	0	13	0	15	0	0
1	0	0	8	0	0	9	0	11	0	0

	WX	0 0	0 1	1 1	1 0
2	0 0	0 0	0 1	0 3	0 2
6	0 1	0 4	0 5	0 7	0 6
4	1 1	0 12	0 13	0 15	0 14
0	1 0	0 8	0 9	0 11	0 10

G

		E=0					
WY WX		0 0	0 1	1 1	1 0		
0 0	0 0	0 1	0 3	0	0		
0 1	0 4	0 5	0 7	0	0		
1 1	0 12	0 13	0 15	0	0		
1 0	0 8	0 9	0 11	0	0		

		F=0						M0
	W X	Y Z	0 0	0 1	1 1	1 0		
2	0 0		0 0	0 1	0 3	0 2		
6	0 1		0 4	0 5	0 7	0 6		
4	1 1		0 12	0 13	0 15	0 14		
0	1 0		0 8	0 9	0 11	0 10		

YZ
WM

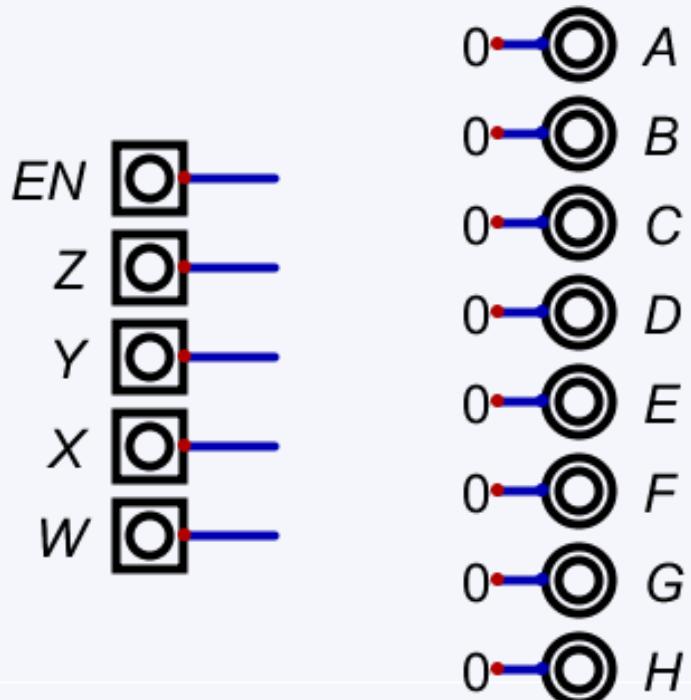
0	0	0	0	0	0
0	1	0	4	0	5
1	1	0	12	0	13
1	0	0	9	0	0

0	0	0	0	1	0	3	0	2
0	1	0	4	0	5	0	7	0
1	1	0	12	0	13	0	15	0
1	0	0	0	0	0	11	0	10

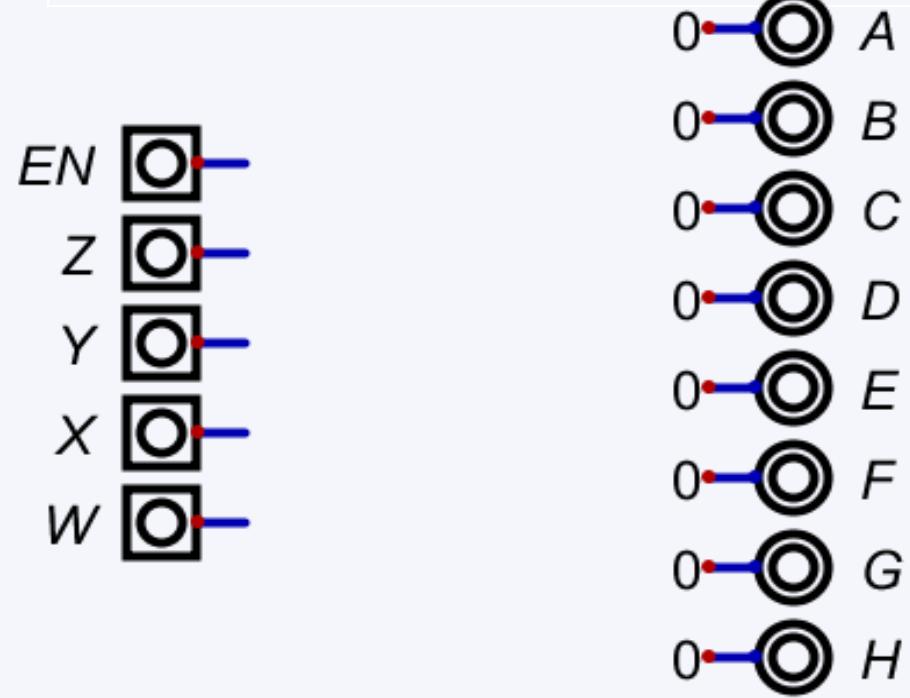
G=

Multiplication table of One design

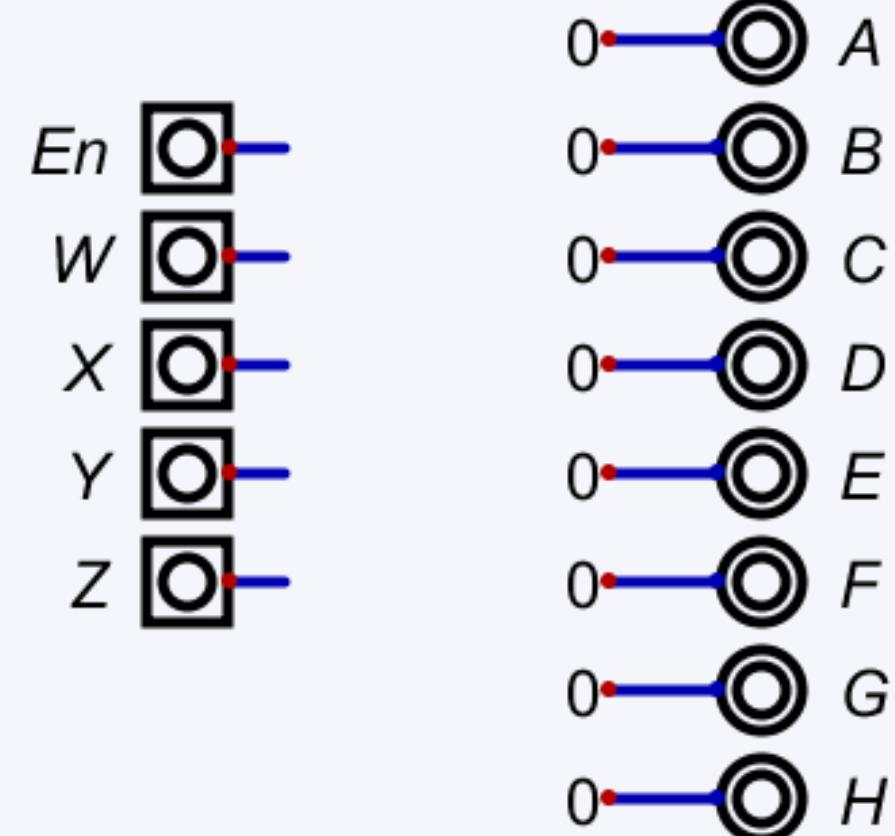
Combinational (C M0T)



Multiplexer (M M0T)



Decoder (D M0T)



Multiplication table of One

$A=0$

W	X	Y	Z	A	B	C	D	E	F	G	H
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	1	0	0	0	0	0	0	0	0
1	0	1	1	1	0	0	0	0	0	0	0
1	0	1	1	0	0	0	0	0	0	0	0

$B=0$

W	X	Y	Z	A	B	C	D	E	F	G	H
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	1	0	0	0	0	0	0	0	0
1	0	1	1	1	0	0	0	0	0	0	0
1	0	1	1	0	0	0	0	0	0	0	0

M1

$C=0$

W	X	Y	Z	A	B	C	D	E	F	G	H
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	1	0	0	0	0	0	0	0	0
1	0	1	1	1	0	0	0	0	0	0	0
1	0	1	1	0	0	0	0	0	0	0	0

$E=W$

W	X	Y	Z	A	B	C	D	E	F	G	H
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	1	0	0	0	0	0	0	0	0
1	1	1	1	1	0	0	0	0	0	0	0
1	1	1	1	0	0	0	0	0	0	0	0

$F=X$

W	X	Y	Z	A	B	C	D	E	F	G	H
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	1	0	0	0	0	0	0	0	0
1	1	1	1	1	0	0	0	0	0	0	0
1	1	1	1	0	0	0	0	0	0	0	0

M1

$D=0$

W	X	Y	Z	A	B	C	D	E	F	G	H
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	1	0	0	0	0	0	0	0	0
1	1	1	1	1	0	0	0	0	0	0	0
1	1	1	1	0	0	0	0	0	0	0	0

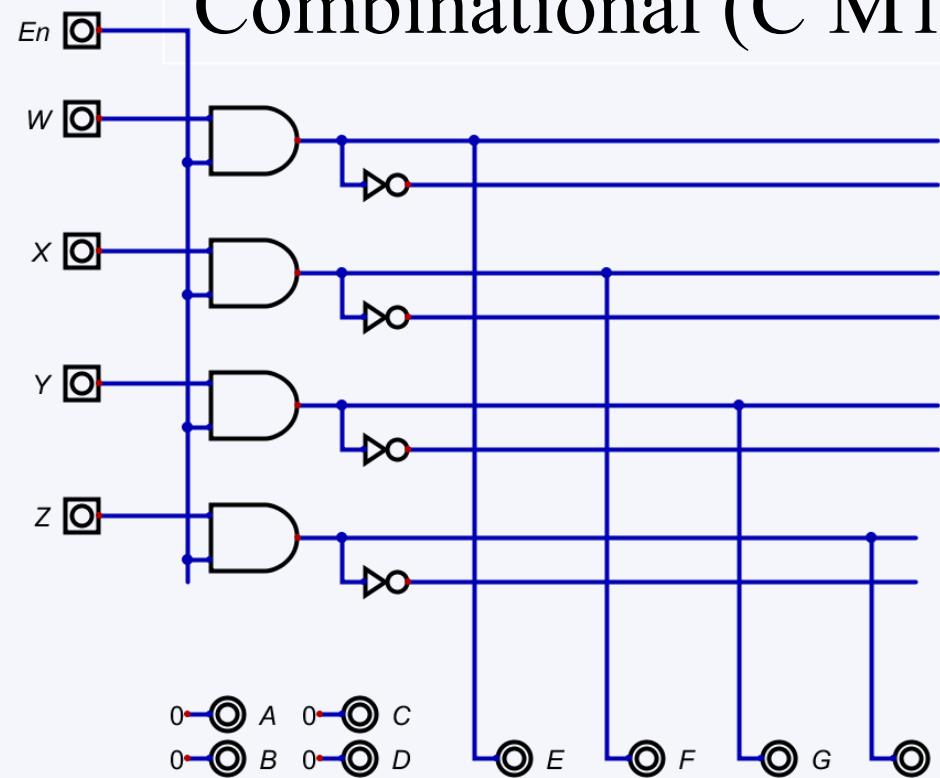
$G=Y$

$H=Z$

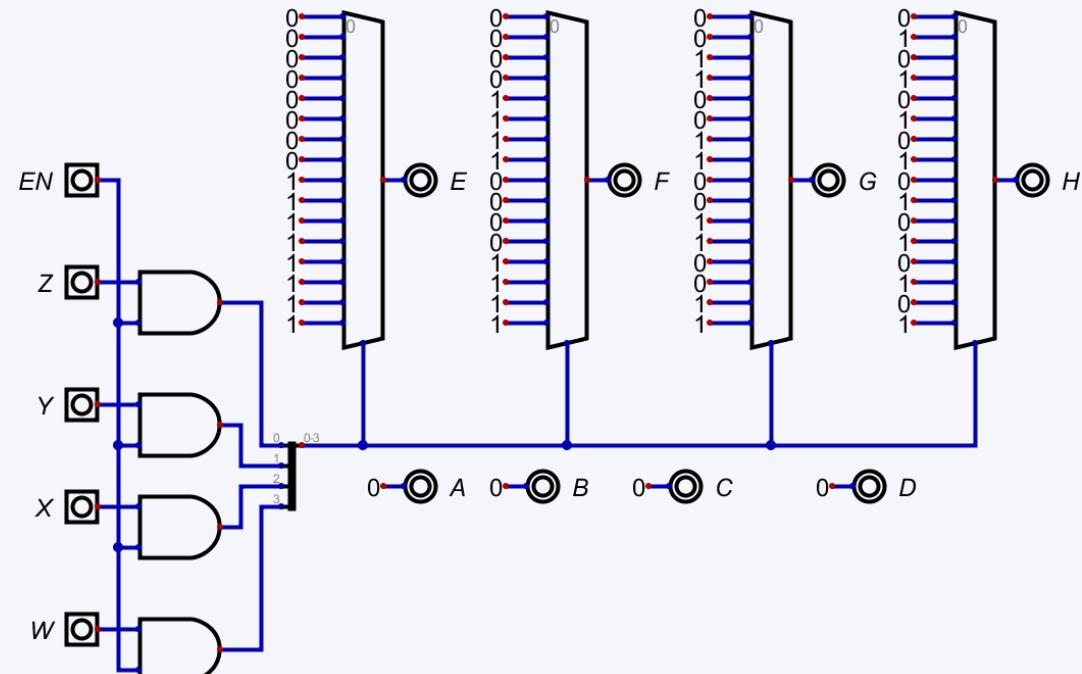
1	En	W	X	Y	Z	A	B	C	D	E	F	G	H
0	1	0	X	X	X	0	0	0	0	0	0	0	0
0	1	0	0	0	0	0	0	0	0	0	0	0	0
1	1	0	0	0	1	0	0	0	0	0	0	0	1
2	1	0	0	1	0	0	0	0	0	0	0	1	0
3	1	0	0	1	1	0	0	0	0	0	0	1	1
4	1	0	1	0	0	0	0	0	0	0	1	0	0
5	1	0	1	0	1	0	0	0	0	0	1	0	1
6	1	0	1	1	0	0	0	0	0	0	1	1	0
7	1	0	1	1	1	0	0	0	0	0	1	1	1
8	1	1	0	0	0	0	0	0	0	1	0	0	0
9	1	1	0	0	1	0	0	0	0	1	0	0	1
10	1	1	0	1	0	0	0	0	0	1	0	1	0
11	1	1	0	1	1	0	0	0	0	1	0	1	1
12	1	1	1	0	0	0	0	0	0	1	1	0	0
13	1	1	1	0	1	0	0	0	0	1	1	0	1
14	1	1	1	1	0	0	0	0	0	1	1	1	0
15	1	1	1	1	1	0	0	0	0	1	1	1	1

Multiplication table of One design

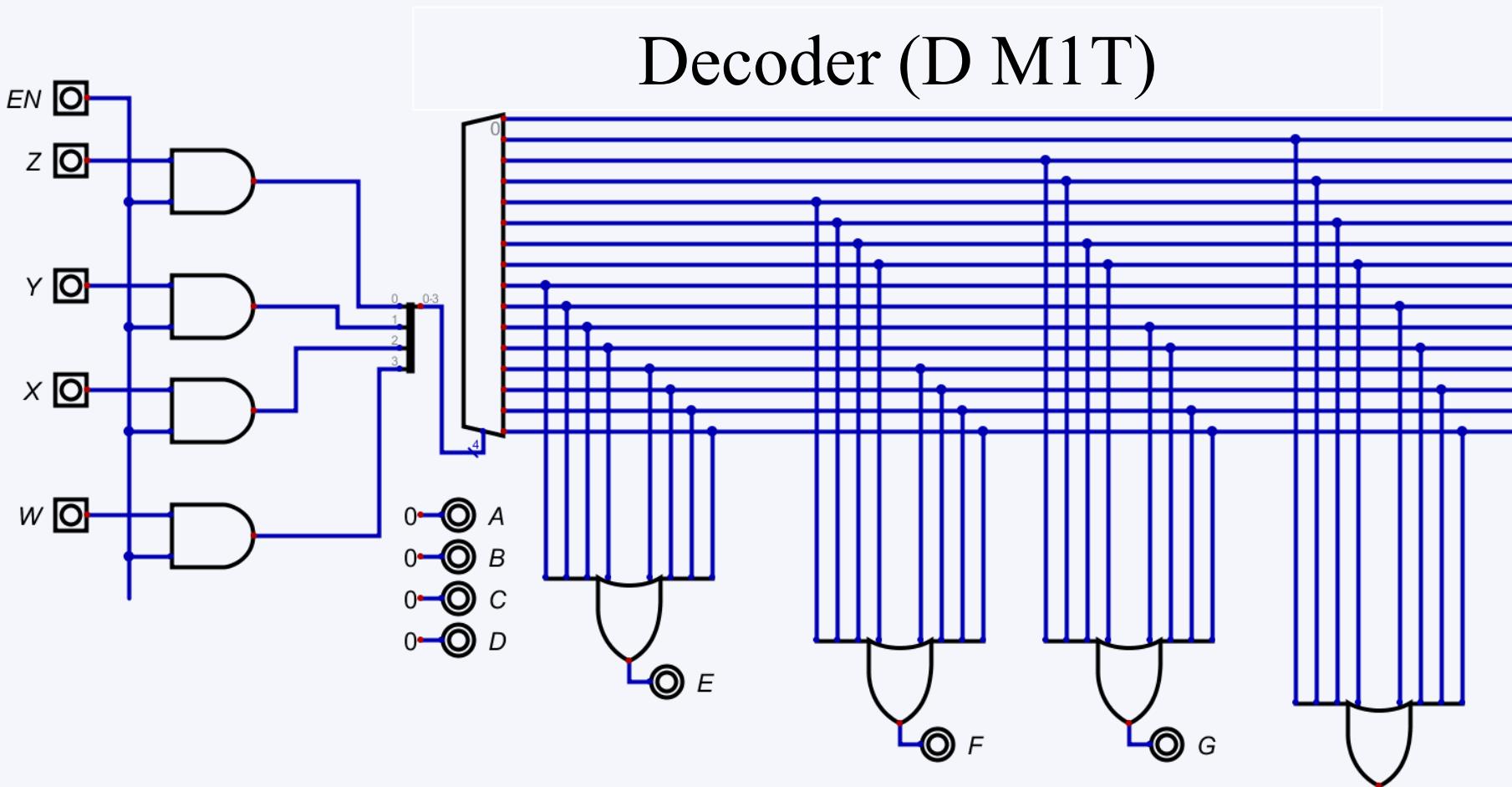
Combinational (C M1T)



Multiplexer (M M1T)



Decoder (D M1T)

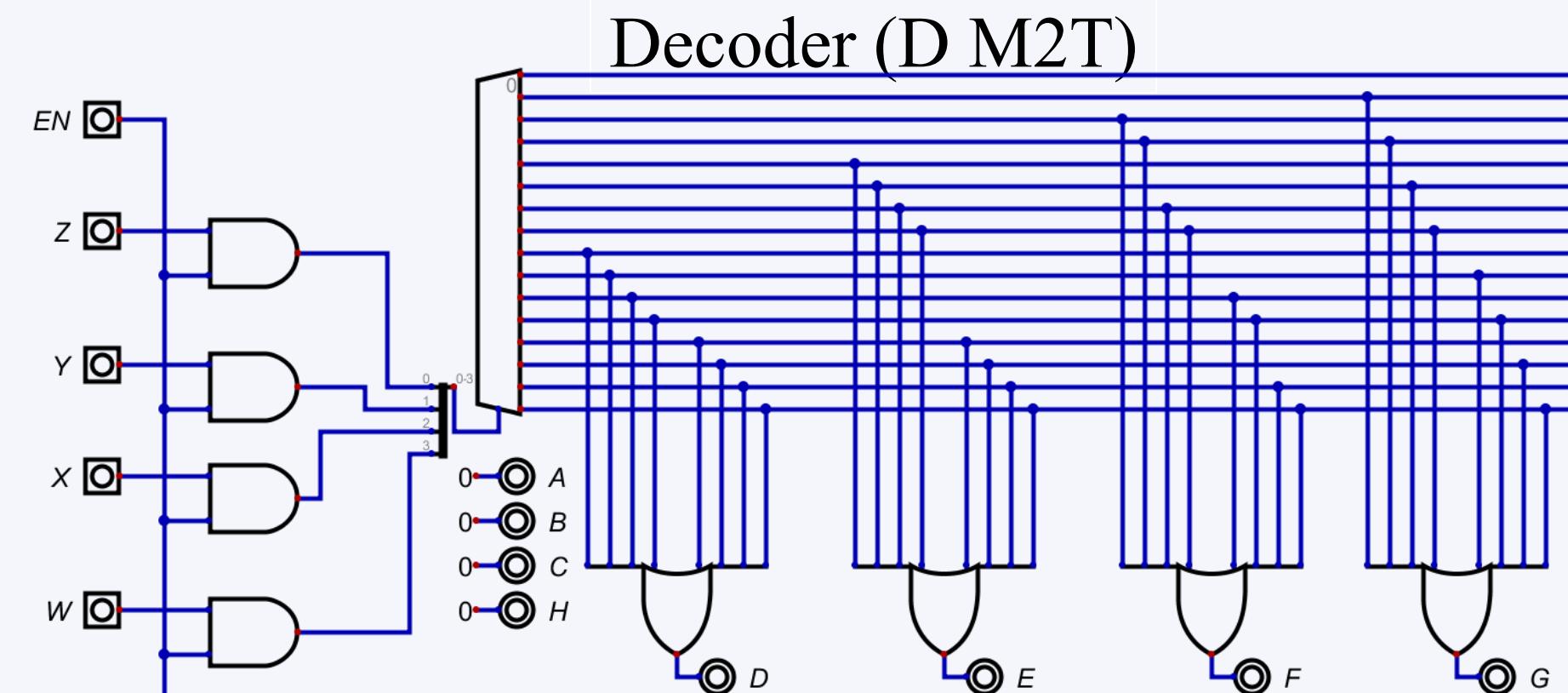
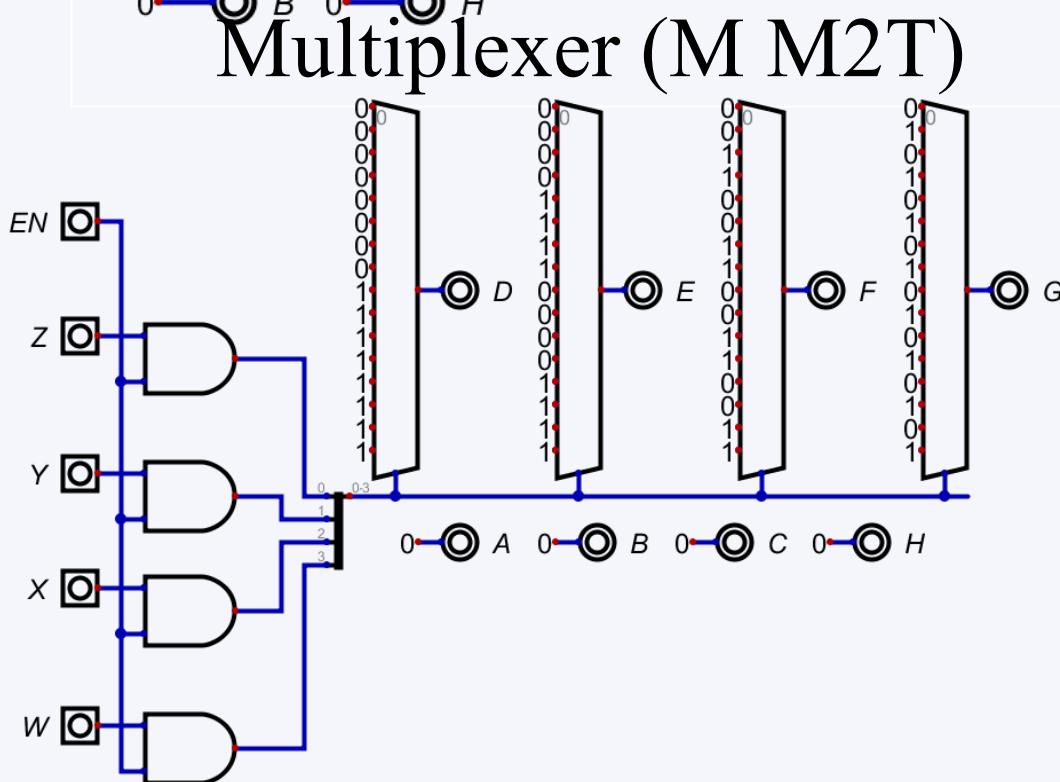
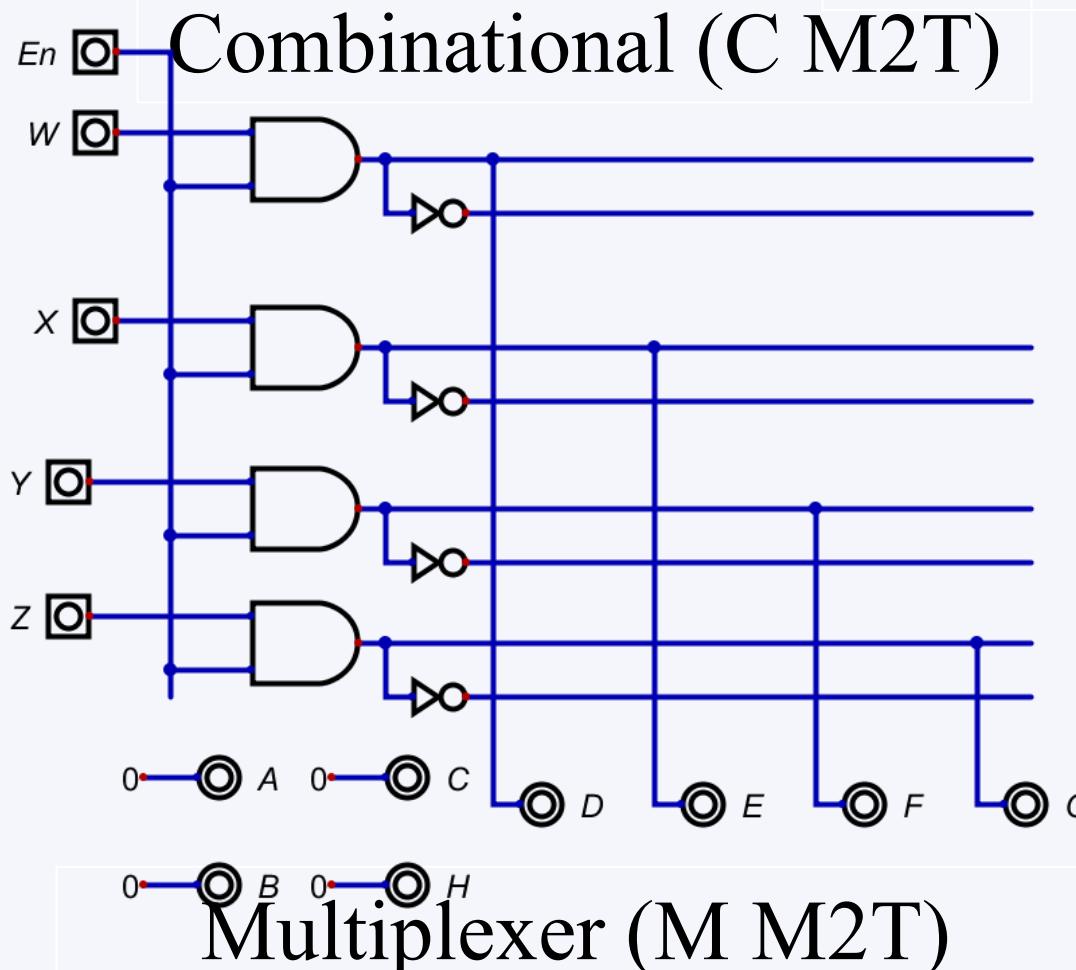


