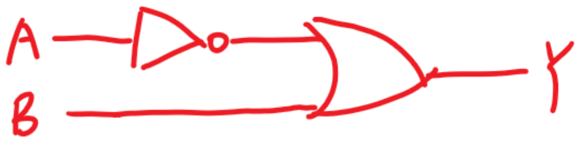
A.1.1

(1.)

A \ B	0	1
0	1	1
1	0	1

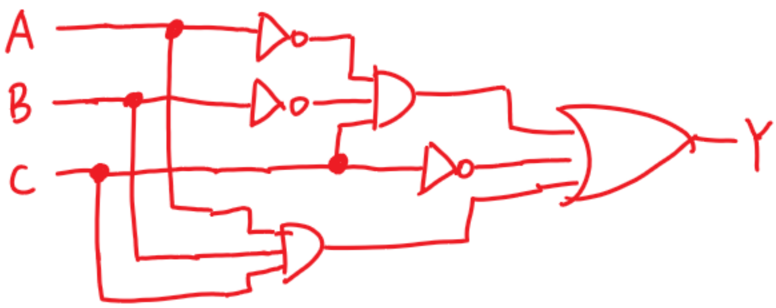
$Y=\bar{A}+B$



(2.)

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

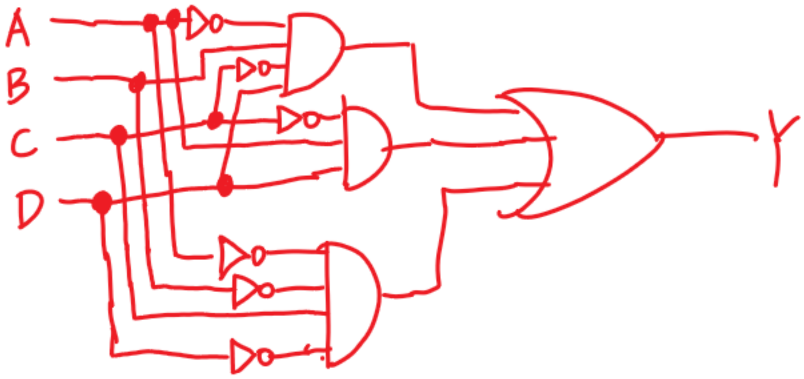
$Y=\bar{C}+\bar{A}\bar{B}C+ABC$



(3.)

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

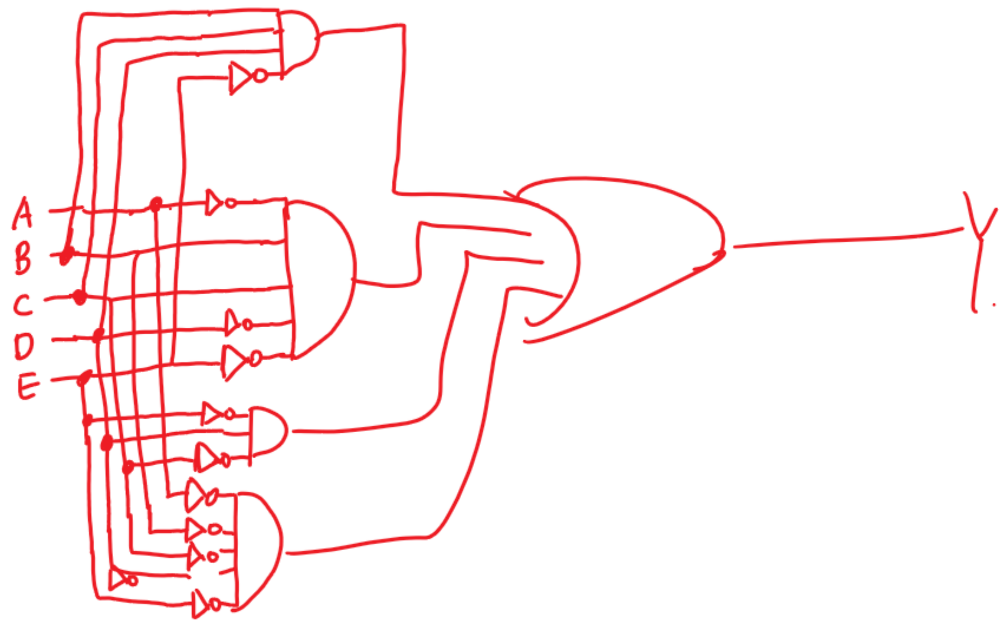
$Y=\bar{A}\bar{B}C\bar{D}+\bar{A}B\bar{C}D+A\bar{C}D$