Multiplication table of Two

		A=0				B=0				M2			
		W	X	Y	Z	W	X	Y	Z	W	X	Y	Z
0	0	0	0	1	1	0	0	1	1	0	0	1	1
0	1	0	0	4	5	0	0	4	5	0	0	4	5
1	1	0	12	0	13	0	12	0	13	0	12	0	13
1	0	0	8	0	9	0	8	0	9	0	8	0	9
		W	X	Y	Z	W	X	Y	Z	W	X	Y	Z
		W	X	Y	Z	W	X	Y	Z	W	X	Y	Z
0	0	0	0	1	0	0	0	1	0	0	0	1	0
0	1	0	0	4	5	0	0	4	5	0	0	4	5
1	1	0	12	0	13	0	12	0	13	0	12	0	13
1	0	0	8	0	9	0	8	0	9	0	8	0	9
		W	X	Y	Z	W	X	Y	Z	W	X	Y	Z
C=0													
		E=X	F=Y	G=Z	H=0	D=W	E=X	F=Y	G=Z	H=0	D=W	E=X	F=Y
0	0	0	0	1	1	0	0	0	1	0	0	1	1
0	1	1	4	1	5	1	4	1	5	1	4	1	5
1	1	1	12	1	13	1	12	1	13	1	12	1	13
1	0	0	8	0	9	0	8	0	9	0	8	0	9
		W	X	Y	Z	W	X	Y	Z	W	X	Y	Z
0	0	0	0	1	1	0	0	0	1	0	0	1	1
0	1	0	4	0	5	0	4	0	5	0	4	0	5
1	1	0	12	0	13	0	12	0	13	0	12	0	13
1	0	0	8	0	9	0	8	0	9	0	8	0	9
		W	X	Y	Z	W	X	Y	Z	W	X	Y	Z
G=Z													

2	En	W	X	Y	Z	A	B	C	D	E	F	G	H
0	0	X	X	X	X	0	0	0	0	0	0	0	0
0	1	0	0	0	0	0	0	0	0	0	0	0	0
1	1	0	0	0	1	0	0	0	0	0	0	1	0
2	1	0	0	1	0	0	0	0	0	0	1	0	0
3	1	0	0	1	1	0	0	0	0	0	1	1	0
4	1	0	1	0	0	0	0	0	0	1	0	0	0
5	1	0	1	0	1	0	0	0	0	0	1	0	1
6	1	0	1	1	0	0	0	0	0	0	1	1	0
7	1	0	1	1	1	0	0	0	0	0	1	1	1
8	1	1	0	0	0	0	0	0	0	1	0	0	0
9	1	1	1	0	1	0	0	0	0	1	0	0	1
10	1	1	0	1	0	0	0	0	0	1	0	1	0
11	1	1	0	1	1	0	0	0	0	1	0	1	1
12	1	1	1	0	0	0	0	0	0	1	1	0	0
13	1	1	1	0	1	0	0	0	0	1	1	0	1
14	1	1	1	1	0	0	0	0	0	1	1	1	0
15	1	1	1	1	1	0	0	0	0	1	1	1	1

Multiplication table of Two design



Multiplication table of Three

W	X	Y	Z	A=0
0	0	0	0	0
0	0	1	0	1
0	1	1	0	1
1	0	0	0	0

W	X	Y	Z	B=0
0	0	0	0	0
0	0	1	0	3
0	1	0	0	7
1	0	0	0	6

W	X	Y	Z	C=WX+YZ
0	0	0	0	0
0	0	1	0	1
0	1	0	0	3
1	0	0	0	2

W	X	Y	Z	D=W'XY+WY'Y'+WX'Z'
0	0	0	0	0
0	0	1	0	1
0	1	0	0	1
1	0	0	0	1

W	X	Y	Z	E=W'XY'+WX'Y'+WXY+WYZ'+W'X'YZ
0	0	0	0	0
0	0	1	0	1
0	1	0	0	1
1	0	0	0	1

W	X	Y	Z	F=XY'+XZ+X'YZ'
0	0	0	0	0
0	0	1	0	1
0	1	0	0	1
1	0	0	0	1

G=Y'Z+YZ'

W	X	Y	Z	M3
0	0	0	0	0
0	0	1	0	3
0	1	0	0	7
1	0	0	0	6

W	X	Y	Z	M3
0	0	0	0	0
0	0	1	0	1
0	1	0	0	5
1	0	0	0	7

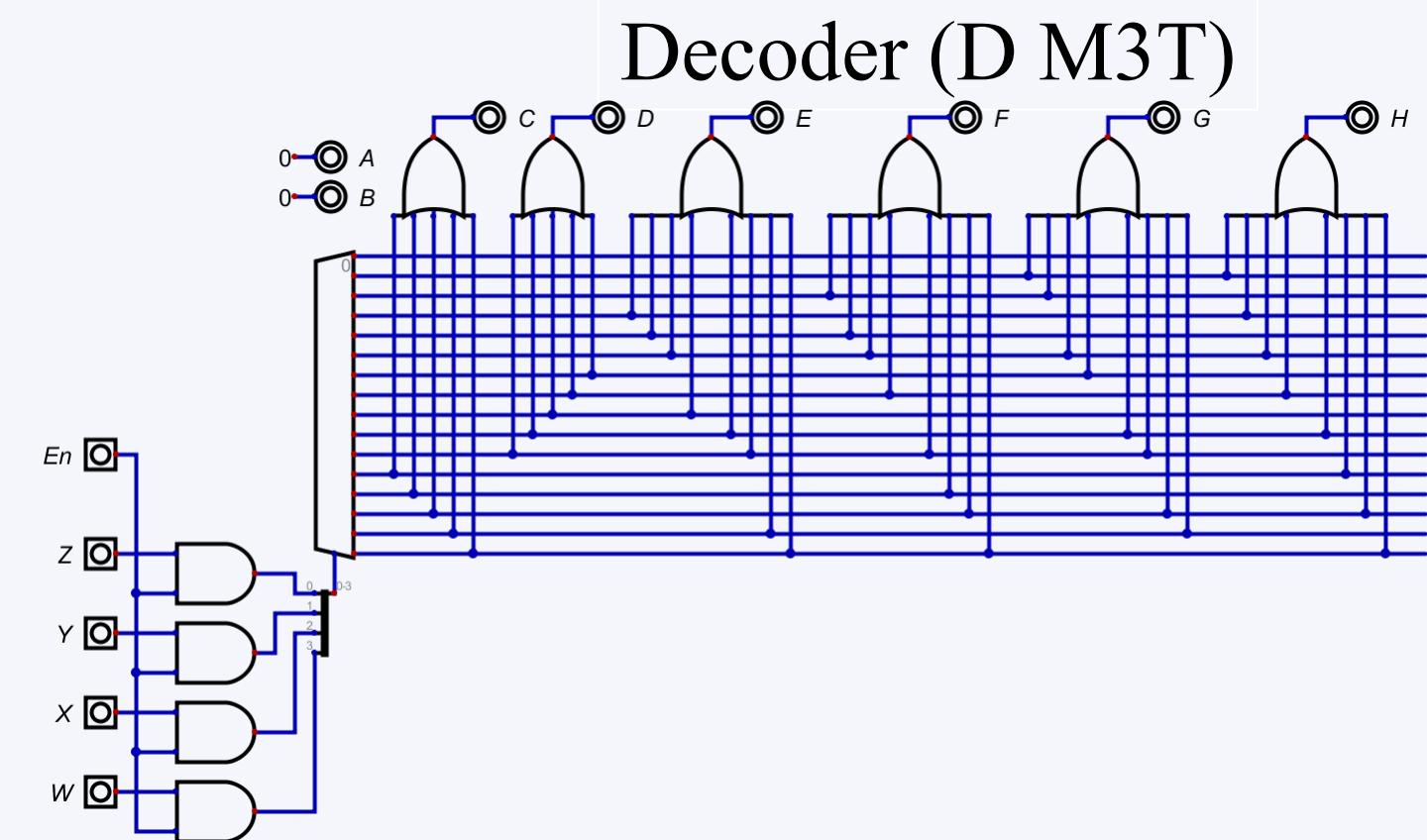
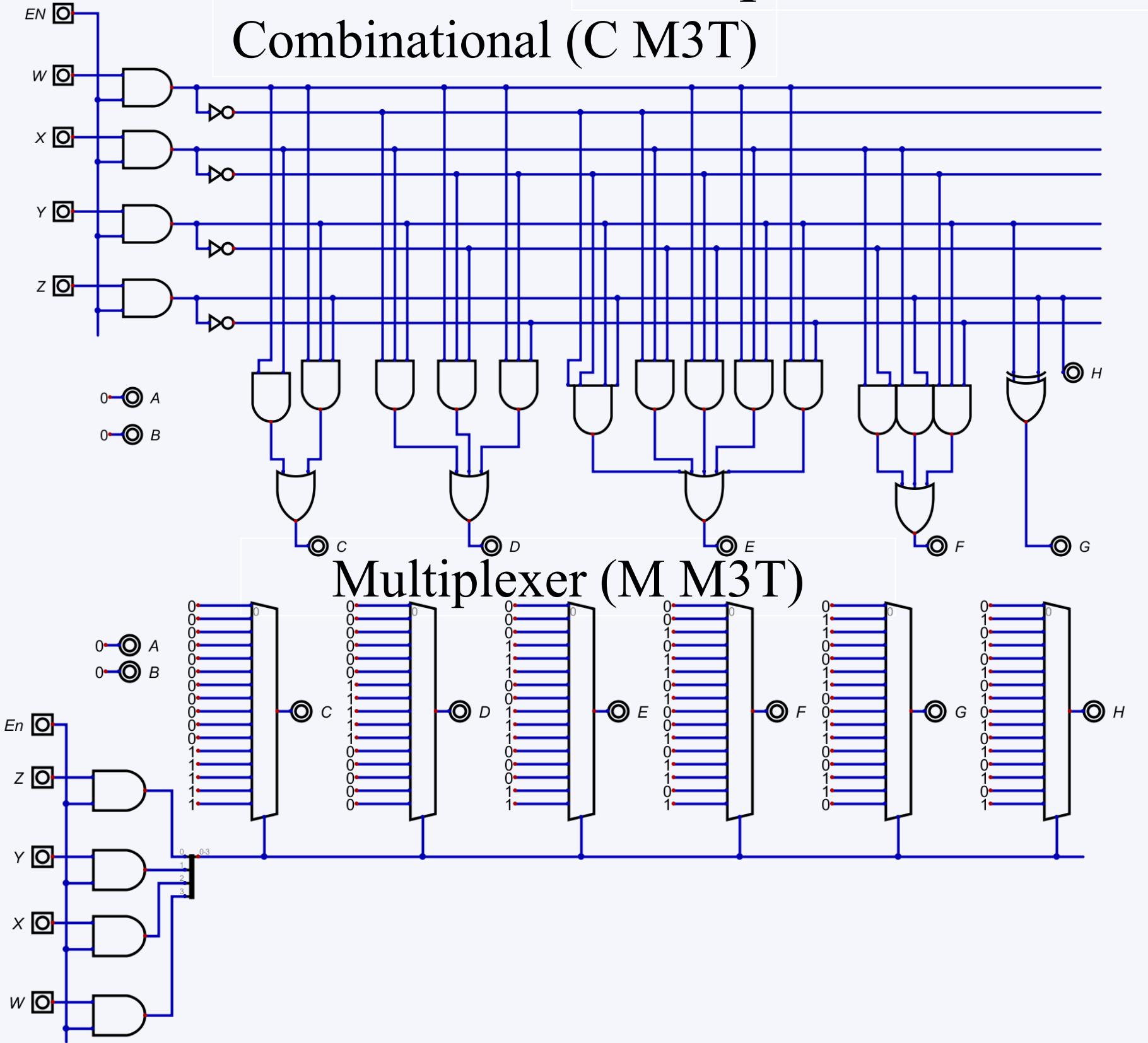
W	X	Y	Z	M3
0	0	0	0	0
0	0	1	0	3
0	1	0	0	7
1	0	0	0	6

W	X	Y	Z	M3
0	0	0	0	0
0	0	1	0	1
0	1	0	0	5
1	0	0	0	7

W	X	Y	Z	H=Z
0	0	0	0	0
0	0	1	0	3
0	1	0	0	7
1	0	0	0	6

3	En	W	X	Y	Z	A	B	C	D	E	F	G	H
0	0	X	X	X	X	0	0	0	0	0	0	0	0
0	1	0	0	0	0	0	0	0	0	0	0	0	0
1	1	0	0	0	1	0	0	0	0	0	0	1	1
2	1	0	0	1	0	0	0	0	0	0	1	1	0
3	1	0	0	1	1	0	0	0	0	1	0	0	1
4	1	0	1	0	0	0	0	0	0	1	1	0	0
5	1	0	1	0	1	0	0	0	0	0	1	1	1
6	1	0	1	1	0	0	0	0	0	1	0	0	1
7	1	0	1	1	1	0	0	0	0	1	0	1	0
8	1	1	0	0	0	0	0	0	0	1	1	0	0
9	1	1	0	0	1	0	0	0	0	1	1	0	1
10	1	1	0	1	0	0	0	0	0	1	1	1	0
11	1	1	0	1	1	0	0	0	1	0	0	0	1
12	1	1	1	0	0	0	1	0	0	0	1	0	0
13	1	1	1	0	1	0	0	1	0	0	1	1	1
14	1	1	1	1	0	0	0	1	0	1	0	1	0
15	1	1	1	1	1	0	0	1	0	1	1	0	1

Multiplication table of Three design



Multiplication table of Four

		A=0			
		W X	Y Z		
0 0	0 0	0 0	0 1	1 1	1 0
0 1	0 4	0 0	0 1	0 3	0 2
1 1	0 12	0 0	0 1	0 7	0 6
1 0	0 8	0 0	0 1	0 9	0 10

		B=0			
		W X	Y Z		
0 0	0 0	0 0	0 1	1 1	1 0
0 1	0 4	0 0	0 1	0 3	0 2
1 1	0 12	0 0	0 1	0 7	0 6
1 0	0 8	0 0	0 1	0 9	0 10

		C=W			
		W X	Y Z		
0 0	0 0	0 0	0 1	1 1	1 0
0 1	0 4	0 0	0 1	1 3	1 2
1 1	1 12	1 1	1 1	1 13	1 15
1 0	1 8	1 1	1 1	1 9	1 11

		D=X			
		W X	Y Z		
0 0	0 0	0 0	0 1	1 1	1 0
0 1	1 4	0 0	0 1	1 3	1 2
1 1	1 12	1 1	1 1	1 13	1 15
1 0	1 8	0 0	0 1	1 9	1 11

		E=Y			
		W X	Y Z		
0 0	0 0	0 0	0 1	1 1	1 0
0 1	0 4	0 0	0 1	1 7	1 6
1 1	1 12	1 1	1 1	1 13	1 15
1 0	1 8	0 0	0 1	1 11	1 10

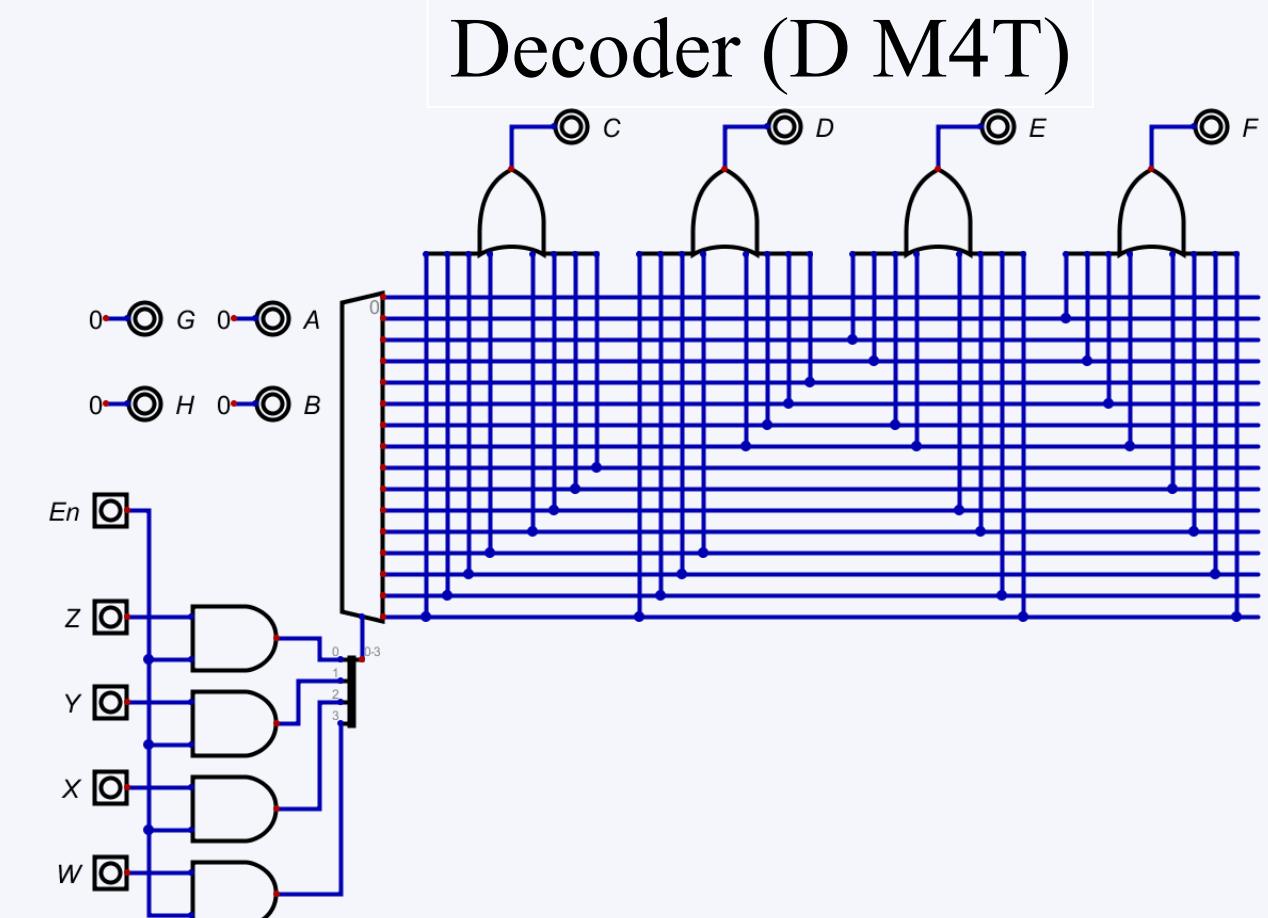
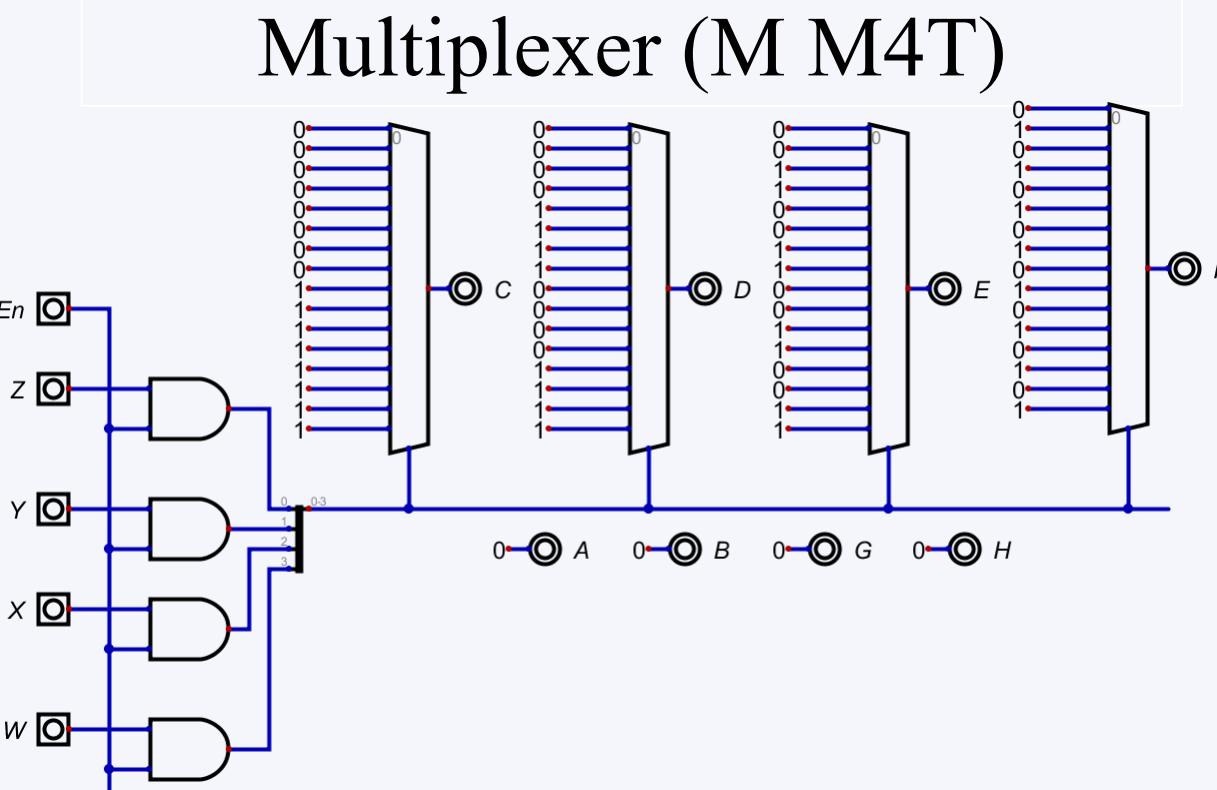
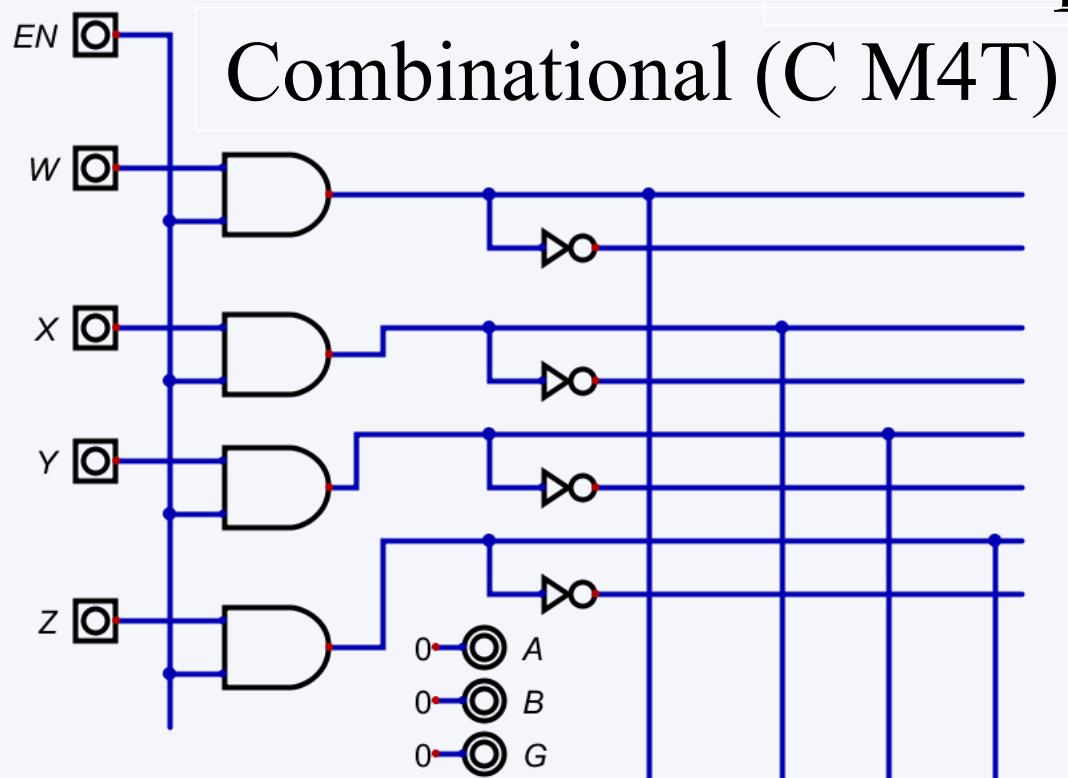
		F=Z			
		W X	Y Z		
0 0	0 0	0 0	0 1	1 1	1 0
0 1	0 4	0 0	0 1	1 5	1 7
1 1	1 12	1 1	1 1	1 13	1 15
1 0	1 8	0 0	0 1	1 9	1 11

		G=0			
		W X	Y Z		
0 0	0 0	0 0	0 1	0 3	0 2
0 1	0 4	0 0	0 1	0 7	0 6
1 1	0 12	0 0	0 1	0 13	0 15
1 0	0 8	0 0	0 1	0 9	0 11

		H=0			
		W X	Y Z		
0 0	0 0	0 0	0 1	0 3	0 2
0 1	0 4	0 0	0 1	0 5	0 7
1 1	0 12	0 0	0 1	0 13	0 15
1 0	0 8	0 0	0 1	0 9	0 11

4	En	W	X	Y	Z	A	B	C	D	E	F	G	H
0	0	X	X	X	X	0	0	0	0	0	0	0	0
1	1	0	0	0	0	0	0	0	0	0	0	0	0
2	1	0	0	0	1	0	0	0	0	0	1	0	0
3	1	0	0	1	1	0	0	0	0	0	1	1	0
4	1	0	1	0	0	0	0	0	0	1	0	0	0
5	1	0	1	0	1	0	0	0	0	1	0	1	0
6	1	0	1	1	0	0	0	0	0	1	1	0	0
7	1	0	1	1	1	0	0	0	0	1	1	1	0
8	1	1	0	0	0	0	0	1	0	0	0	0	0
9	1	1	1	0	1	0	0	1	0	0	1	0	0
10	1	1	0	1	0	0	0	1	0	1	0	0	0
11	1	1	0	1	1	0	0	1	0	1	1	0	0
12	1	1	1	0	0	0	0	1	1	0	0	0	0
13	1	1	1	0	1	0	0	1	1	0	1	0	0
14	1	1	1	1	0	0	0	1	1	1	0	0	0
15	1	1	1	1	1	0	0	1	1	1	1	0	0

Multiplication table of Four design



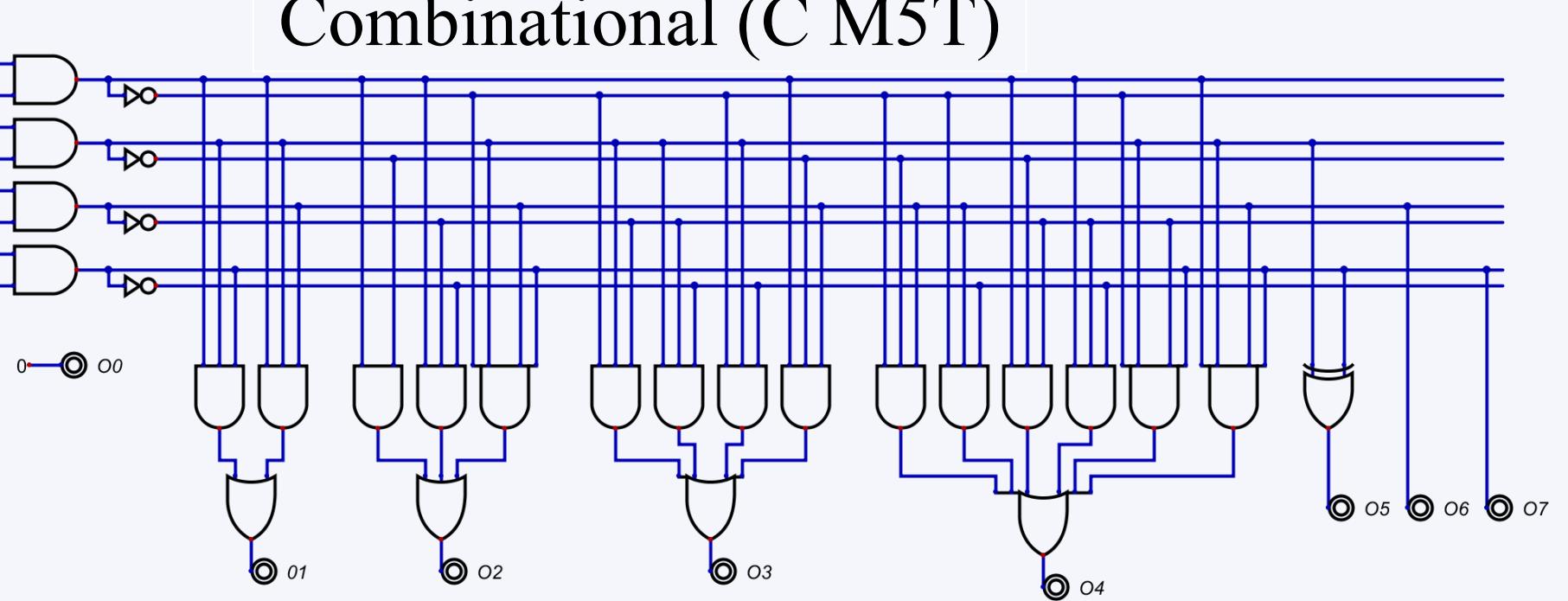
Multiplication table of Five

		A=0				B=WXZ+WXY				M5			
		W	X	Y	Z	W	X	Y	Z	W	X	Y	Z
0	0	0	0	1	1	0	0	1	1	0	0	0	2
0	1	0	4	0	5	0	1	4	5	0	1	4	6
1	1	0	12	0	13	0	1	12	13	1	1	15	14
1	0	0	8	0	9	0	1	8	9	0	1	11	10
		W	X	Y	Z	W	X	Y	Z	W	X	Y	Z
0	0	0	0	1	1	0	0	0	1	0	0	0	2
0	1	0	4	0	5	0	1	1	4	1	0	7	6
1	1	1	12	0	13	0	1	12	13	1	1	15	14
1	0	1	8	1	9	1	0	8	9	1	1	11	10
C=WX'+WY'Z'+W'XYZ													
		W	X	Y	Z	W	X	Y	Z	W	X	Y	Z
0	0	0	0	1	1	0	0	1	1	0	0	0	2
0	1	0	4	1	5	0	1	4	5	0	1	7	6
1	1	1	12	0	13	0	1	12	13	1	1	15	14
1	0	1	8	1	9	1	0	8	9	1	1	11	10
		W	X	Y	Z	W	X	Y	Z	W	X	Y	Z
0	0	0	0	1	1	0	0	0	1	1	0	0	2
0	1	0	4	0	5	0	1	4	5	0	1	7	6
1	1	1	12	0	13	0	1	12	13	1	1	15	14
1	0	1	8	1	9	1	0	8	9	1	1	11	10
		W	X	Y	Z	W	X	Y	Z	W	X	Y	Z
0	0	0	0	1	1	0	0	0	1	1	0	0	2
0	1	0	4	0	5	0	1	4	5	0	1	7	6
1	1	1	12	0	13	0	1	12	13	1	1	15	14
1	0	1	8	0	9	0	1	8	9	0	1	11	10
G=Y													
		W	X	Y	Z	W	X	Y	Z	W	X	Y	Z
0	0	0	0	1	1	0	0	0	1	1	0	0	2
0	1	0	4	0	5	0	1	4	5	0	1	7	6
1	1	1	12	0	13	0	1	12	13	1	1	15	14
1	0	1	8	0	9	0	1	8	9	0	1	11	10
		W	X	Y	Z	W	X	Y	Z	W	X	Y	Z
0	0	0	0	1	1	0	0	0	1	1	0	0	2
0	1	0	4	0	5	0	1	4	5	0	1	7	6
1	1	1	12	0	13	0	1	12	13	1	1	15	14
1	0	1	8	0	9	0	1	8	9	0	1	11	10

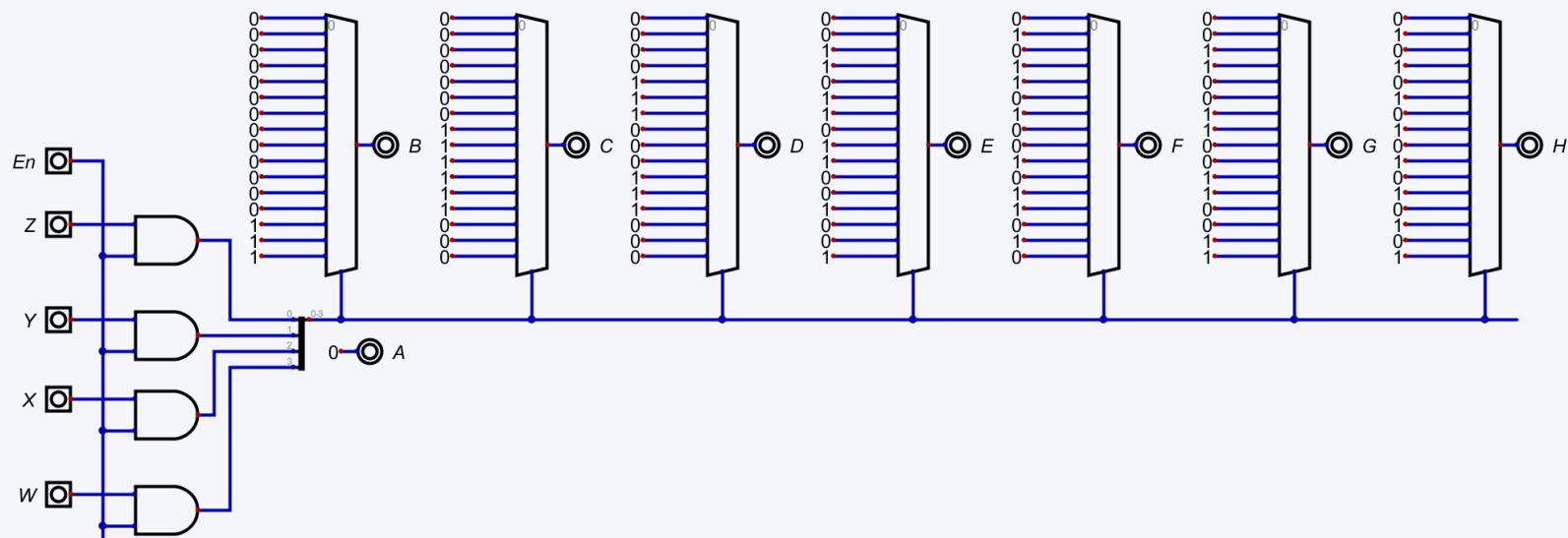
5	En	W	X	Y	Z	A	B	C	D	E	F	G	H
0	0	X	X	X	X	0	0	0	0	0	0	0	0
0	1	0	0	0	0	0	0	0	0	0	0	0	0
1	1	0	0	0	1	0	0	0	0	0	1	0	1
2	1	0	0	1	0	0	0	0	0	1	0	1	0
3	1	0	0	1	1	0	0	0	0	1	1	1	1
4	1	0	1	0	0	0	0	0	1	0	1	0	0
5	1	0	1	0	1	0	0	0	0	1	1	0	0
6	1	0	1	1	0	0	0	0	0	1	1	1	0
7	1	0	1	1	1	0	0	0	1	0	0	0	1
8	1	1	0	0	0	0	0	0	1	0	1	0	0
9	1	1	0	0	1	0	0	0	1	0	1	1	0
10	1	1	0	1	0	0	0	1	1	0	0	1	0
11	1	1	0	1	1	0	0	1	1	0	1	1	1
12	1	1	1	0	0	0	1	1	1	1	1	0	0
13	1	1	1	0	1	0	1	0	0	0	0	0	1
14	1	1	1	1	0	0	1	0	0	0	1	1	0
15	1	1	1	1	1	0	1	0	0	1	0	1	1

Multiplication table of Five design

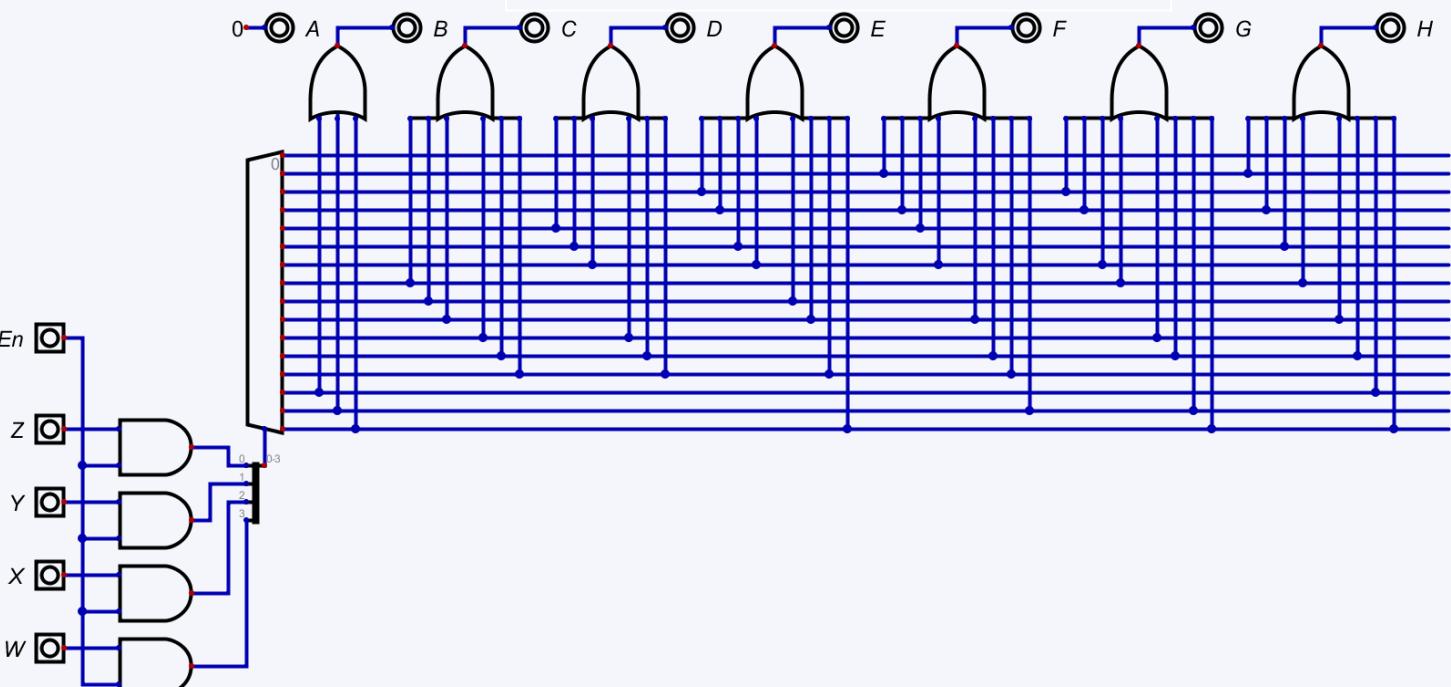
Combinational (C M5T)



Multiplexer (M M5T)



Decoder (D M5T)



Multiplication table of Six

	$\cancel{W} \cancel{X}$	$Y \cancel{Z}$	$A=0$	
	0 0	0 1	1 1	1 0
0 0	0 0	0 1	0 3	0 2
0 1	0 4	0 5	0 7	0 6
1 1	0 12	0 13	0 15	0 14
1 0	0 8	0 9	0 11	0 10

	$\cancel{W} \cancel{X}$	$Y \cancel{Z}$	$B=W\bar{X}+WYZ$	
	0 0	0 1	1 1	1 0
0 0	0 0	0 1	1 3	2
0 1	0 4	0 5	0 7	6
1 1	0 12	0 13	0 15	14
1 0	0 8	0 9	0 11	10

	$\cancel{W} \cancel{X}$	$Y \cancel{Z}$	$C=W'XY+W'X'Y'+WX'YZ'$	
	0 0	0 1	1 1	1 0
0 0	0 0	0 1	1 3	2
0 1	0 4	0 5	1 7	6
1 1	0 12	0 13	1 15	14
1 0	1 8	1 9	1 11	1 10

$C=W'XY+W'X'Y'+WX'YZ'$

	$\cancel{W} \cancel{X}$	$Y \cancel{Z}$	$E=XY'+XZ+X'YZ'$	
	0 0	0 1	1 1	1 0
0 0	0 0	0 1	1 3	1 2
0 1	1 4	1 5	1 7	6
1 1	1 12	1 13	1 15	14
1 0	8	9	11	1 10

$E=XY'+XZ+X'YZ'$

	$\cancel{W} \cancel{X}$	$Y \cancel{Z}$	$G=Z$	
	0 0	0 1	1 1	1 0
0 0	0 0	1	1 3	2
0 1	0 4	1 5	1 7	6
1 1	0 12	1 13	1 15	14
1 0	8	1 9	1 11	10

$G=Z$

	$\cancel{W} \cancel{X}$	$Y \cancel{Z}$	$M6$	
	0 0	0 1	1 1	1 0
0 0	0 0	0 1	1 3	2
0 1	0 4	0 5	0 7	6
1 1	1 12	1 13	1 15	1 14
1 0	1 8	1 9	1 11	1 10

	$\cancel{W} \cancel{X}$	$Y \cancel{Z}$	$M6$	
	0 0	0 1	1 1	1 0
0 0	0 0	0 1	1 3	2
0 1	1 4	1 5	0 7	6
1 1	1 12	1 13	1 15	1 14
1 0	1 8	1 9	1 11	1 10

	$\cancel{W} \cancel{X}$	$Y \cancel{Z}$	$D=WX'Y'+W'XY+WXY+WYZ+W'X'YZ$	
	0 0	0 1	1 1	1 0
0 0	0 0	0 1	1 3	2
0 1	1 4	1 5	0 7	6
1 1	1 12	1 13	1 15	1 14
1 0	1 8	1 9	1 11	1 10