(4.)

AB \ CDE	000	001	011	010	110	111	101	100
00	1	0	0	1	0	0	0	0
01	0	0	0	1	1	0	0	1
11	0	0	0	1	1	0	0	0
10	0	0	0	1	0	0	0	0

$$Y = \bar{A}\bar{B}\bar{C}\bar{D}\bar{E} + \bar{C}D\bar{E} + BCD\bar{E} + \bar{A}BC\bar{D}\bar{E}$$



A.2.1(a)

when $N = 3$

$Y = A \oplus B \oplus C$

A	B	C	$A \oplus B$	$A \oplus B \oplus C$
0	0	0	0	0
0	0	1	0	1
0	1	0	1	1
0	1	1	1	0
1	0	0	1	1
1	0	1	1	0
1	1	0	0	0
1	1	1	0	1

When N = 3, the output will be TRUE when there are exact 1 input is TRUE or all of the three inputs are TRUE

(b) When $N = 4$

A	B	C	D	$A \oplus B$	$A \oplus B \oplus C$	$A \oplus B \oplus C \oplus D$
0	0	0	0	0	0	0
0	0	0	1	0	0	1
0	0	1	0	0	1	1
0	0	1	1	0	1	0
0	1	0	0	1	1	1
0	1	0	1	1	1	0
0	1	1	0	1	0	0
0	1	1	1	1	0	1
1	0	0	0	1	1	1
1	0	0	1	1	1	0
1	0	1	0	1	0	0
1	0	1	1	1	0	1
1	1	0	0	0	0	0
1	1	0	1	0	0	1
1	1	1	0	0	1	1
1	1	1	1	0	1	0

When N = 3, the output will be TRUE when there
are exact 1 input is FALSE or TRUE.

A2.2 (i)

a	b	c	$b\oplus c$	$a(b\oplus c)$	ab	ac	$ab\oplus ac$
0	0	0	0	0	0	0	0
0	0	1	1	0	0	0	0
0	1	0	1	0	0	0	0
0	1	1	0	0	0	0	0
1	0	0	0	0	0	0	0
1	0	1	1	1	0	1	1
1	1	0	1	1	1	0	1
1	1	1	0	0	1	1	0

prove by truth table, $a(b\oplus c) = ab\oplus ac$

(2)

a	b	c	$a\oplus b$	$(a\oplus b)\oplus c$	$b\oplus c$	$a\oplus(b\oplus c)$
0	0	0	0	0	0	0
0	0	1	0	1	1	1
0	1	0	1	1	1	1
0	1	1	1	0	0	0
1	0	0	1	1	0	1
1	0	1	1	0	1	0
1	1	0	0	0	1	0
1	1	1	0	1	0	1

prove by truth table
$(a\oplus b)\oplus c = a\oplus(b\oplus c)$

A2.3

a	b	c	$a\oplus b\oplus c$	$a\odot b$	$a\odot b\odot c$
0	0	0	0	1	0
0	0	1	1	1	1
0	1	0	1	0	1
0	1	1	0	0	0
1	0	0	1	0	1
1	0	1	0	0	0
1	1	0	0	1	0
1	1	1	1	1	1