$D=WX'Y'+W'XY+WXY+WYZ+W'X'YZ$

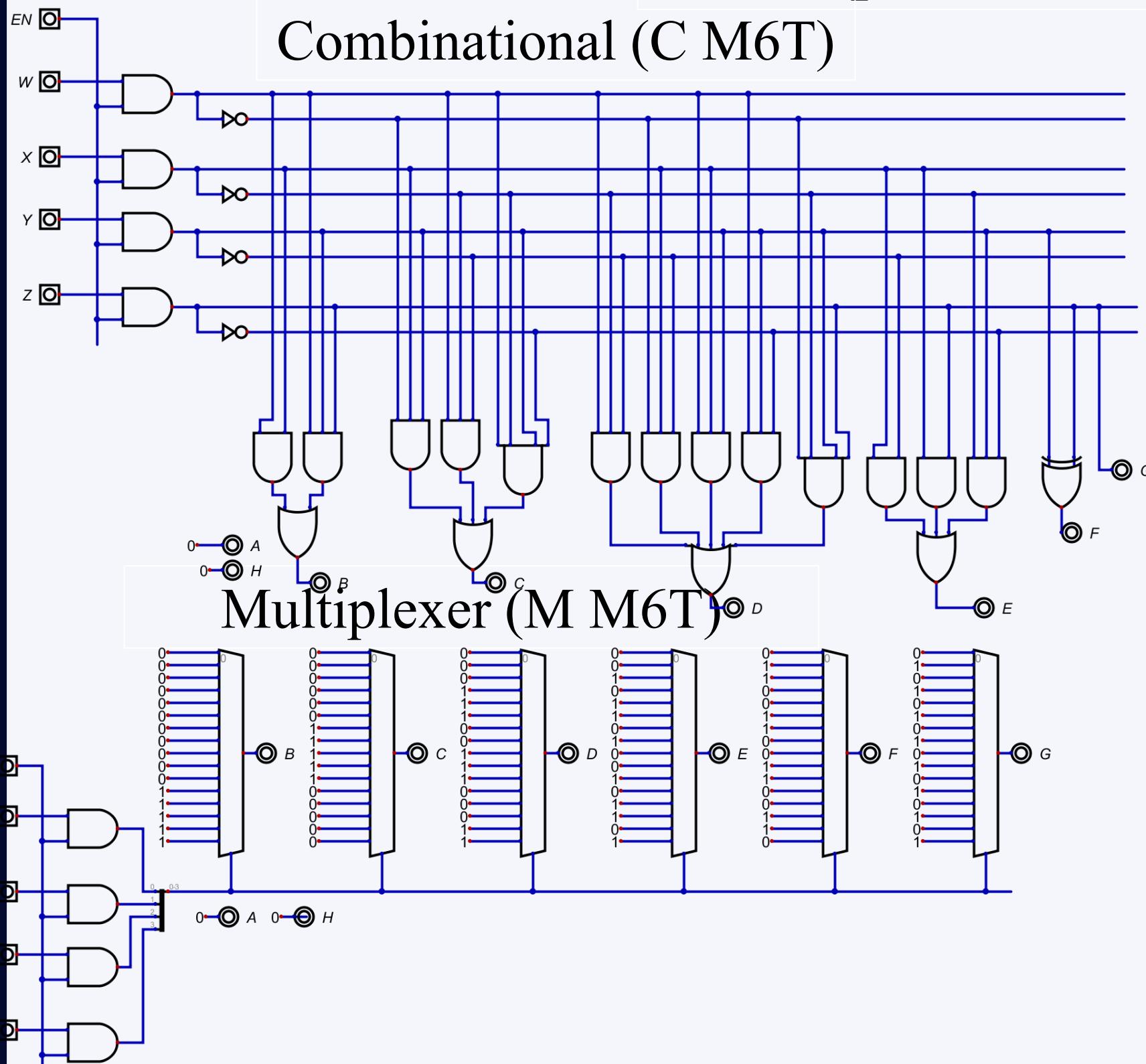
	$\cancel{W} \cancel{X}$	$Y \cancel{Z}$	$F=YZ'+Y'Z$	
	0 0	0 1	1 1	1 0
0 0	0 0	0 1	1 3	2
0 1	0 4	0 5	0 7	6
1 1	0 12	0 13	0 15	0 14
1 0	0 8	0 9	0 11	0 10

	$\cancel{W} \cancel{X}$	$Y \cancel{Z}$	$H=0$	
	0 0	0 1	1 1	1 0
0 0	0 0	0 1	0 3	2
0 1	0 4	0 5	0 7	6
1 1	0 12	0 13	0 15	0 14
1 0	0 8	0 9	0 11	0 10

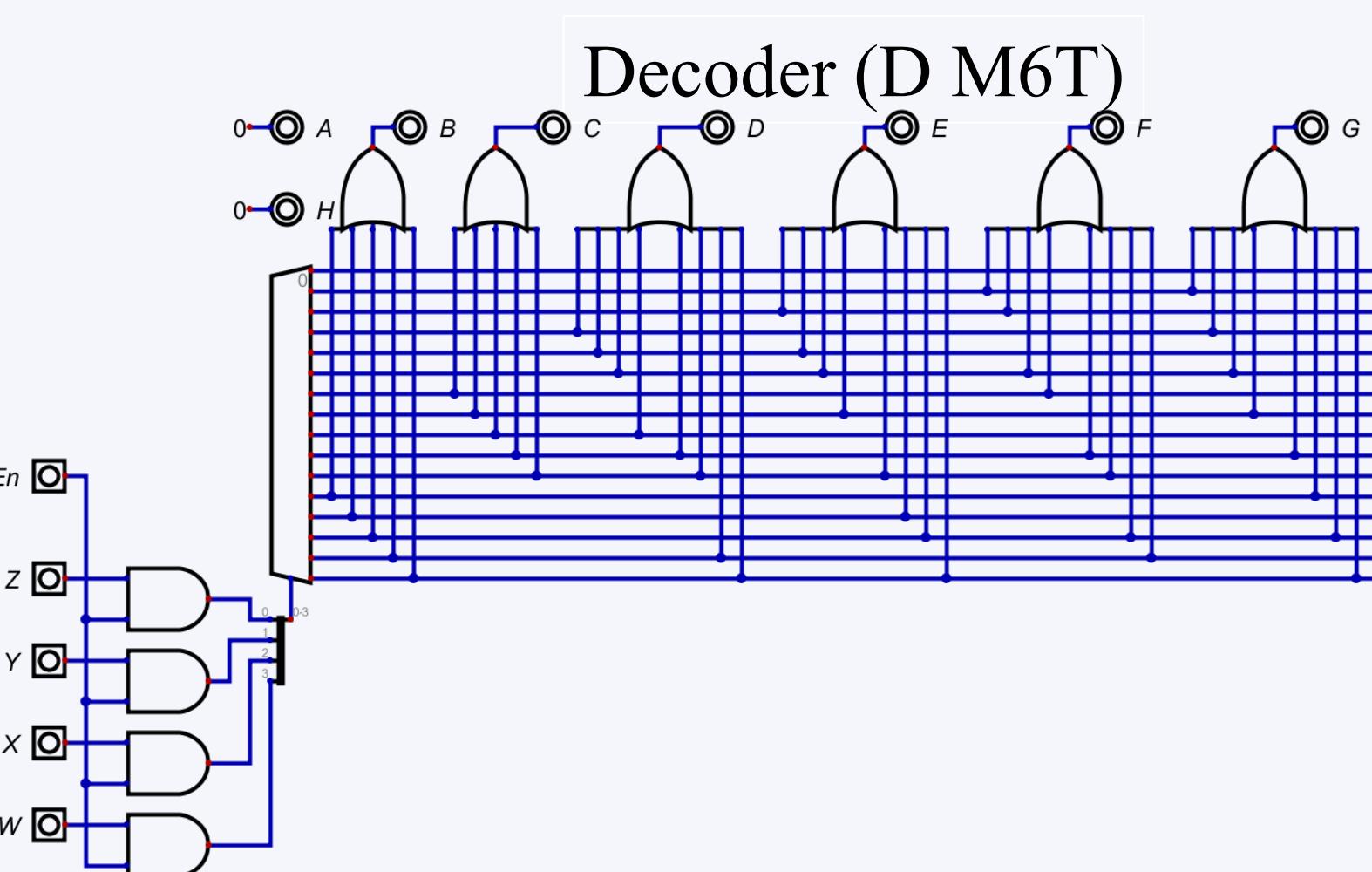
6	En	W	X	Y	Z	A	B	C	D	E	F	G	H
0	0	X	X	X	X	0	0	0	0	0	0	0	0
1	1	0	0	0	0	0	0	0	0	0	0	0	0
2	1	0	0	0	1	0	0	0	0	1	1	0	0
3	1	0	0	1	1	0	0	0	0	1	0	0	1
4	1	0	1	0	0	0	0	0	0	1	1	0	0
5	1	0	1	0	1	0	0	0	0	1	1	1	0
6	1	0	1	1	0	0	0	0	1	0	0	1	0
7	1	0	1	1	1	0	0	1	0	1	0	1	0
8	1	1	0	0	0	0	0	1	1	0	0	0	0
9	1	1	1	0	1	0	0	1	1	0	1	1	0
10	1	1	0	1	0	0	0	1	1	1	1	0	0
11	1	1	0	1	1	0	1	0	0	0	0	1	0
12	1	1	1	0	0	1	0	0	1	0	0	0	0

Multiplication table of Six design

Combinational (C M6T)



Multiplexer (M M6T)



Multiplication table of Seven

W X\YZ	0 0	0 1	1 1	1 0
A=0	0 0	0 1	1 1	1 0
0 0	0 0	0 1	0 3	0 2
0 1	0 4	0 5	0 7	0 6
1 1	0 12	0 13	0 15	0 14
1 0	0 8	0 9	0 11	0 10

W X\YZ	0 0	0 1	1 1	1 0
B=WX+WY	0 0	0 1	1 1	1 0
0 0	0	1	3	2
0 1	4	5	7	6
1 1	1 12	1 13	1 15	1 14
1 0	8	9	11	10

W X\YZ	0 0	0 1	1 1	1 0
C=XY+W'XZ+W'Y'	0 0	0 1	1 1	1 0
0 0	0	1	3	2
0 1	4	1 5	1 7	1 6
1 1	12	13	1 15	1 14
1 0	1 8	1 9	11	10

W X\YZ	0 0	0 1	1 1	1 0
D=WY'+XY'Z'+W'YZ	0 0	0 1	1 1	1 0
0 0	0	1	3	2
0 1	1 4	5	7	6
1 1	1 12	1 13	1 15	14
1 0	1 8	1 9	1 11	10

W X\YZ	0 0	0 1	1 1	1 0
E=WZ+W'X'Y'+W'YZ'+W'XY'Z'	0 0	0 1	1 1	1 0
0 0	0	1	3	1 2
0 1	1 4	5	7	1 6
1 1	1 12	1 13	1 15	14
1 0	1 8	1 9	1 11	10

W X\YZ	0 0	0 1	1 1	1 0
F=X'Y+X'Z+XY'Z'	0 0	0 1	1 1	1 0
0 0	0	1	3	1 2
0 1	1 4	5	7	1 6
1 1	1 12	1 13	1 15	14
1 0	1 8	1 9	1 11	1 10

W X\YZ	0 0	0 1	1 1	1 0
G=YZ'+Y'Z	0 0	0 1	1 1	1 0
0 0	0	1	3	1 2
0 1	1 4	5	7	1 6
1 1	1 12	1 13	15	1 14
1 0	1 8	1 9	11	1 10

W X\YZ	0 0	0 1	1 1	1 0
M7	0 0	0 1	1 1	1 0
0 0	0	1	3	2
0 1	4	5	7	6
1 1	1 12	1 13	1 15	1 14
1 0	8	9	11	10

W X\YZ	0 0	0 1	1 1	1 0
M7	0 0	0 1	1 1	1 0
0 0	0	1	1	3
0 1	1 4	5	7	6
1 1	1 12	1 13	15	14
1 0	1 8	1 9	11	10

W X\YZ	0 0	0 1	1 1	1 0
M7	0 0	0 1	1 1	1 0
0 0	0	1	1	2
0 1	1 4	5	7	6
1 1	1 12	1 13	15	14
1 0	1 8	1 9	11	10

W X\YZ	0 0	0 1	1 1	1 0
M7	0 0	0 1	1 1	1 0
0 0	0	1	1	3
0 1	1 4	5	7	6
1 1	1 12	1 13	1 15	14
1 0	1 8	1 9	11	10

W X\YZ	0 0	0 1	1 1	1 0
M7	0 0	0 1	1 1	1 0
0 0	0	1	1	2
0 1	1 4	5	7	6
1 1	1 12	1 13	1 15	14
1 0	1 8	1 9	1 11	10

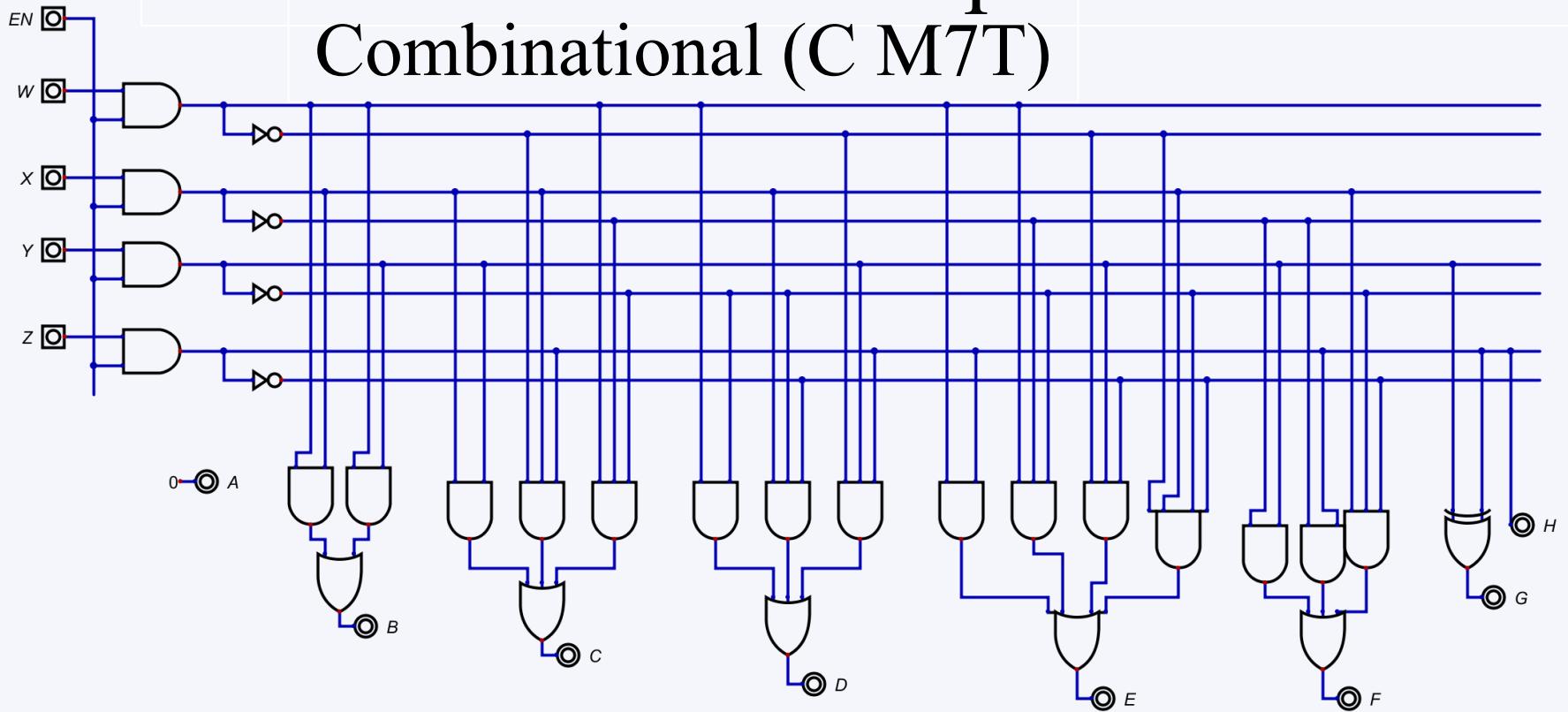
W X\YZ	0 0	0 1	1 1	1 0
H=Z	0 0	0 1	1 1	1 0
0 0	0	1	3	2
0 1	4	5	7	6
1 1	12	13	15	14
1 0	8	9	11	10

7	En	W	X	Y	Z	A	B	C	D	E	F	G	H

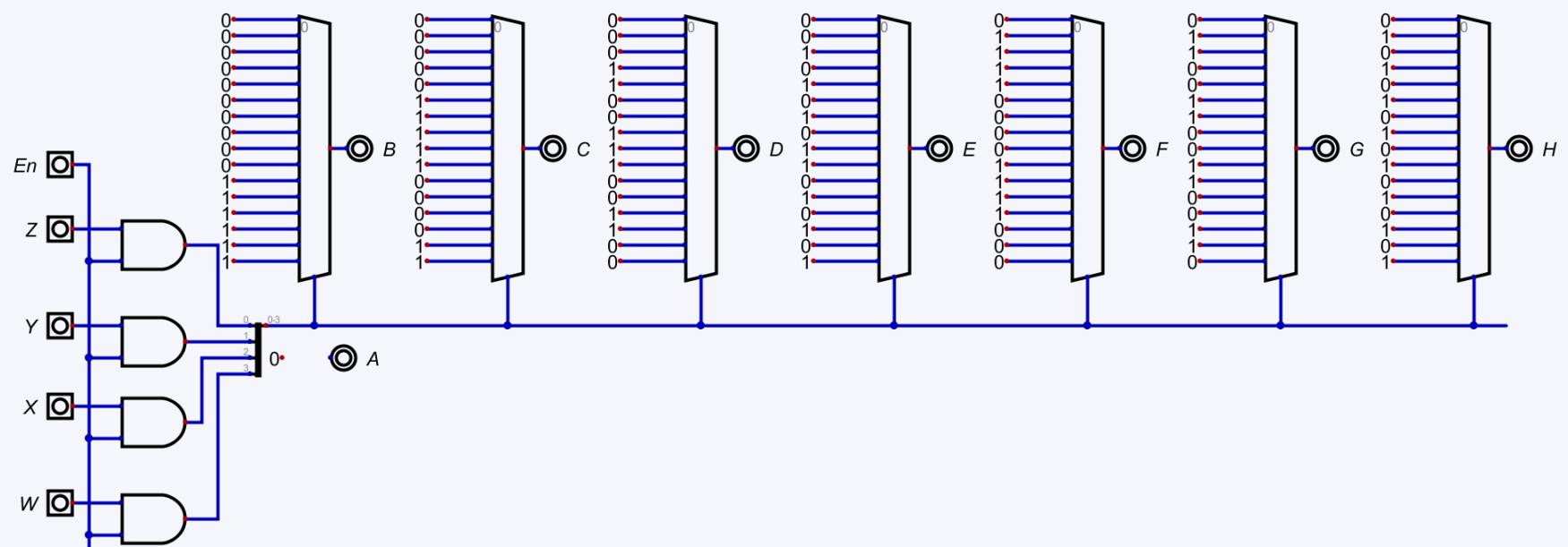
<tbl_r cells="1

Multiplication table of Seven design

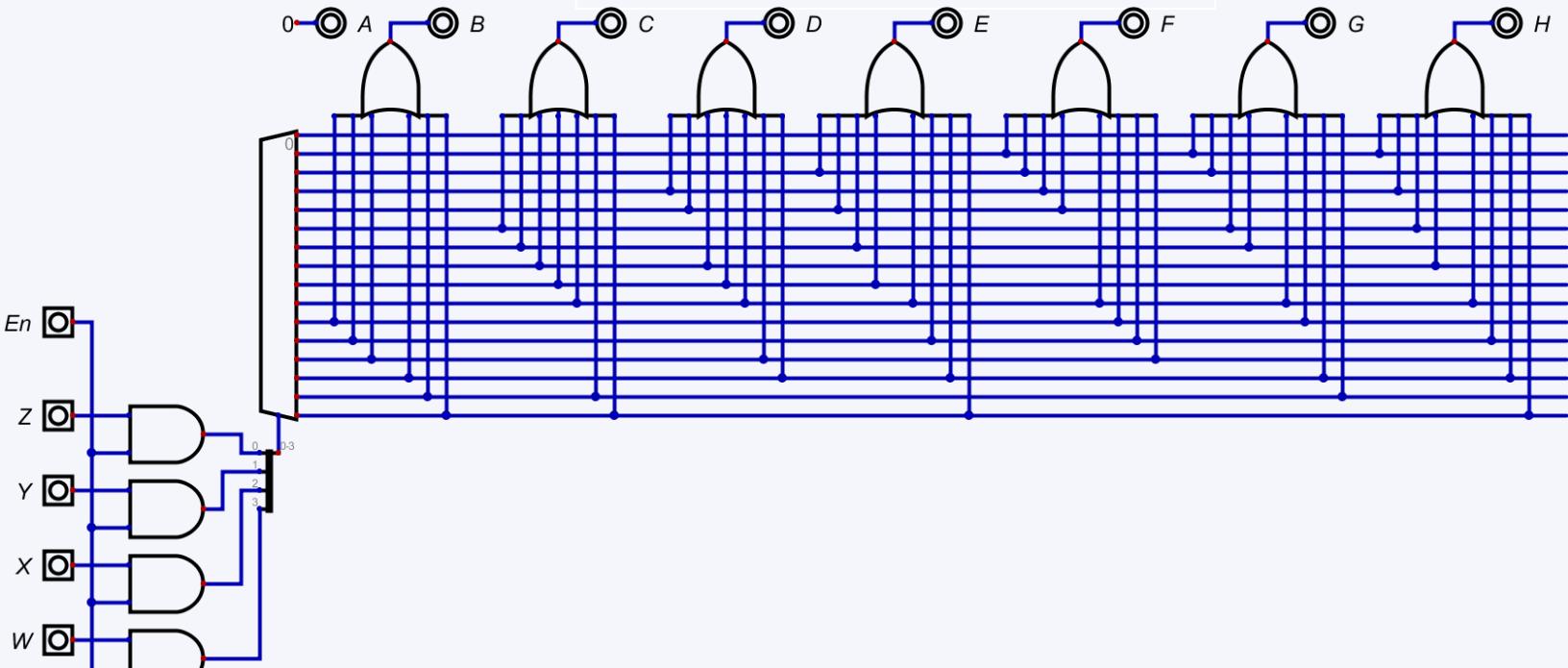
Combinational (C M7T)



Multiplexer (M M7T)



Decoder (D M7T)



Multiplication table of Eight

		A=0			
		0 0	0 1	1 1	1 0
		W X	Y Z		
0 0	0 0	0 0	0 1	0 3	0 2
0 1	0 4	0 0	0 5	0 7	0 6
1 1	0 12	0 12	0 13	0 15	0 14
1 0	0 8	0 8	0 9	0 11	0 10

		B=W			
		0 0	0 1	1 1	1 0
		W X	Y Z		
0 0	0 0	0 0	0 1	1 3	2 2
0 1	0 4	0 4	0 5	5 7	6 6
1 1	1 12	1 12	1 13	1 15	1 14
1 0	1 8	1 8	1 9	9 11	1 10

		C=X			
		0 0	0 1	1 1	1 0
		W X	Y Z		
0 0	0 0	0 0	1 1	1 3	2 2
0 1	1 4	1 4	1 5	1 7	1 6
1 1	1 12	1 12	1 13	1 15	1 14
1 0	8	8	9	11	10

		D=Y			
		0 0	0 1	1 1	1 0
		W X	Y Z		
0 0	0 0	0 0	0 1	0 3	0 2
0 1	0 4	0 4	0 5	0 7	0 6
1 1	0 12	0 12	0 13	0 15	0 14
1 0	0 8	0 8	0 9	0 11	0 10

		E=Z			
		0 0	0 1	1 1	1 0
		W X	Y Z		
0 0	0 0	0 0	1 1	1 3	2 2
0 1	1 4	1 4	1 5	1 7	6 6
1 1	1 12	1 12	1 13	1 15	14 14
1 0	8	8	1 9	1 11	10 10

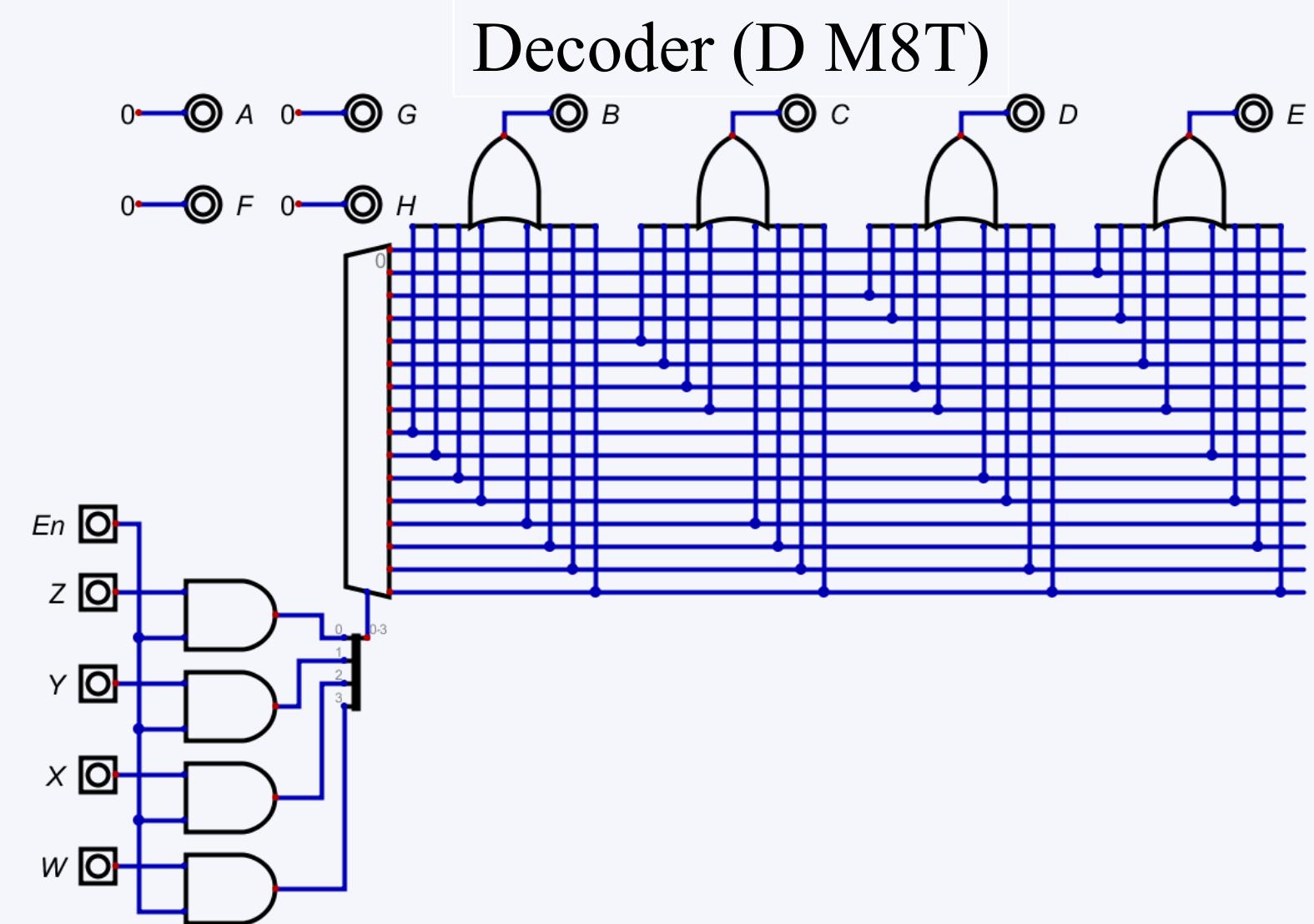
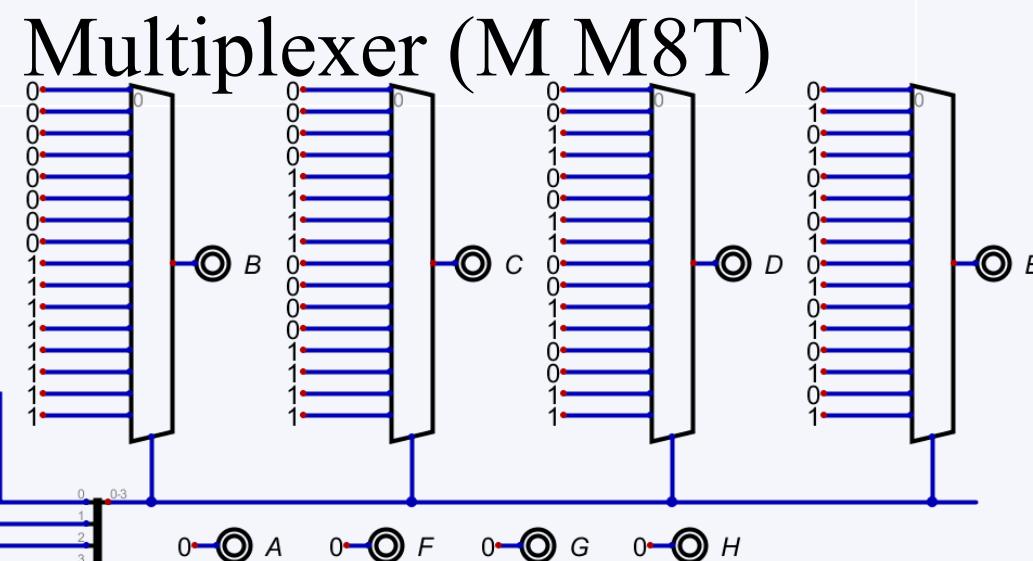
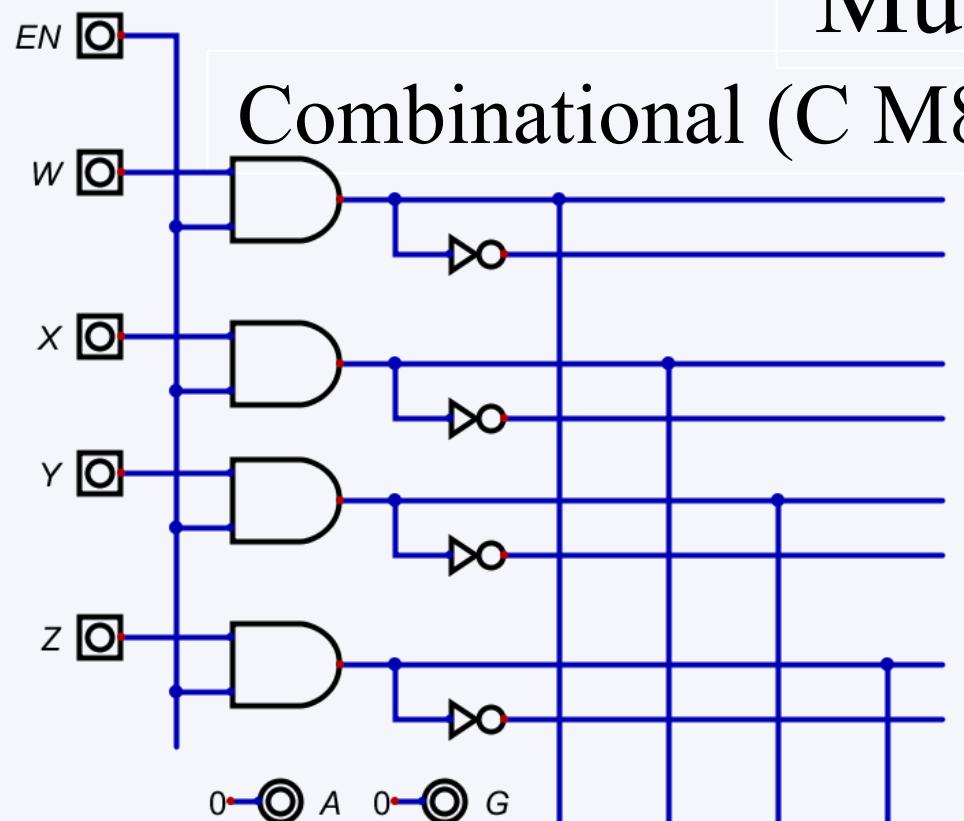
		F=0			
		0 0	0 1	1 1	1 0
		W X	Y Z		
0 0	0 0	0 0	0 1	0 3	0 2
0 1	0 4	0 4	0 5	0 7	0 6
1 1	0 12	0 12	0 13	0 15	0 14
1 0	0 8	0 8	0 9	0 11	0 10

		G=0			
		0 0	0 1	1 1	1 0
		W X	Y Z		
0 0	0 0	0 0	0 1	0 3	0 2
0 1	0 4	0 0	0 5	0 7	0 6
1 1	0 12	0 12	0 13	0 15	0 14
1 0	0 8	0 8	0 9	0 11	0 10

		H=0			
		0 0	0 1	1 1	1 0
		W X	Y Z		
0 0	0 0	0 0	0 1	0 3	0 2
0 1	0 4	0 4	0 5	0 7	0 6
1 1	0 12	0 12	0 13	0 15	0 14
1 0	0 8	0 8	0 9	0 11	0 10

8	En	W	X	Y	Z	A	B	C	D	E	F	G	H
0	0	X	X	X	X	0	0	0	0	0	0	0	0
1	1	0	0	0	0	0	0	0	0	0	0	0	0
2	1	0	0	0	1	0	0	0	0	1	0	0	0
3	1	0	0	1	1	0	0	0	0	1	1	0	0
4	1	0	1	0	0	0	0	1	0	0	0	0	0
5	1	0	1	0	1	0	0	0	1	0	1	0	0
6	1	0	1	1	0	0	0	1	1	0	0	0	0
7	1	0	1	1	1	0	0	1	1	1	0	0	0
8	1	1	0	0	0	0	1	0	0	0	0	0	0
9	1	1	1	0	1	0	0	0	1	0	0	0	0
10	1	1	0	1	0	0	1	0	1	0	0	0	0
11	1	1	0	1	1	0	1	0	1	1	0	0	0
12	1	1	1	0	0	1	1	0	0	0	0	0	0
13	1	1	1	0	1	0	1	1	0	1	0	0	0
14	1	1	1	1	0	0	1	1	1	0	0	0	0
15	1	1	1	1	1	0	1	1	1	1	0	0	0

Multiplication table of Eight design



Multiplication table of Nine

		A=WXYZ				
		0 0	0 1	1 1	1 0	
W X	Y Z	0 0	0	1	3	2
0 0	0 0	0	1	3	2	
0 1	0 1	4	5	7	6	
1 1	1 1	12	13	15	14	
1 0	1 0	8	9	11	10	

		B=WY'Z+WXY'+WZ'				
		0 0	0 1	1 1	1 0	
W X	Y Z	0 0	0	1	3	2
0 0	0 0	0	1	3	2	
0 1	0 1	4	5	7	6	
1 1	1 1	12	13	15	14	
1 0	1 0	1	8	1	9	

		C=W'X+XY'+XYZ'+WX'YZ				
		0 0	0 1	1 1	1 0	
W X	Y Z	0 0	0	1	3	2
0 0	0 0	0	1	1	3	2
0 1	0 1	1	4	1	5	7
1 1	1 1	1	12	1	13	15
1 0	1 0	1	8	9	11	10

		D=W'Y+YZ'+WY'Z				
		0 0	0 1	1 1	1 0	
W X	Y Z	0 0	0	1	3	2
0 0	0 0	0	1	1	3	2
0 1	0 1	1	4	1	5	7
1 1	1 1	1	12	1	13	15
1 0	1 0	1	8	9	11	10

		E=W'Z+WZ'				
		0 0	0 1	1 1	1 0	
W X	Y Z	0 0	0	1	3	2
0 0	0 0	0	1	1	3	2
0 1	0 1	1	4	1	5	7
1 1	1 1	1	12	1	13	15
1 0	1 0	1	8	9	11	10

		F=X				
		0 0	0 1	1 1	1 0	
W X	Y Z	0 0	0	1	3	2
0 0	0 0	0	1	1	3	2
0 1	0 1	1	4	1	5	7
1 1	1 1	1	12	1	13	15
1 0	1 0	1	8	9	11	10

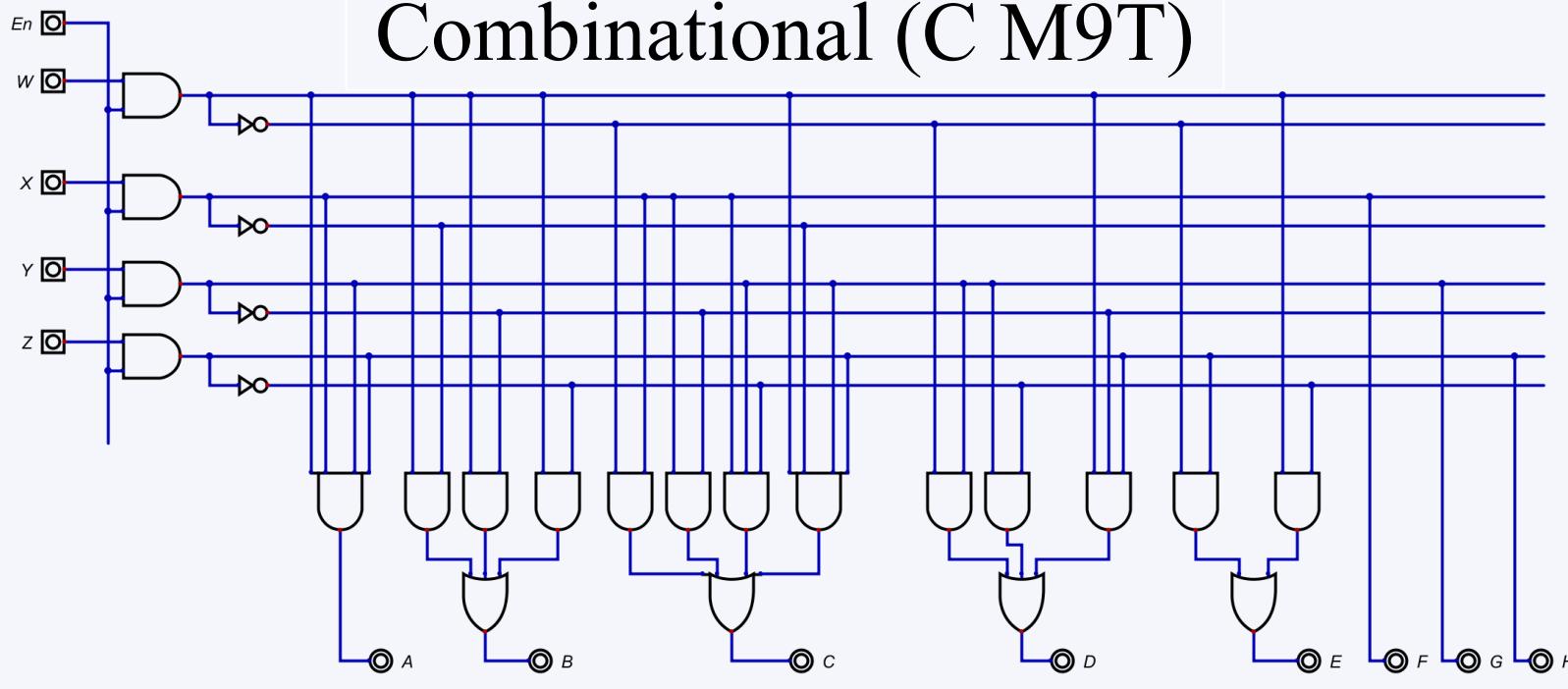
		G=Y				
		0 0	0 1	1 1	1 0	
W X	Y Z	0 0	0	1	3	2
0 0	0 0	0	1	1	3	2
0 1	0 1	4	5	1	7	6
1 1	1 1	12	13	1	15	14
1 0	1 0	8	9	1	11	10

		H=Z				
		0 0	0 1	1 1	1 0	
W X	Y Z	0 0	0	1	3	2
0 0	0 0	0	1	1	3	2
0 1	0 1	4	5	1	7	6
1 1	1 1	12	13	1	15	14
1 0	1 0	8	9	1	11	10

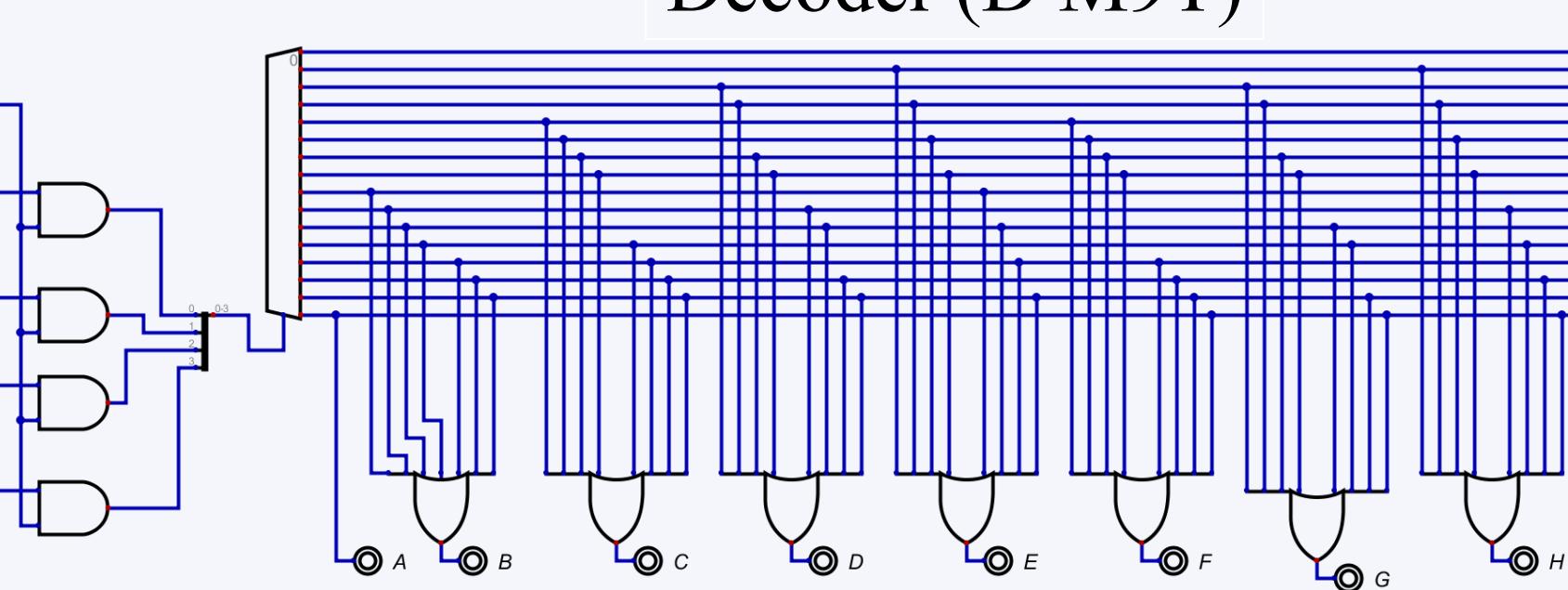
9	En	W	X	Y	Z	A	B	C	D	E	F	G	H
0	0	X	X	X	X	0	0	0	0	0	0	0	0
0	1	0	0	0	0	0	0	0	0	0	0	0	0
1	1	0	0	0	1	0	0	0	0	1	0	0	1
2	1	0	0	1	0	0	0	0	1	0	0	1	0
3	1	0	0	1	1	0	0	0	1	1	0	1	1
4	1	0	1	0	0	0	0	1	0	0	1	0	0
5	1	0	1	0	1	0	0	0	1	0	1	1	0
6	1	0	1	1	0	0	0	1	1	0	1	1	0
7	1	0	1	1	1	0	0	1	1	1	1	1	1
8	1	1	0	0	0	0	1	0	0	1	0	0	0
9	1	1	0	0	1	0	1	0	1	0	0	0	1
10	1	1	0	1	0	0	1	0	1	1	0	1	0
11	1	1	0	1	1	0	1	1	0	0	0	1	1
12	1	1	1	0	0	1	1	0	1	1	0	0	0
13	1	1	1	0	1	0	1	1	1	0	1	0	1
14	1	1	1	1	0	0	1	1	1	1	1	1	0
15	1	1	1	1	1	1	0	0	0	0	1	1	1

Multiplication table of Nine design

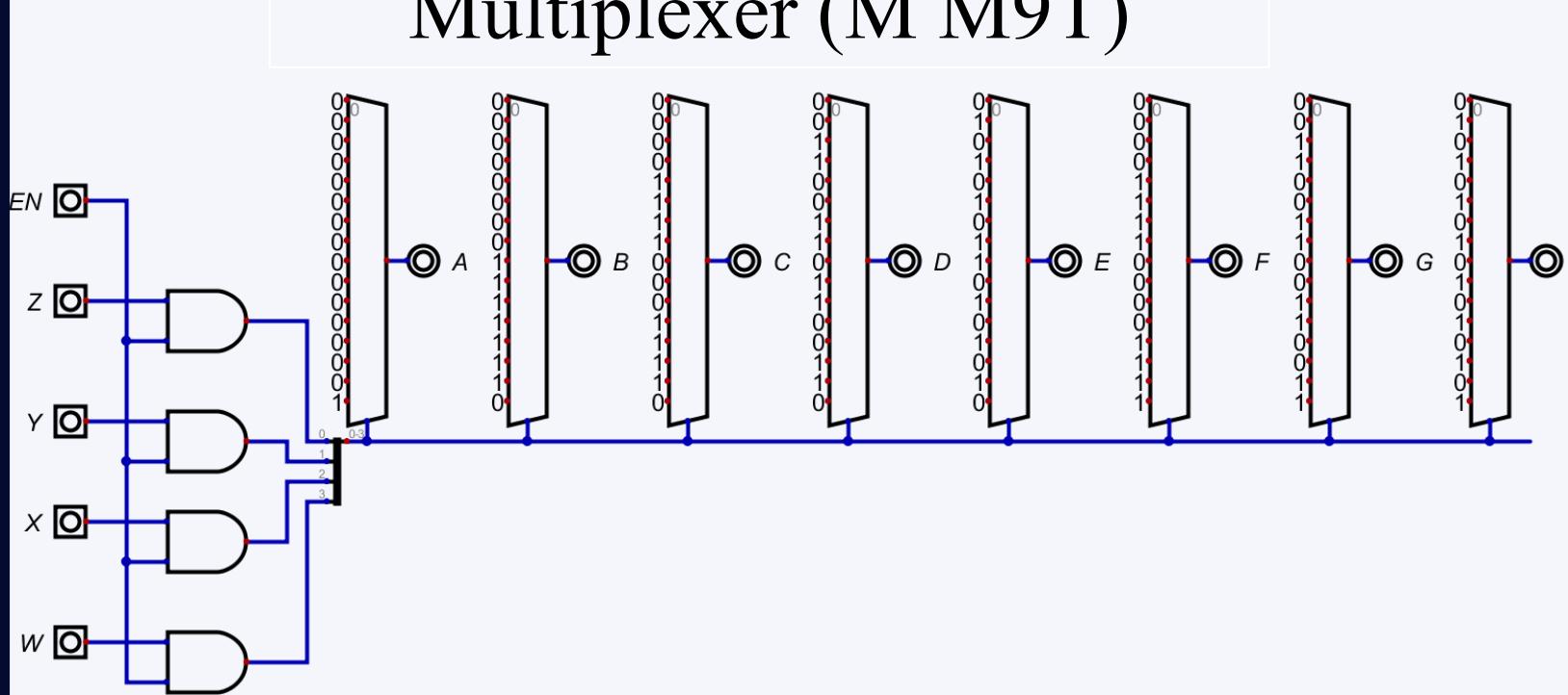
Combinational (C M9T)



Decoder (D M9T)



Multiplexer (M M9T)



Multiplication table of Ten

		A=WXZ+WXY				
		0 0	0 1	1 1	1 0	
W X	Z Y	0 0	0	1	3	2
0 0	0 0	0	1	3	2	
0 1	0 1	4	5	7	6	
1 1	1 1	12	13	15	14	
1 0	1 0	8	9	11	10	