prove by truth table, $a\oplus b\oplus c = a\odot b\odot c$

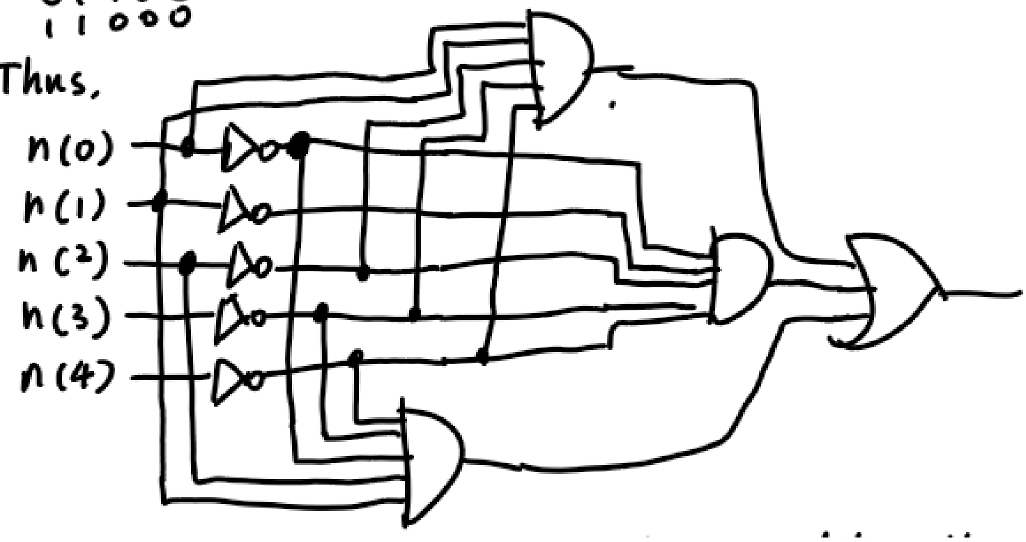
A3.3

	n(0)	n(1)	n(2)	n(3)	n(4)	chkdiv3	chkdiv4	chkdiv12(d)
0	0	0	0	0	0	1	1	1
1	0	0	0	0	1	0	0	0
2	0	0	0	1	0	0	0	0
3	0	0	0	1	1	1	0	0
4	0	0	1	0	0	0	1	0
5	0	0	1	0	1	0	0	0
6	0	0	1	1	0	1	0	0
7	0	0	1	1	1	0	0	0
8	0	1	0	0	0	0	1	0
9	0	1	0	0	1	1	0	0
10	0	1	0	1	0	0	0	0
11	0	1	0	1	1	0	0	0
12	0	1	1	0	0	1	1	1
13	0	1	1	0	1	0	0	0
14	0	1	1	1	0	0	0	0
15	0	1	1	1	1	1	0	0
16	1	0	0	0	0	0	1	0
17	1	0	0	0	1	0	0	0
18	1	0	0	1	0	1	0	0
19	1	0	0	1	1	0	0	0
20	1	0	1	0	0	0	1	0
21	1	0	1	0	1	1	0	0
22	1	0	1	1	0	0	0	0
23	1	0	1	1	1	0	0	0
24	1	1	0	0	0	1	1	1
25	1	1	0	0	1	0	0	0
26	1	1	0	1	0	0	0	0
27	1	1	0	1	1	1	0	0
28	1	1	1	0	0	0	1	0
29	1	1	1	0	1	0	0	0
30	1	1	1	1	0	1	0	0
31	1	1	1	1	1	0	0	0

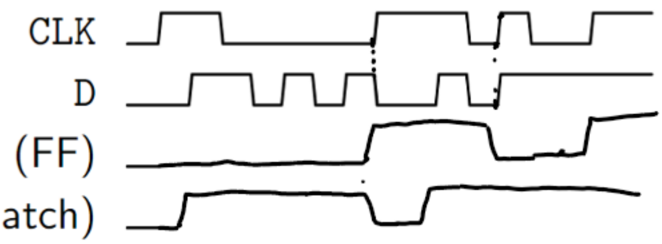
From the truth table,

00000
01100
11000

Thus,



A4.