		B=WX'+WY'Z'+W'XYZ				
		0 0	0 1	1 1	1 0	
W X	Z Y	0 0	0	1	3	2
0 0	0 0	0	1	3	2	
0 1	0 1	4	5	7	6	
1 1	1 1	12	13	15	14	
1 0	1 0	1	8	9	11	

		C=XY'Z+W'XY'+WX'Y+W'XZ'				
		0 0	0 1	1 1	1 0	
W X	Z Y	0 0	0	1	3	2
0 0	0 0	0	1	3	2	
0 1	0 1	1	4	5	6	
1 1	1 1	1	12	13	15	
1 0	1 0	8	9	11	10	

		D=W'X'Y+W'YZ'+WX'Y'+WY'Z'+W'XY'Z+WXYZ				
		0 0	0 1	1 1	1 0	
W X	Z Y	0 0	0	1	3	2
0 0	0 0	0	1	3	2	
0 1	0 1	1	4	5	6	
1 1	1 1	1	12	13	15	
1 0	1 0	8	9	11	10	

		E=XZ'+X'Z				
		0 0	0 1	1 1	1 0	
W X	Z Y	0 0	0	1	3	2
0 0	0 0	1	4	5	6	
0 1	0 1	1	12	13	15	
1 1	1 1	8	9	11	10	

		F=Y				
		0 0	0 1	1 1	1 0	
W X	Z Y	0 0	0	1	3	2
0 0	0 0	0	1	3	2	
0 1	0 1	4	5	7	6	
1 1	1 1	12	13	15	14	
1 0	1 0	8	9	11	10	

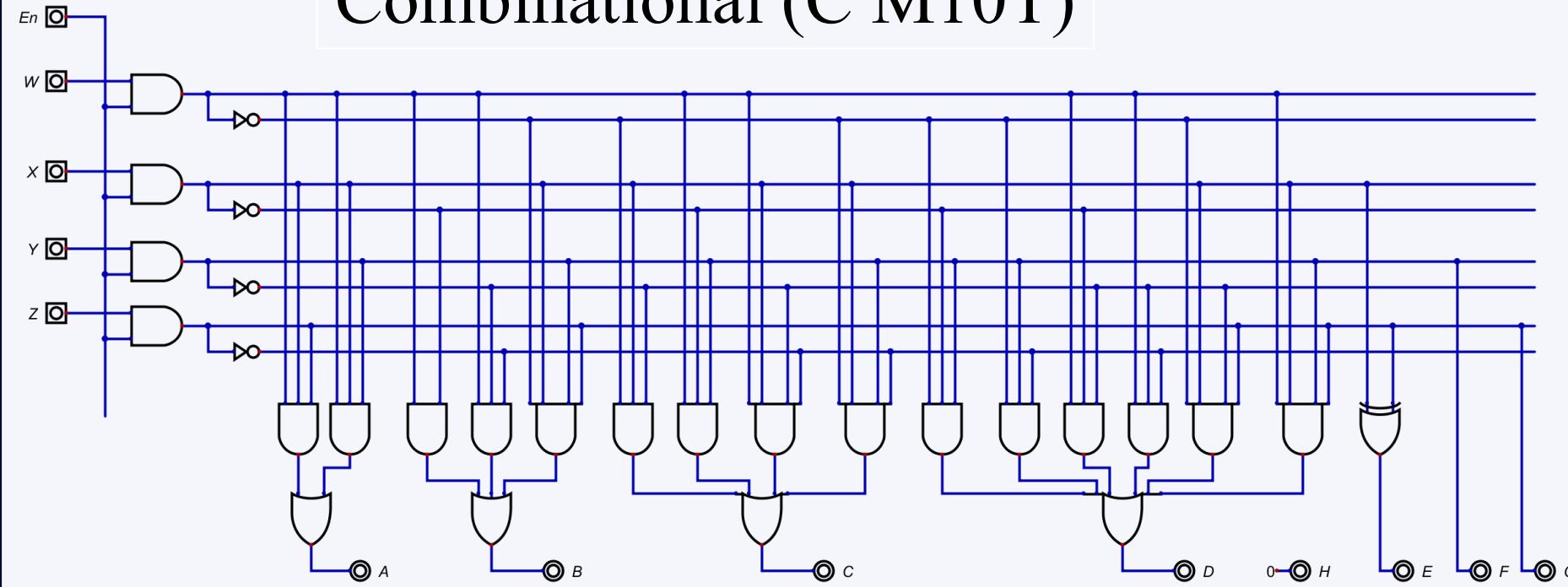
		G=Z				
		0 0	0 1	1 1	1 0	
W X	Z Y	0 0	0	1	3	2
0 0	0 0	0	1	3	2	
0 1	0 1	4	5	7	6	
1 1	1 1	12	13	15	14	
1 0	1 0	8	9	11	10	

		H=0				
		0 0	0 1	1 1	1 0	
W X	Z Y	0 0	0	1	3	2
0 0	0 0	0	0	1	3	
0 1	0 1	0	4	5	7	
1 1	1 1	0	12	0	13	
1 0	1 0	0	8	0	9	

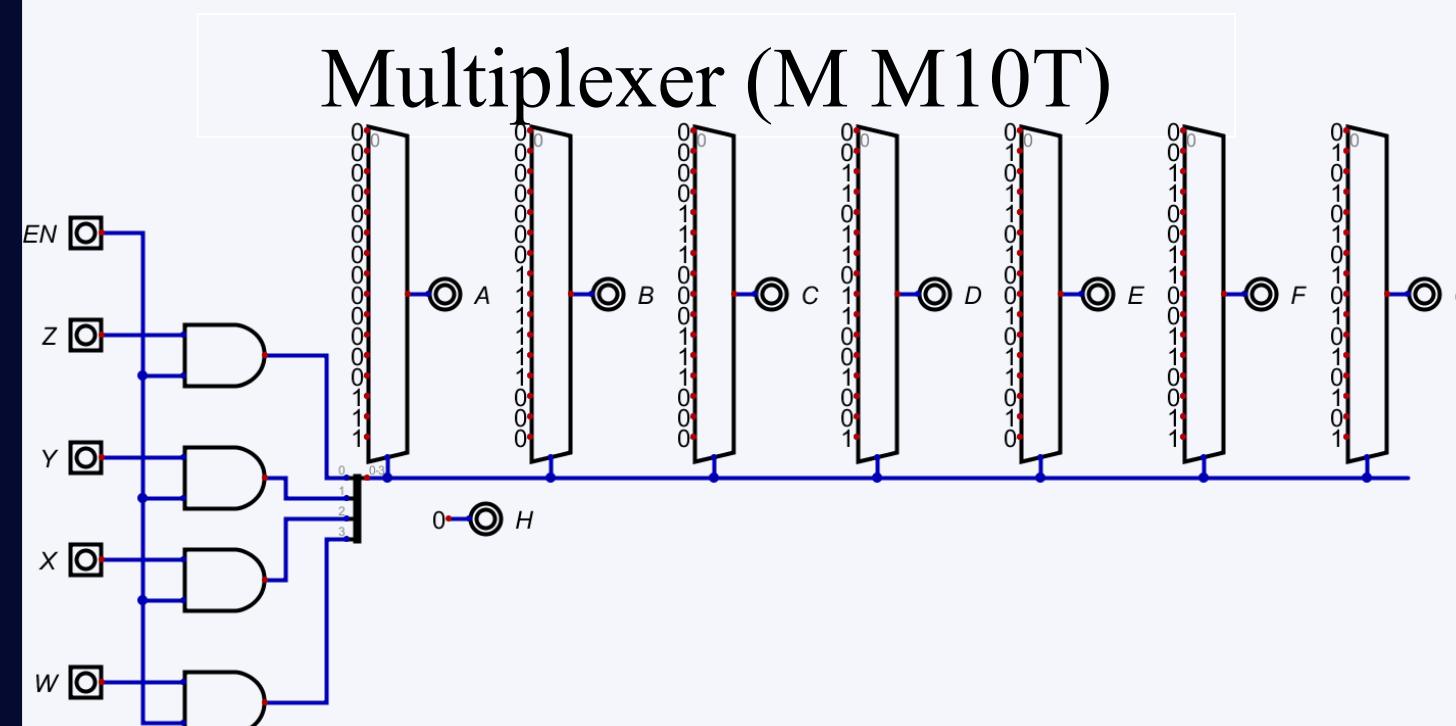
10	En	W	X	Y	Z	A	B	C	D	E	F	G	H
0	0	X	X	X	X	0	0	0	0	0	0	0	0
0	1	0	0	0	0	0	0	0	0	0	0	0	0
1	1	0	0	0	1	0	0	0	0	1	0	1	0
2	1	0	0	1	0	0	0	0	1	0	1	0	0
3	1	0	0	1	1	0	0	0	1	1	1	1	0
4	1	0	1	0	0	0	0	1	0	1	0	0	0
5	1	0	1	0	1	0	0	0	1	1	0	0	1
6	1	0	1	1	0	0	0	1	1	1	1	0	0
7	1	0	1	1	1	0	1	0	0	0	1	1	0
8	1	1	0	0	0	0	1	0	1	0	0	0	0
9	1	1	0	0	1	0	1	0	1	1	0	1	0
10	1	1	0	1	0	0	1	1	0	0	1	0	0
11	1	1	0	1	1	0	1	1	0	1	1	1	0
12	1	1	1	0	0	1	1	1	1	0	0	0	0
13	1	1	1	0	1	1	0	0	0	0	0	1	0
14	1	1	1	1	0	1	0	0	0	1	1	0	0
15	1	1	1	1	1	1	0	1	0	0	1	1	0

Multiplication table of Ten design

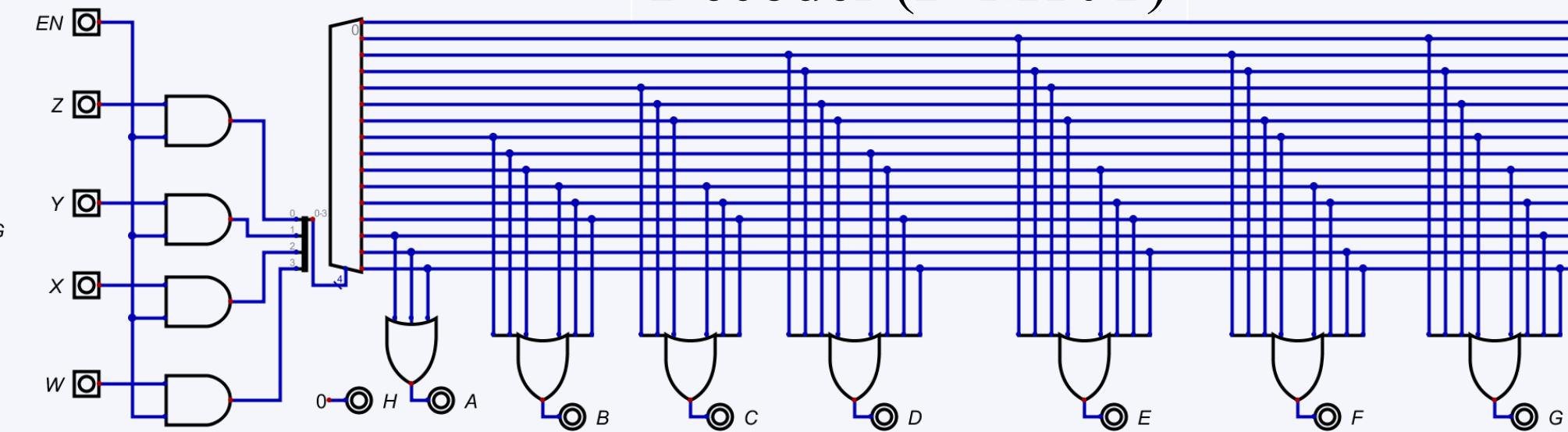
Combinational (C M10T)



Multiplexer (M M10T)



Decoder (D M10T)



Multiplication table of Eleven

W X	Y Z	0 0	0 1	1 1	1 0	
W X		0 0	0	1	3	2
0 0		0	0	1	3	2
0 1		4	5	7	6	
1 1		12	13	15	14	
1 0		8	9	11	10	

W X	Y Z	0 0	0 1	1 1	1 0	M11
W X		0 0	0	1	3	2
0 0		0	0	1	3	2
0 1		4	5	7	6	
1 1		12	13	15	14	
1 0		8	9	11	10	

W X	Y Z	0 0	0 1	1 1	1 0	
W X		0 0	0	1	3	2
0 0		0	0	1	3	2
0 1		1	4	5	7	6
1 1		12	13	15	14	
1 0		8	1	9	11	10

W X	Y Z	0 0	0 1	1 1	1 0	
W X		0 0	0	1	3	2
0 0		0	0	1	3	2
0 1		1	4	5	7	6
1 1		12	13	15	14	
1 0		8	1	9	11	10

W X	Y Z	0 0	0 1	1 1	1 0	
W X		0 0	0	1	3	2
0 0		0	0	1	3	2
0 1		1	4	5	7	6
1 1		12	13	15	14	
1 0		8	1	9	11	10

W X	Y Z	0 0	0 1	1 1	1 0	
W X		0 0	0	1	3	2
0 0		0	0	1	3	2
0 1		1	4	5	7	6
1 1		12	13	15	14	
1 0		8	1	9	11	10

W X	Y Z	0 0	0 1	1 1	1 0	
W X		0 0	0	1	3	2
0 0		0	0	1	3	2
0 1		1	4	5	7	6
1 1		12	13	15	14	
1 0		8	1	9	11	10

W X	Y Z	0 0	0 1	1 1	1 0	
W X		0 0	0	1	3	2
0 0		0	0	1	3	2
0 1		1	4	5	7	6
1 1		12	13	15	14	
1 0		8	1	9	11	10

W X	Y Z	0 0	0 1	1 1	1 0	
W X		0 0	0	1	3	2
0 0		0	0	1	3	2
0 1		1	4	5	7	6
1 1		12	13	15	14	
1 0		8	1	9	11	10

W X	Y Z	0 0	0 1	1 1	1 0	
W X		0 0	0	1	3	2
0 0		0	0	1	3	2
0 1		1	4	5	7	6
1 1		12	13	15	14	
1 0		8	1	9	11	10

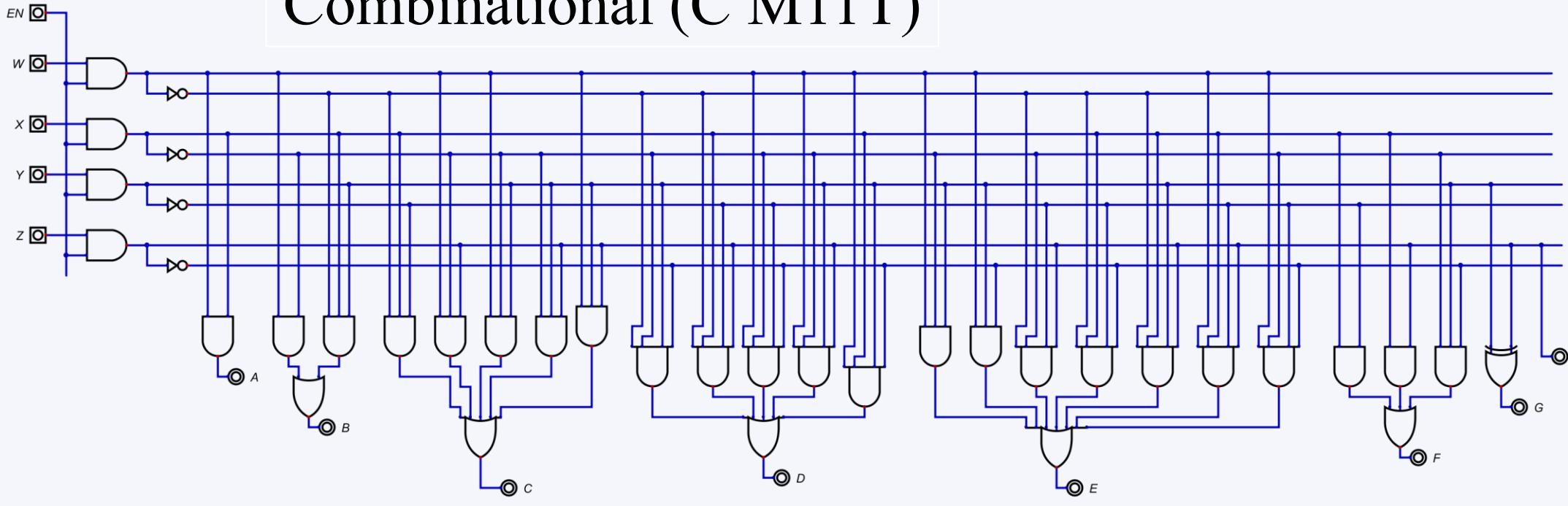
W X	Y Z	0 0	0 1	1 1	1 0	
W X		0 0	0	1	3	2
0 0		0	0	1	3	2
0 1		1	4	5	7	6
1 1		12	13	15	14	
1 0		8	1	9	11	10

W X	Y Z	0 0	0 1	1 1	1 0	M11
W X		0 0	0	1	3	2
0 0		0	0	1	3	2
0 1		4	5	7	6	
1 1		12	13	15	14	
1 0		8	1	9	11	10

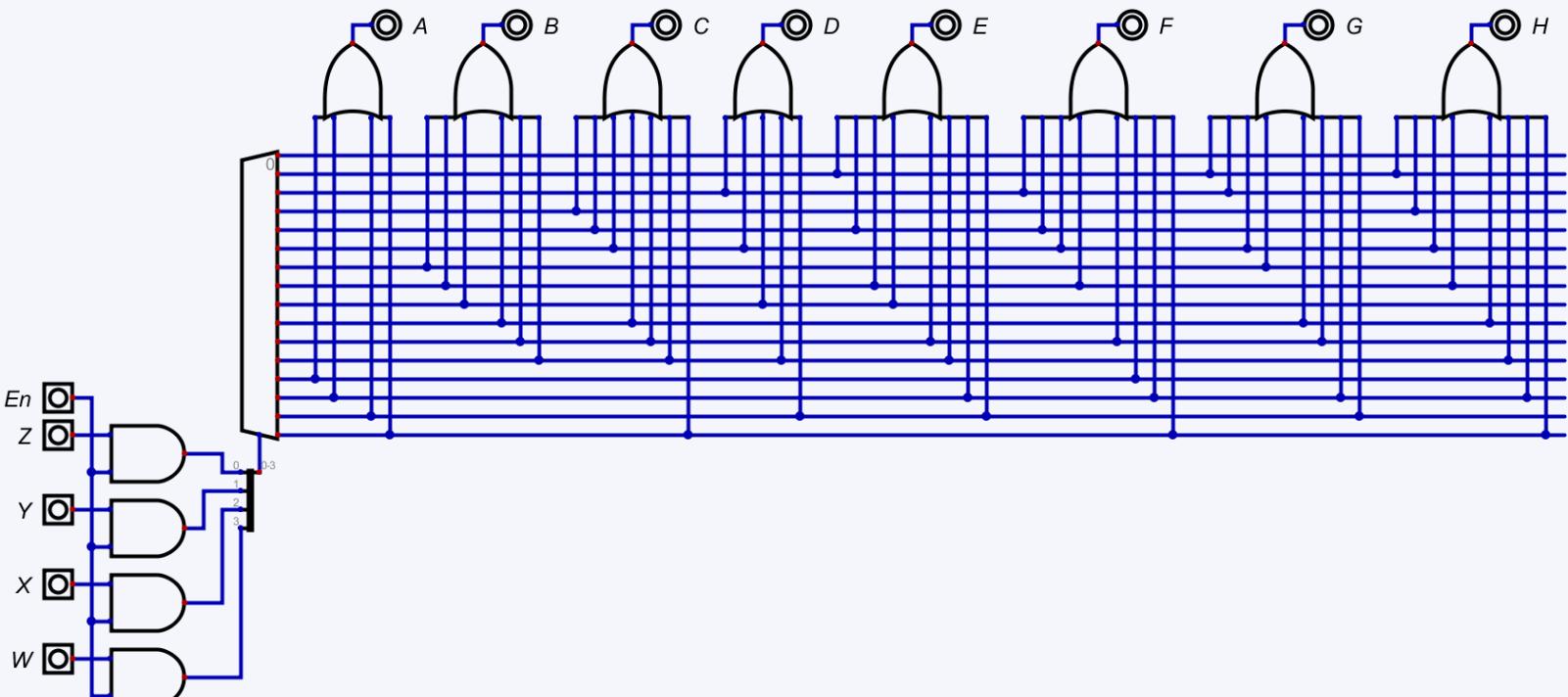
~~W~~X	~~Y~~Z	0 0	0 1	

Multiplication table of Eleven design

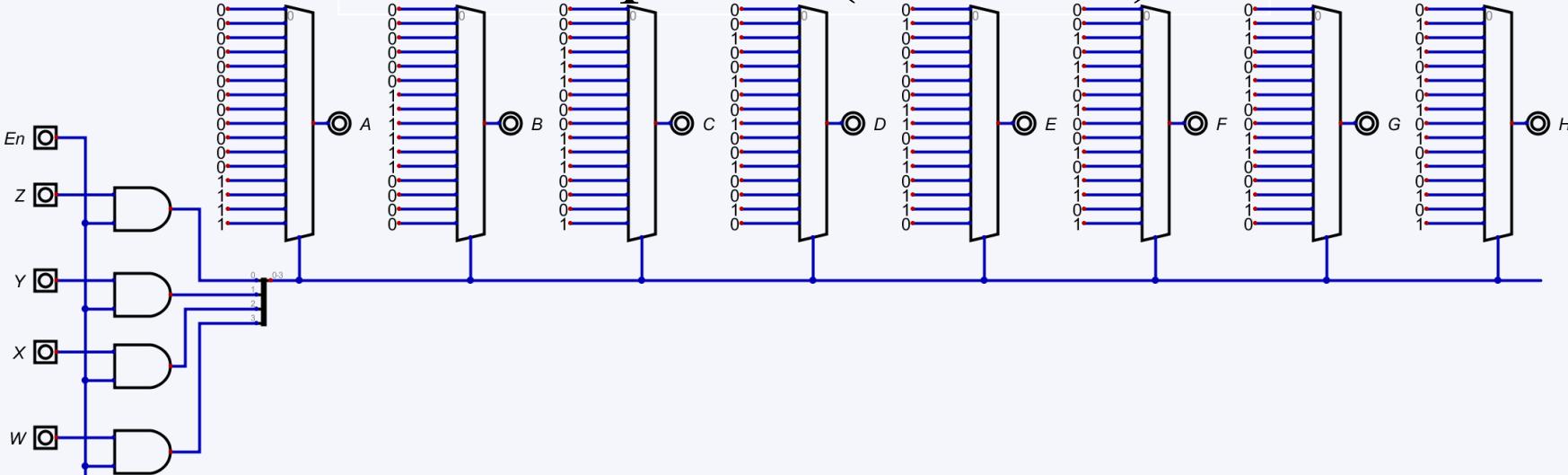
Combinational (C M11T)



Decoder (D M11T)



Multiplexer (M M11T)



Multiplication table of Twelve

		A=WX+WXYZ				
		0 0	0 1	1 1	1 0	
W X	Y Z	0 0	0	1	3	2
0 0	0 0	0	1	3	2	
0 1	0 1	4	5	7	6	
1 1	1 1	1 12	1 13	1 15	1 14	
1 0	1 0	8	9	1 11	10	

		B=W'XY+WXY'+WX'Z'				
		0 0	0 1	1 1	1 0	
W X	Y Z	0 0	0	1	3	2
0 0	0 0	0	1	3	2	
0 1	0 1	4	5	1 7	1 6	
1 1	1 1	12	13	15	14	
1 0	1 0	1 8	1 9	11	1 10	

		C=W'X'YZ+W'XY'+WXY+W'X'Y'+WY				
		0 0	0 1	1 1	1 0	
W X	Y Z	0 0	0	1	3	2
0 0	0 0	0	1	3	1 2	
0 1	0 1	4	1 5	7	1 6	
1 1	1 1	12	1 13	15	1 14	
1 0	1 0	8	1 9	11	1 10	

		D=XY'+XZ+X'YZ'				
		0 0	0 1	1 1	1 0	
W X	Y Z	0 0	0	1	3	1 2
0 0	0 0	0	1	1	3	2
0 1	0 1	4	1 5	1 7	6	
1 1	1 1	12	1 13	1 15	14	
1 0	1 0	8	1 9	1 11	10	

		E=Y'Z+YZ'				
		0 0	0 1	1 1	1 0	
W X	Y Z	0 0	0	1	3	1 2
0 0	0 0	0	1	5	1 6	
1 1	1 1	12	1 13	15	1 14	
1 0	1 0	8	1 9	11	1 10	

		F=Z				
		0 0	0 1	1 1	1 0	
W X	Y Z	0 0	0	1	3	2
0 0	0 0	0	1	1	3	2
0 1	0 1	4	1 5	1 7	6	
1 1	1 1	12	1 13	1 15	14	
1 0	1 0	8	1 9	1 11	10	

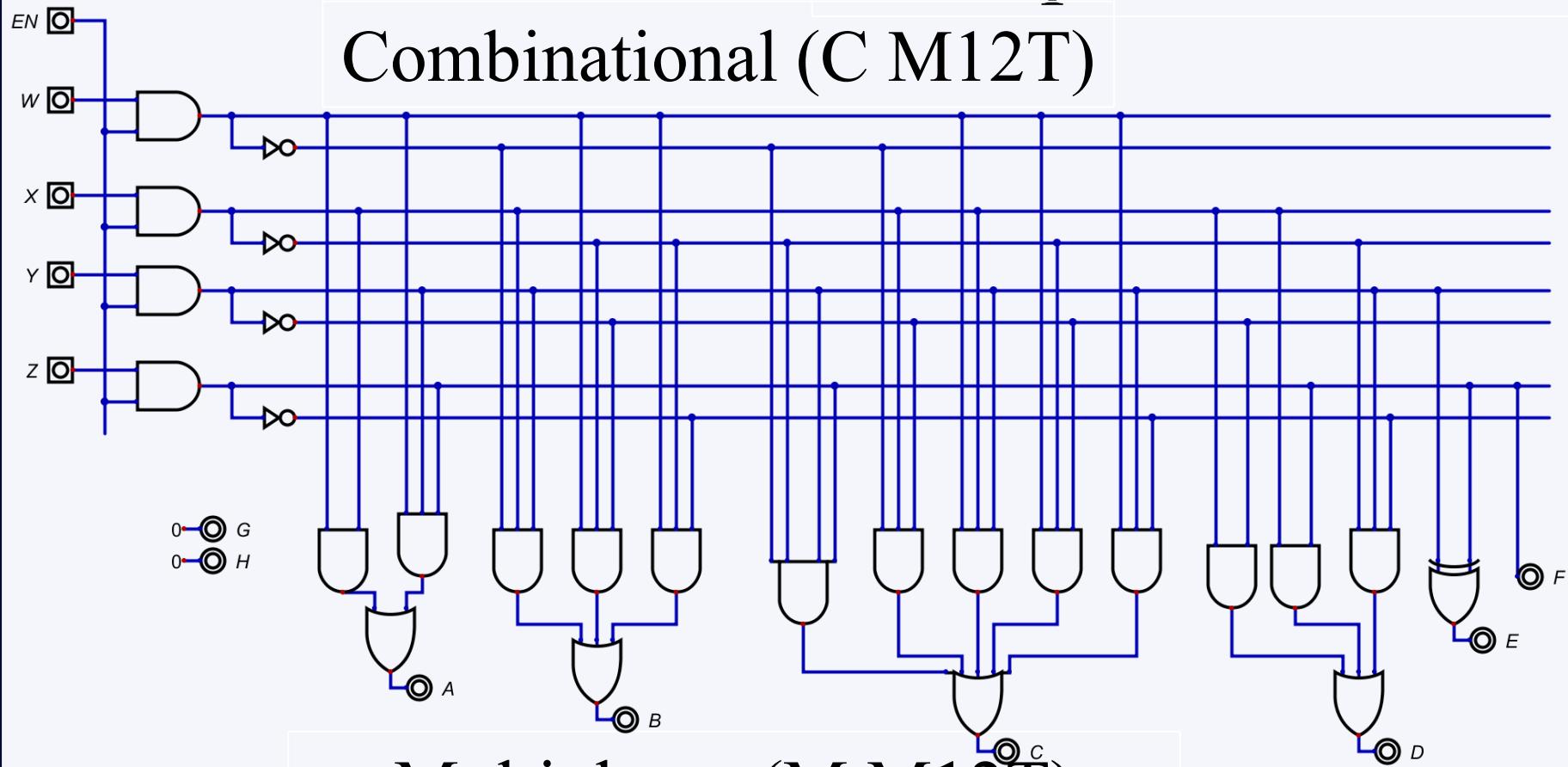
		G=0							
		0 0	0 1	1 1	1 0				
W X	Y Z	0 0	0	1	3	2			
0 0	0 0	0	0	1	3	2			
0 1	0 1	0	4	5	0	6			
1 1	1 1	0	12	0	13	0	15	0	14
1 0	1 0	0	8	0	9	0	11	0	10

		H=0							
		0 0	0 1	1 1	1 0				
W X	Y Z	0 0	0	1	3	2			
0 0	0 0	0	0	1	3	2			
0 1	0 1	0	4	5	0	6			
1 1	1 1	0	12	0	13	0	15	0	14
1 0	1 0	0	8	0	9	0	11	0	10

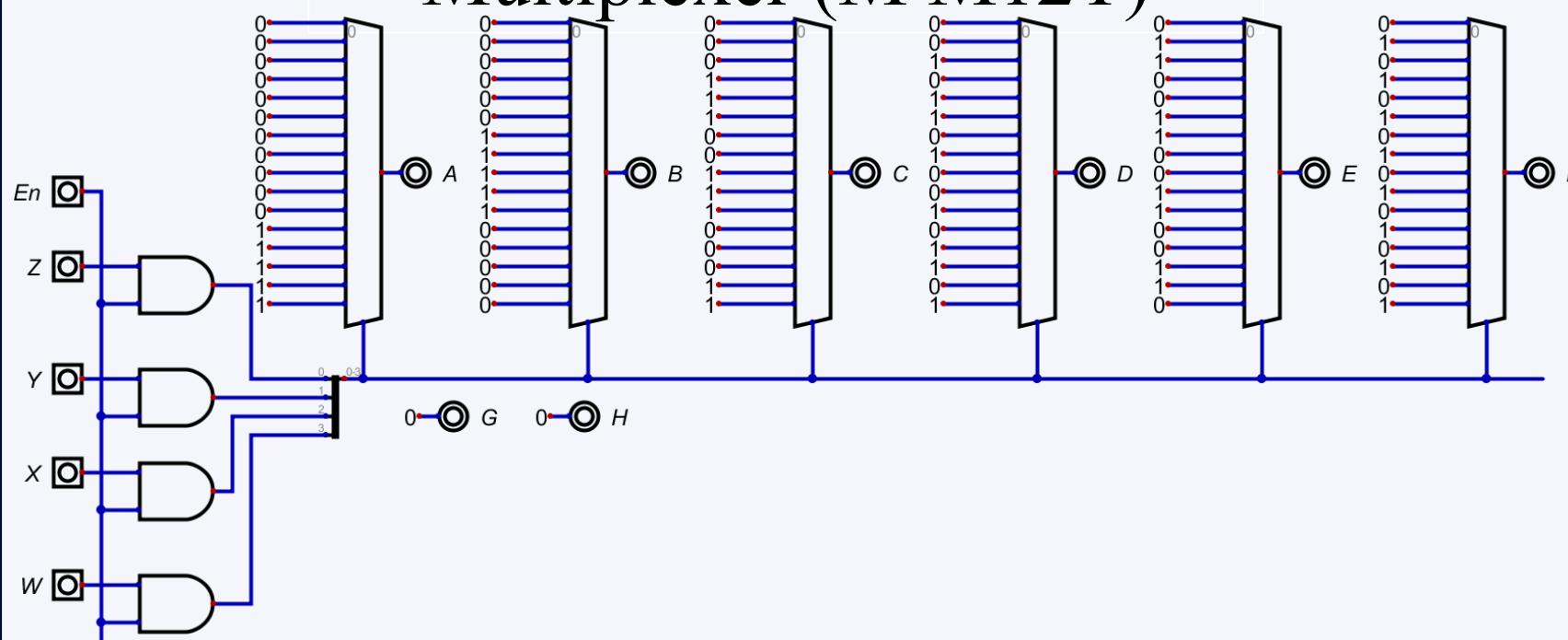
12	En	W	X	Y	Z	A	B	C	D	E	F	G	H
0	0	X	X	X	X	0	0	0	0	0	0	0	0
0	1	0	0	0	0	0	0	0	0	0	0	0	0
1	1	0	0	0	1	0	0	0	0	1	1	0	0
2	1	0	0	1	0	0	0	0	1	1	0	0	0
3	1	0	0	1	1	0	0	1	0	0	1	0	0
4	1	0	1	0	0	0	0	1	1	0	0	0	0
5	1	0	1	0	1	0	0	1	1	1	1	0	0
6	1	0	1	1	0	0	1	0	0	1	0	0	0
7	1	0	1	1	1	0	1	0	1	0	1	0	0
8	1	1	0	0	0	0	1	1	0	0	0	0	0
9	1	1	0	0	1	0	1	1	0	1	1	0	0
10	1	1	0	1	0	0	1	1	1	1	0	0	0
11	1	1	0	1	1	1	0	0	0	0	0	1	0
12	1	1	1	0	0	1	0	0	1	0	0	0	0
13	1	1	1	0	1	1	0	0	1	1	1	0	0
14	1	1	1	1	0	1	0	1	0	1	0	0	0
15	1	1	1	1	1								

Multiplication table of Twelve design

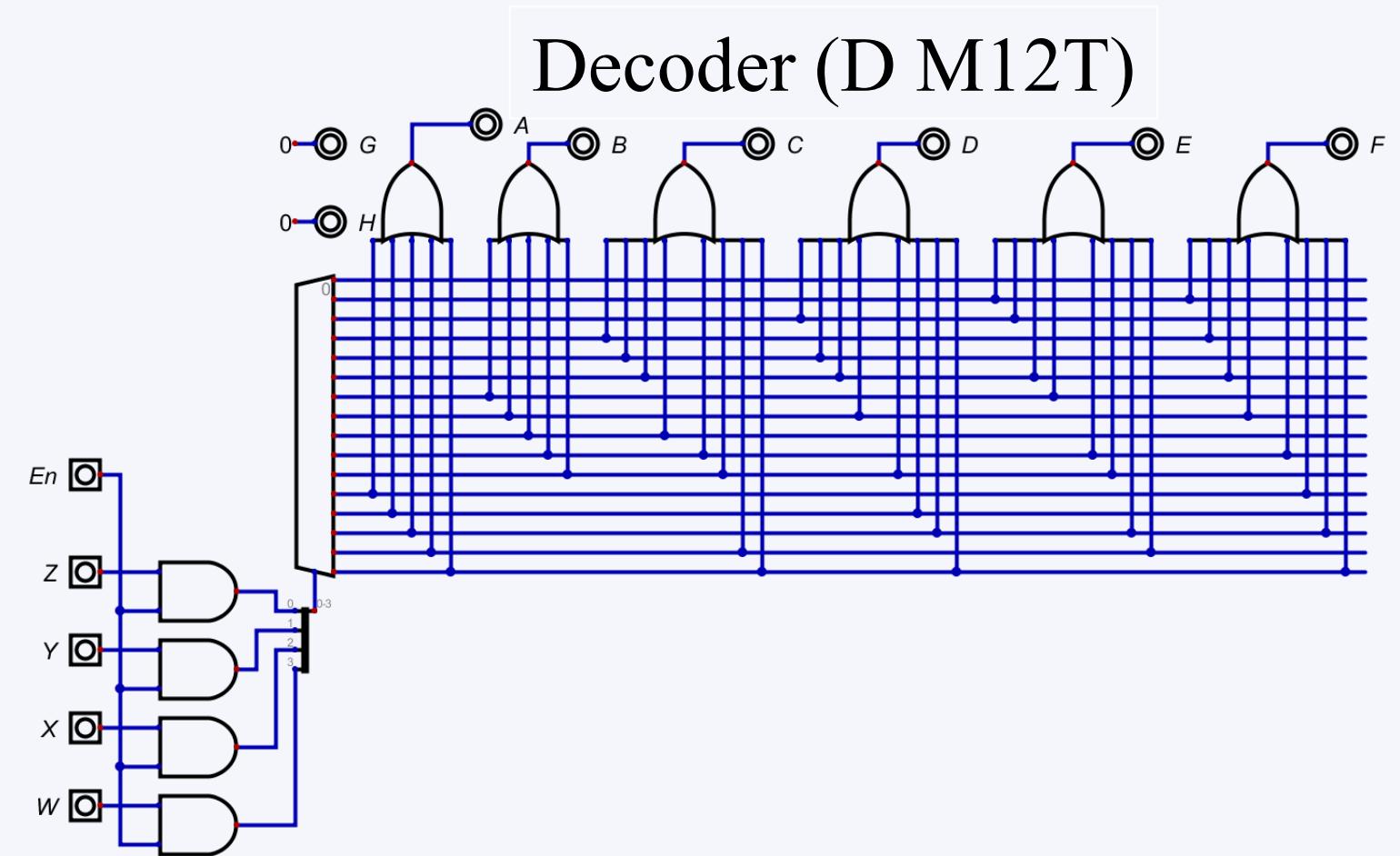
Combinational (C M12T)



Multiplexer (M M12T)



Decoder (D M12T)



Multiplication table of Thirteen

$$A = W'X + WY$$

W	X	Y	Z
0	0	0	1
0	1	1	1
1	0	0	0

0	0	0	1	3	2
0	1	4	5	7	6
1	1	12	1	13	1
1	0	8	9	11	1
0	0	0	1	1	0

W	X	Y	Z
0	0	0	1
0	1	4	5
1	1	12	1
1	0	8	1
0	0	0	1

$$C = WY'Z + W'XY'Z' + W'X'YZ + WXYZ' +$$

$$E = WYZ' + W'XY + W'X'Y'Z + WXY' + WY'$$

$$Z' + W'X'Y'Z$$

W	X	Y	Z
0	1	1	1
1	0	0	0

W	X	Y	Z
0	0	0	1
0	1	4	5
1	1	12	1
1	0	8	9
0	0	0	1

$$W'Y'Z + W'XY'Z + W'X'YZ + WXYZ' +$$

W	X	Y	Z
0	0	0	1
0	1	4	5
1	1	12	1
1	0	8	9
0	0	0	1

$$G = Y$$

$$B = W'XZ + W'XY + WX'Y' + XYZ$$

W	X	Y	Z
0	0	0	1
0	1	1	1
1	0	0	0

W	X	Y	Z
0	0	0	1
0	1	4	5
1	1	12	1
1	0	8	9
0	0	0	1

W	X	Y	Z
0	0	0	1
0	1	4	5
1	1	12	1
1	0	8	9
0	0	0	1

$$D = XY'Z' + W'X'YZ + W'XYZ + WXYZ' + W$$

$$F = X'Z + XZ$$

W	X	Y	Z
0	0	0	1
0	1	1	1
1	0	0	0

W	X	Y	Z
0	0	0	1
0	1	4	5
1	1	12	1
1	0	8	9
0	0	0	1

$$G = Y$$

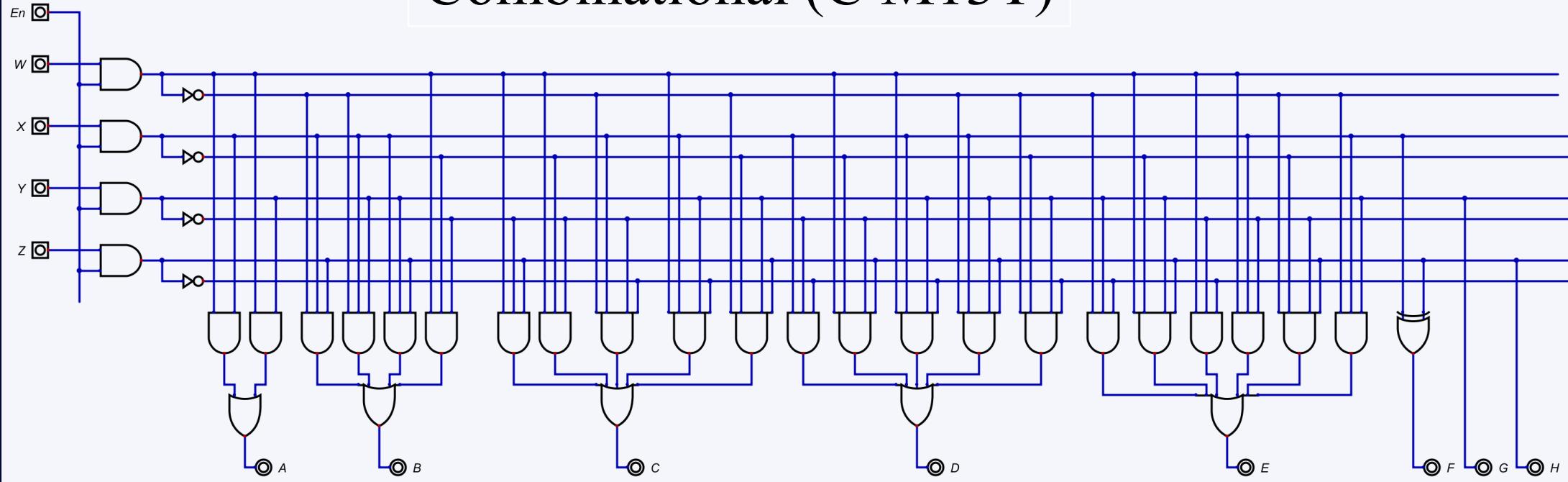
W	X	Y	Z
0	0	0	1
0	1	4	5
1	1	12	1
1	0	8	9
0	0	0	1

$$H = Z$$

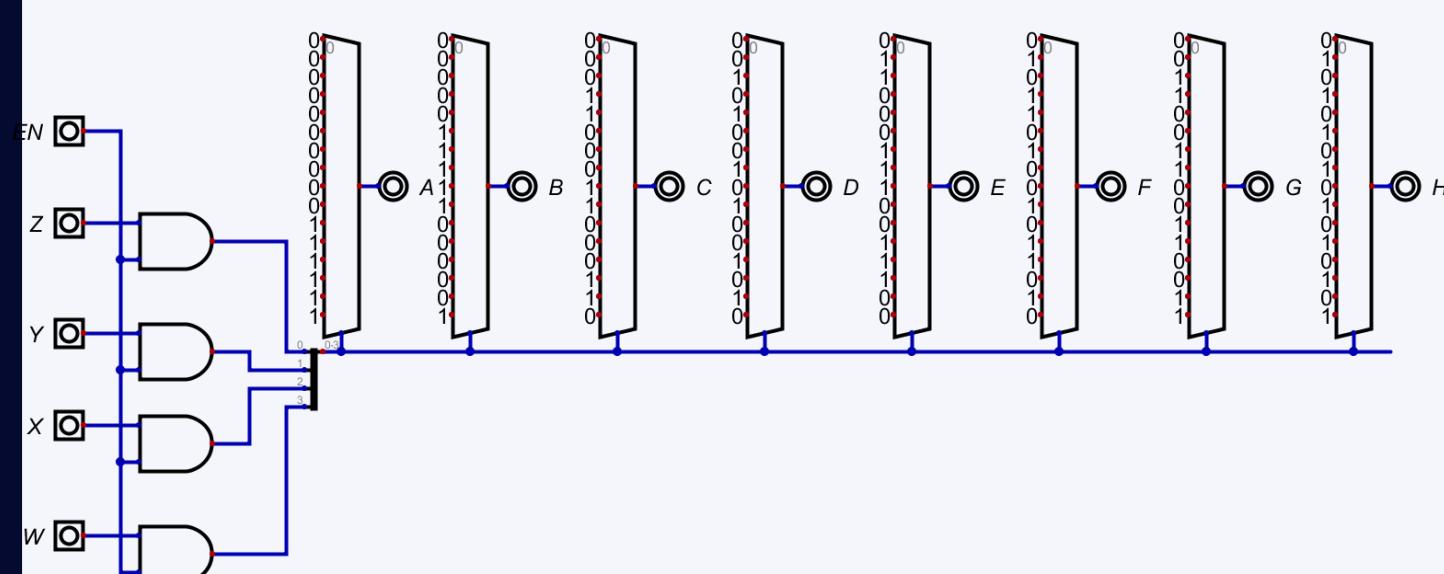
13	En	W	X	Y	Z	A	B	C	D	E	F	G	H
0	0	X	X	X	X	0	0	0	0	0	0	0	0
0	1	0	0	0	0	0	0	0	0	0	0	0	0
1	1	0	0	0	1	0	0	0	0	1	1	0	1
2	1	0	0	1	0	0	0	0	1	1	0	1	0
3	1	0	0	1	1	0	0	1	0	0	1	1	1
4	1	0	1	0	0	0	0	1	1	0	1	0	0
5	1	0	1	0	1	0	1	0	0	0	0	0	1
6	1	0	1	1	0	0	1	0	0	1	1	1	0
7	1	0	1	1	1	0	1	0	1	1	0	1	1
8	1	1	0	0	0	0	1	1	0	1	0	0	0
9	1	1	1	0	1	0	1	1	1	0	1	0	1
10	1	1	0	1	0	1	0	0	0	0	0	1	0
11	1	1	0	1	1	1	0	0	0	1	1	1	1
12	1	1	1	0	0	1	0	0	1	1	1	0	0
13	1	1	1	0	1	1	0	1	0	1	0	0	1
14	1	1	1	1	0	1	0	1	1	0	1	1	0
15	1	1	1	1	1	1	1	1	0	0	0	1	1

Multiplication table of Thirteen design

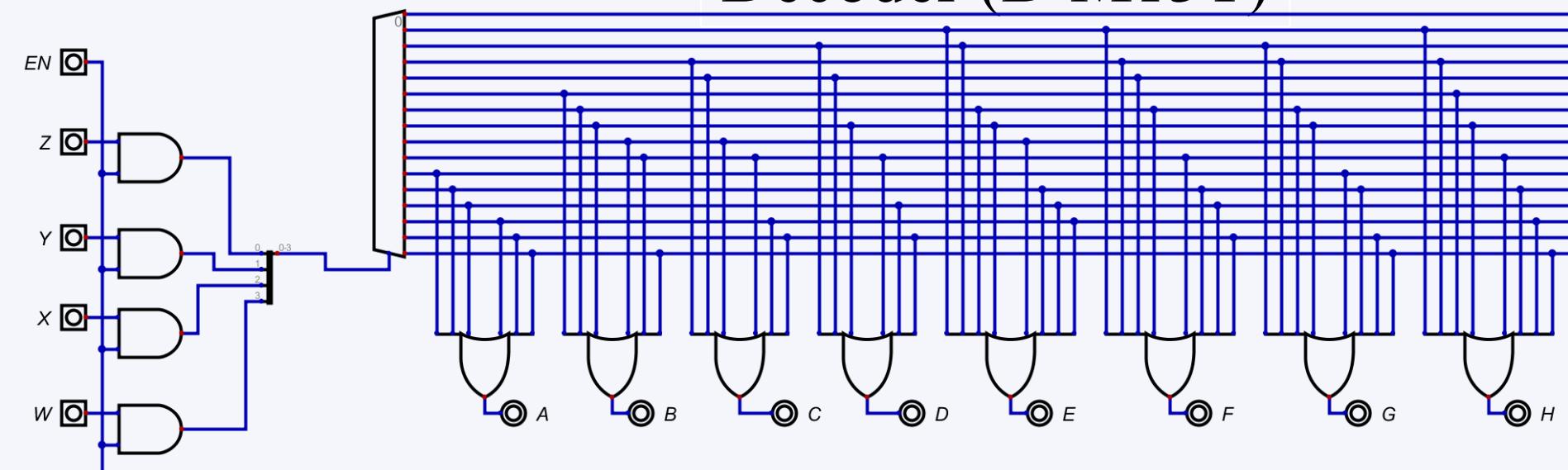
Combinational (C M13T)