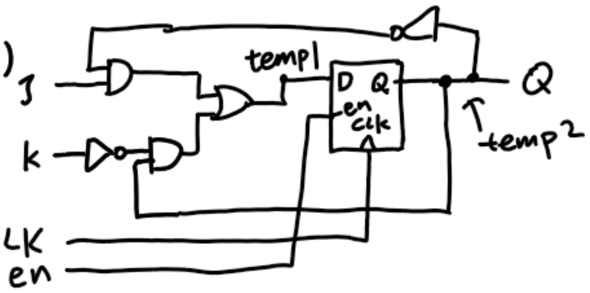


A3.4

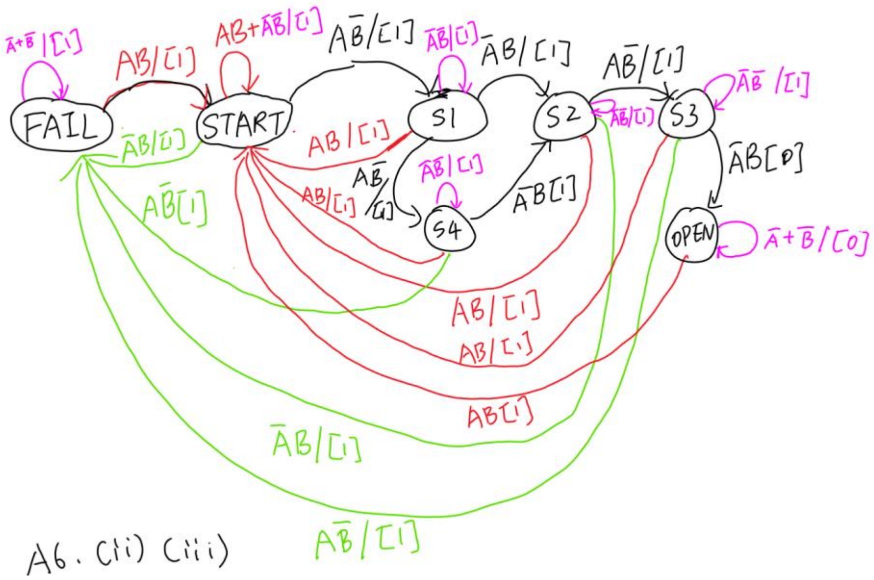
After I decompose these two approaches into two-inputs gates, the first approach using divisible by 12 is equal to both divisible by 3 and 4 has **46** two-inputs gates. If directly write chkdiv12 by its truth table, there are **14** two-inputs gates. Thus, the first approach is more physically larger.

A5.

(a)



A6. (i)



A6. (ii) (iii)

STATE REPRESENT	
0000	FAIL
0001	START
0010	S1
0011	S2
0100	S3
0101	S4
0110	OPEN

Current State	A	B	Next State	Output
0000	0	0	0000	1
0000	0	1	0000	1
0000	1	0	0000	1
0000	1	1	0001	1
0001	0	0	0001	1
0001	0	1	0000	1
0001	1	0	0010	1
0001	1	1	0001	1
0010	0	0	0010	1
0010	0	1	0011	1
0010	1	0	0101	1
0010	1	1	0001	1
0011	0	0	0011	1
0011	0	1	0000	1
0011	1	0	0100	1
0011	1	1	0001	1
0100	0	0	0100	1
0100	0	1	0110	0
0100	1	0	0000	1
0100	1	1	0001	1
0101	0	0	0000	1
0101	0	1	0011	1
0101	1	0	0000	1
0101	1	1	0001	1
0110	0	0	0110	0
0110	0	1	0110	0
0110	1	0	0110	0
0110	1	1	0001	1