Multiplexer (M M13T)



Decoder (D M13T)



Multiplication table of Fourteen

		A=WX+WY			
		0 0	0 1	1 1	1 0
W X		0 0	0 1	1 1	1 0
0 0	0	0	1	3	2
0 1	4	5	7	6	
1 1	1 12	1 13	1 15	1 14	
1 0	8	9	1 11	1 10	

		B=XY+WX'Y'+W'XZ			
		0 0	0 1	1 1	1 0
W X		0 0	0 1	1 1	1 0
0 0	0	0	1	3	2
0 1	4	5	1 7	1 6	
1 1	1 12	1 13	1 15	1 14	
1 0	8	9	1 11	1 10	

		C=WY'+W'XY'Z'+W'YZ			
		0 0	0 1	1 1	1 0
W X		0 0	0 1	1 1	1 0
0 0	0	1	1	3	1 2
0 1	1 4	5	7	6	
1 1	1 12	1 13	1 15	1 14	
1 0	8	1 9	1 11	1 10	

		D=WZ+W'YZ'+W'XY'Z'+WX'Y'Z'			
		0 0	0 1	1 1	1 0
W X		0 0	0 1	1 1	1 0
0 0	0	1	1	3	1 2
0 1	1 4	5	7	6	
1 1	1 12	1 13	1 15	1 14	
1 0	8	1 9	1 11	1 10	

		E=X'Y+XY'Z'+X'Z			
		0 0	0 1	1 1	1 0
W X		0 0	0 1	1 1	1 0
0 0	0	1	1	3	1 2
0 1	1 4	5	7	6	
1 1	1 12	1 13	1 15	1 14	
1 0	8	1 9	1 11	1 10	

		F=YZ'+Y'Z			
		0 0	0 1	1 1	1 0
W X		0 0	0 1	1 1	1 0
0 0	0	1	1	3	1 2
0 1	4	5	7	1 6	
1 1	1 12	1 13	1 15	1 14	
1 0	8	1 9	1 11	1 10	

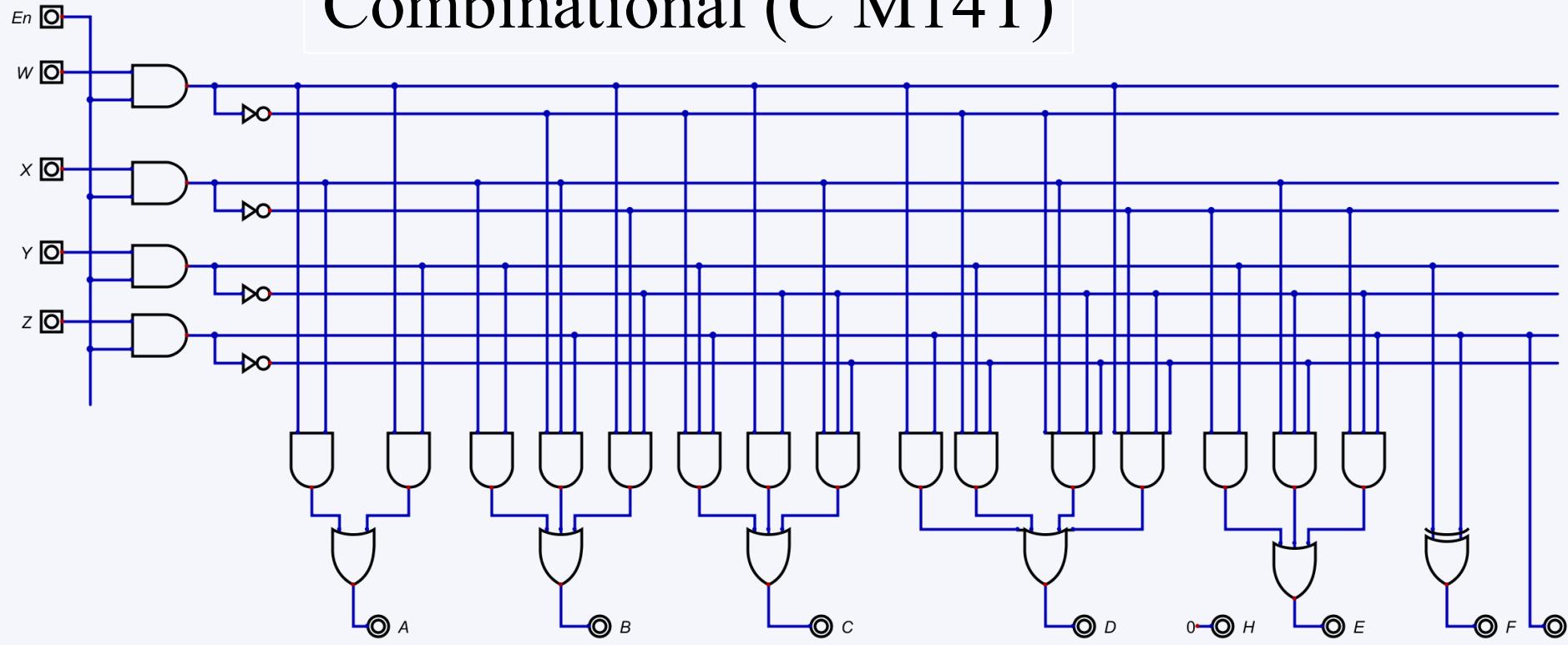
		G=Z			
		0 0	0 1	1 1	1 0
W X		0 0	0 1	1 1	1 0
0 0	0	1	1	3	2
0 1	4	5	1 7	1 6	
1 1	1 12	1 13	1 15	1 14	
1 0	8	1 9	1 11	1 10	

		H=0			
		0 0	0 1	1 1	1 0
W X		0 0	0 1	1 1	1 0
0 0	0	0	1	3	2
0 1	0 4	0 5	0 7	0 6	
1 1	0 12	0 13	0 15	0 14	
1 0	0 8	0 9	0 11	0 10	

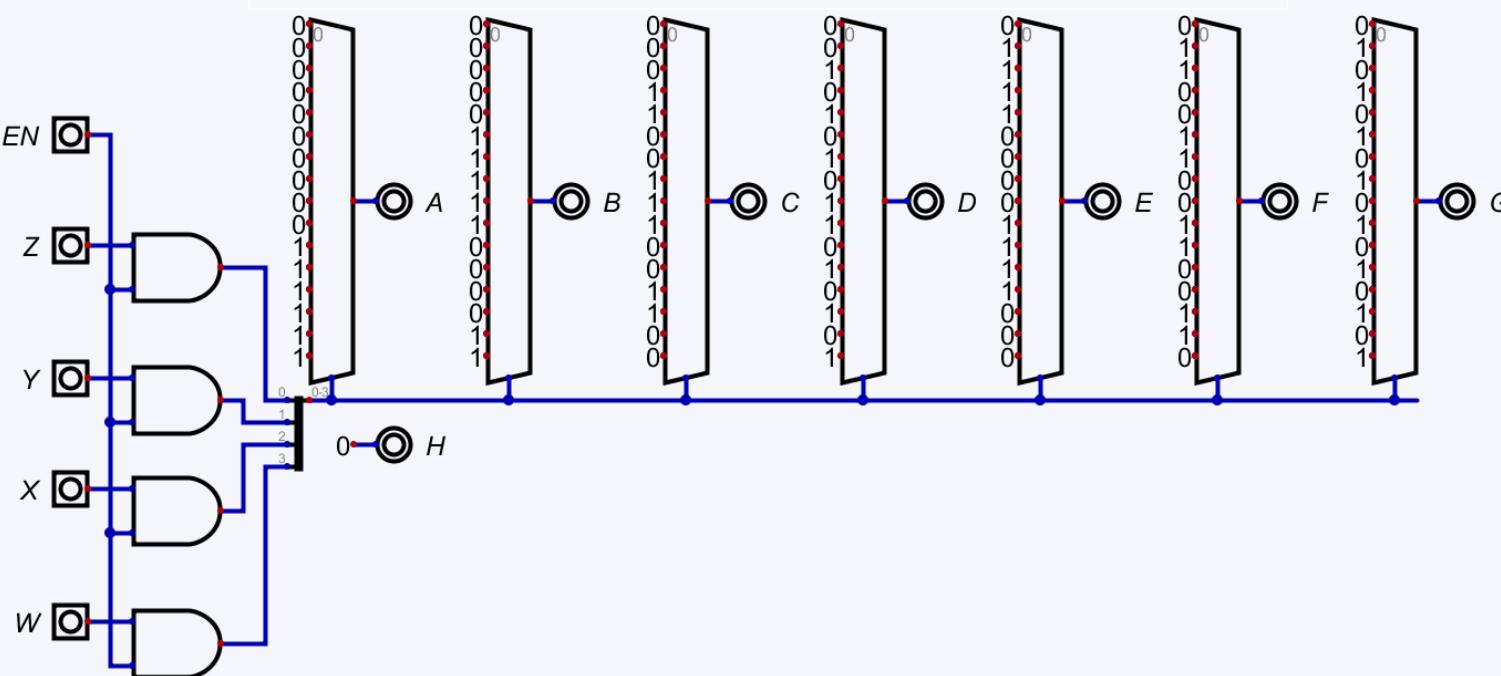
14	En	W	X	Y	Z	A	B	C	D	E	F	G	H
0	0	X	X	X	X	0	0	0	0	0	0	0	0
0	1	0	0	0	0	0	0	0	0	0	0	0	0
1	1	0	0	0	1	0	0	0	0	1	1	1	0
2	1	0	0	1	0	0	0	0	1	1	1	0	0
3	1	0	0	1	1	0	0	1	0	1	0	1	0
4	1	0	1	0	0	0	0	1	1	1	0	0	0
5	1	0	1	0	1	0	1	0	0	0	1	1	0
6	1	0	1	1	0	0	1	0	1	0	1	0	0
7	1	0	1	1	1	0	1	1	0	0	0	1	0
8	1	1	0	0	0	0	1	1	1	0	0	0	0
9	1	1	1	0	1	0	1	1	1	1	1	1	0
10	1	1	0	1	0	1	0	0	0	1	1	0	0
11	1	1	0	1	1	1	0	0	1	1	0	1	0
12	1	1	1	0	0	1	0	1	0	1	0	0	0
13	1	1	1	0	1	1	0	1	1	0	1	1	0
14	1	1	1	1	0	1	1	0	0	0	1	0	0
15	1	1	1	1	1	1	1	1	0	1	0	0	1

Multiplication table of Fourteen design

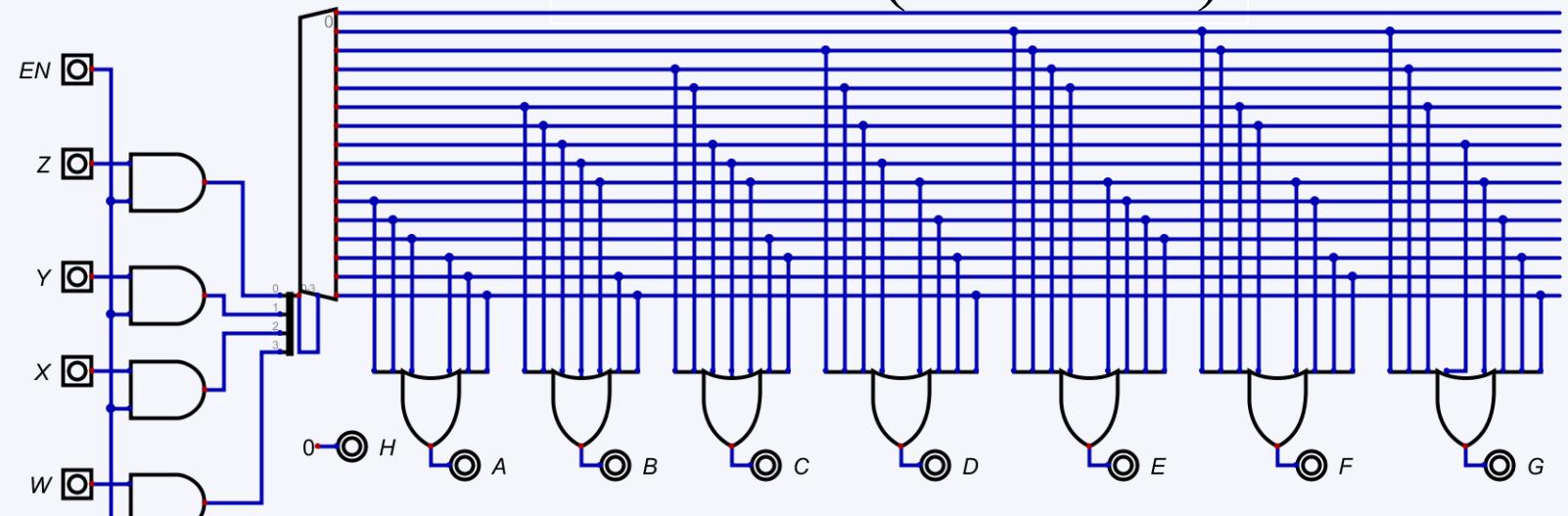
Combinational (C M14T)



Multiplexer (M M14T)



Decoder (D M14T)



Multiplication table of Fifteen

WX		YZ			A=WX+WY+WZ		
W	X	Y	Z	W	X	Y	Z
0	0	0	0	0	0	1	
0	0	1	0	0	1		3
0	1	0	0	0	4	5	
0	1	1	0	0	12	13	7
1	1	0	0	1	1	13	15
1	0	0	1	1	8	9	11
1	0	1	0	1	1	11	1

X	Y	Z	W	X	Y	Z	W	X	Y	Z	W
0	0			0	1			1	1		
0	1			0	1			1	0		
0	0			0				1	1	3	
0	1			1	4			5	1	7	
1	1			1	12			13	1	15	
1	0			1	8			9	1	11	

	$C = YZ + WY'Z' + XY'Z'$
$\begin{matrix} \cancel{Y} \\ \cancel{W} \\ X \end{matrix}$	$E = W'Y + W'Z + W'XY'Z' + WX'Y'Z'$
0 0	0 1 1 1 0

	3	4	5	6	7	8
0	1	4	1	5	1	7
1	1	12	13	15		
1	0	1				

	1	8	9	11		
X W	Y X	Z Y	0 0	0 1	1 1	1 0
0 0		0	1	1	3	1
0 1		4	1	5	7	1
1 1		12	1	13	15	1
1 0		8	1	9	11	1

$W \backslash X \backslash Y \backslash Z$	$B = XY + XZ + WX'Y'Z'$				M1	
	0 0	0 1	1 1	1 0		
0 0	0	1	3	2		
0 1	4	1 5	1 7	1 6		
1 1	12	1 13	1 15	1 14		
1 0	1 8	9	11	10		

W X Y Z	0 0	0 1	1 1	1 0
0 0	0	1	3	1 2
0 1	1 4	5	7	1 6
1 1	1 12	13	15	1 14
1 0	1 8	9	11	1 10

$$D = YZ' + WY'Z' + XY'Z'$$

$$F = X'Y + XY'Z' + X'Z$$

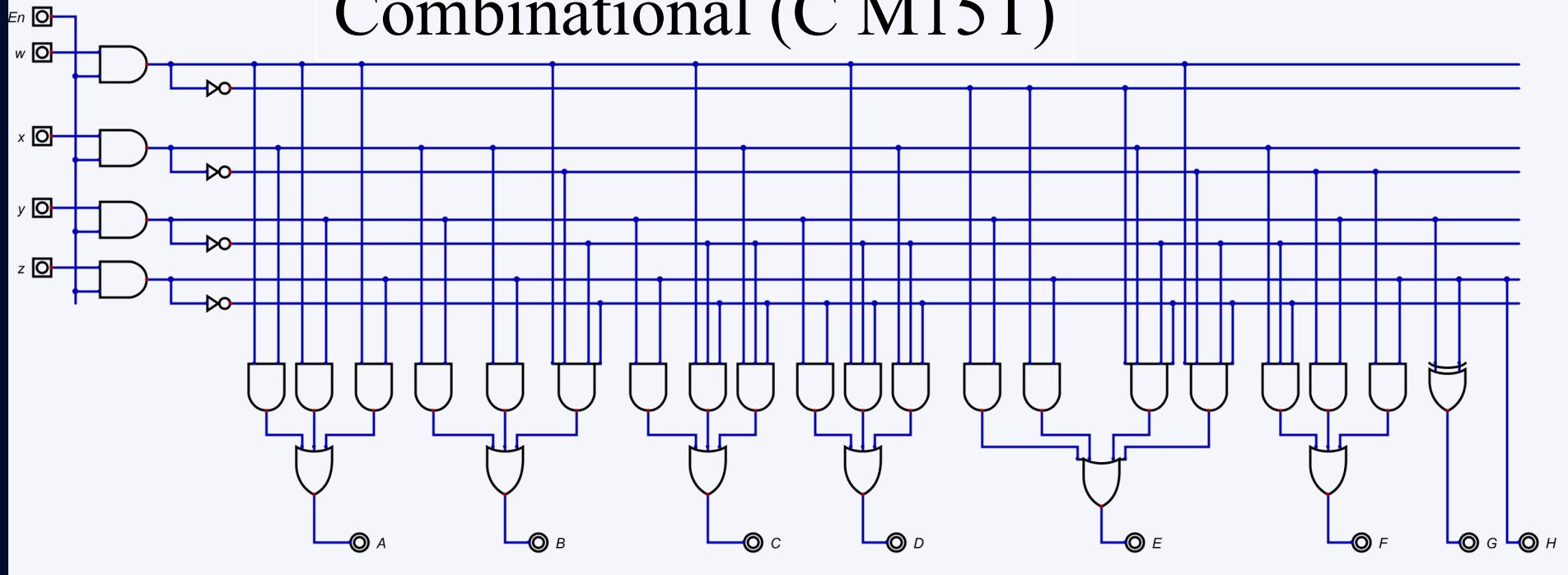
W	X	Y	Z	0	0	0	1	1	1	1	0	M1
0	0			0	1	1	1	3	1	2		

	8	9	10	
WX YZ	0 0	0 1	1 1	1 0
0 0	0	1 1	1 3	2
0 1	4	1 5	1 7	6
1 1	12	1 13	1 15	14
1 0	8	1 9	1 11	10

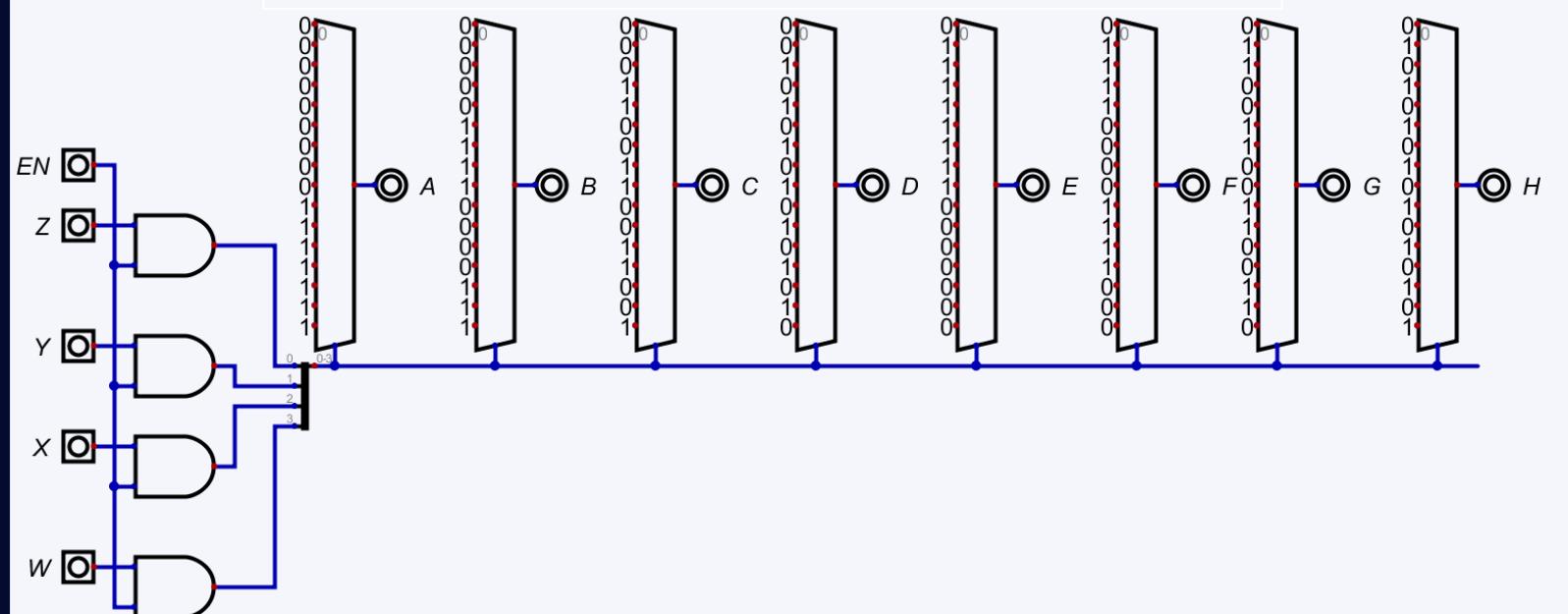
15	En	W	X	Y	Z	A	B	C	D	E	F	G	H
	0	X	X	X	X	0	0	0	0	0	0	0	0
0	1	0	0	0	0	0	0	0	0	0	0	0	0
1	1	0	0	0	1	0	0	0	0	1	1	1	1
2	1	0	0	1	0	0	0	0	1	1	1	1	0
3	1	0	0	1	1	0	0	1	0	1	1	0	1
4	1	0	1	0	0	0	0	1	1	1	1	0	0
5	1	0	1	0	1	0	1	0	0	1	0	1	1
6	1	0	1	1	0	0	1	0	1	1	0	1	0
7	1	0	1	1	1	0	1	1	0	1	0	0	1
8	1	1	0	0	0	0	1	1	1	1	0	0	0
9	1	1	0	0	1	1	0	0	0	0	1	1	1
10	1	1	0	1	0	1	0	0	1	0	1	1	0
11	1	1	0	1	1	1	0	1	0	0	1	0	1
12	1	1	1	0	0	1	0	1	1	0	1	0	0
13	1	1	1	0	1	1	1	0	0	0	0	1	1
14	1	1	1	1	0	1	1	0	1	0	0	1	0
15	1	1	1	1	1	1	1	1	0	0	0	0	1

Multiplication table of Fifteen design

Combinational (C M15T)



Multiplexer (M M15T)



Decoder (D M15T)

