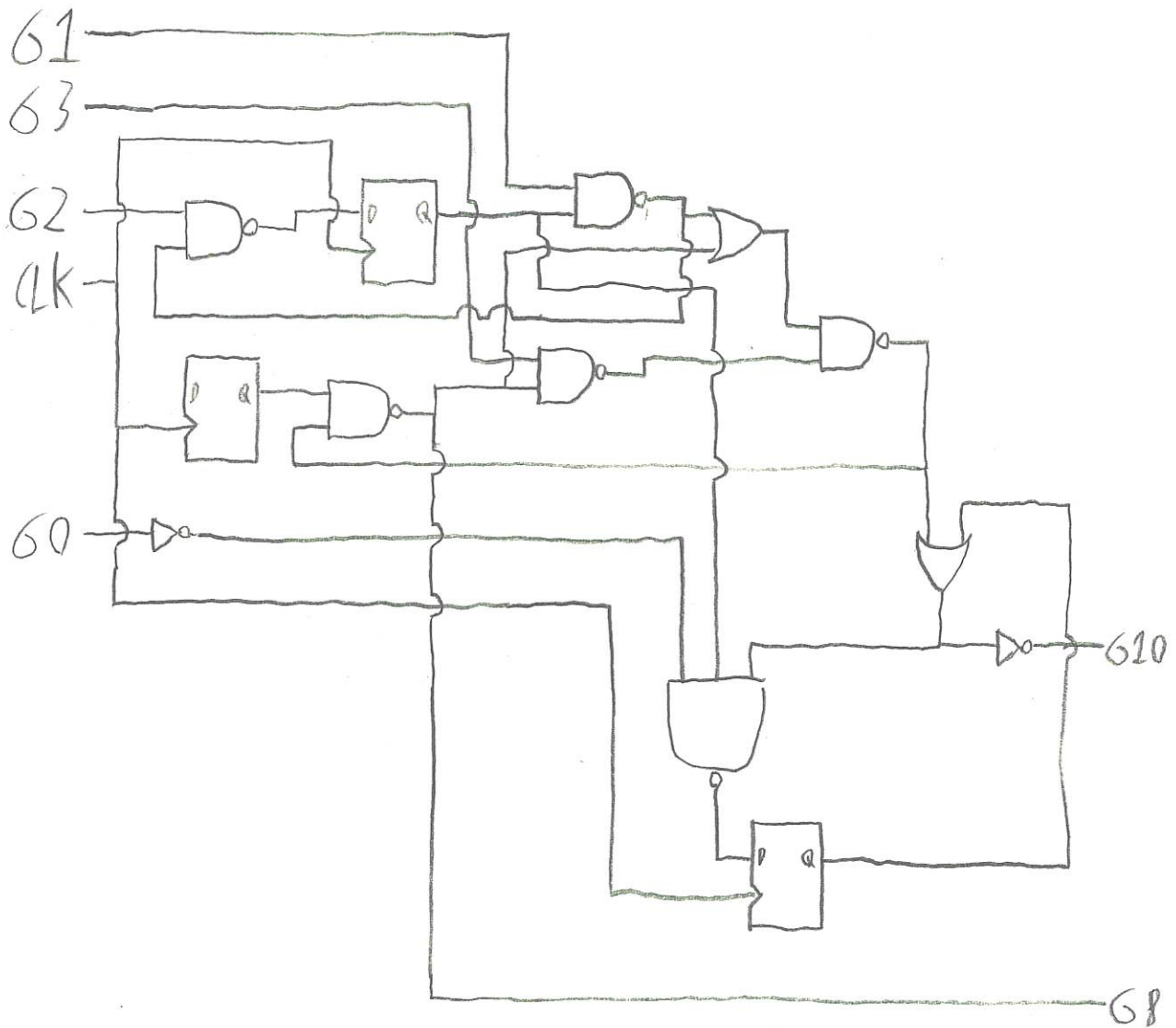
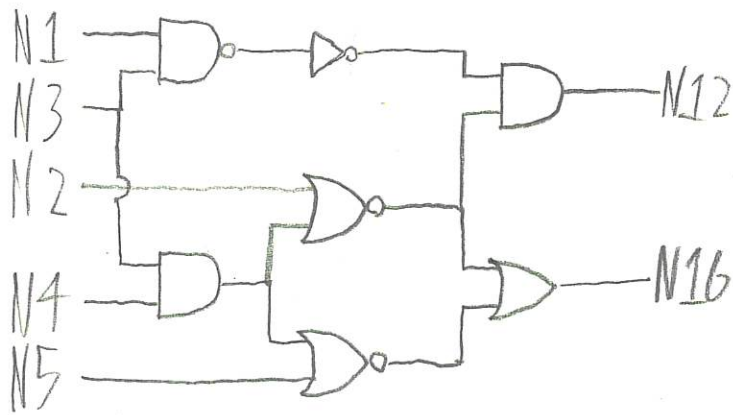
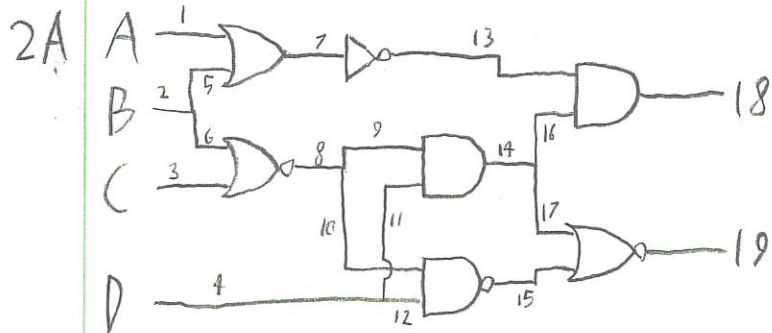


1.1



1.2

P1	1	2	3	4	5	12	16
V1	1	0	0	0	0	0	1
V2	Z	0	0	0	0	0	1
V3	0	1	0	Z	Z	0	X
V4	1	0	Z	0	1	X	1



Fault Equiv.

1/0	ϕ
1/1	5/1, 7/1, 13/0, 16/0, 18/0
2/0	ϕ
2/1	ϕ
5/0	ϕ
6/0	ϕ
6/1	3/1, 8/0
3/0	ϕ
4/0	ϕ
4/1	ϕ
7/0	13/1
8/1	ϕ
9/1	ϕ
10/0	12/0, 15/1, 17/1, 19/0,
10/1	ϕ
11/1	ϕ
12/1	ϕ
14/1	ϕ
15/0	ϕ
16/1	ϕ
17/0	ϕ
18/1	ϕ
19/1	ϕ
9/0	11/0, 14/0 (missed this one)

2B

1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1
2	0	0	0	0	1	1	1	1	0	0	0	0	1	1	1
3	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1
4	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0
/ 1/0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
/ 1/1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
/ 2/0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
/ 2/1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
\ 5/0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
\ 6/0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
/ 6/1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
/ 3/0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
/ 4/0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
/ 4/1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
/ 7/0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
/ 8/1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
/ 9/0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0
/ 9/1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
\ 10/0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
/ 10/1	0	0	0	0	0	1	1	1	0	0	0	1	0	1	1
/ 11/1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
\ 12/1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
/ 14/1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
/ 15/0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
/ 16/1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
/ 17/0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0
/ 18/1	1	0	1	0	1	1	1	1	1	1	1	1	1	1	1
/ 19/1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1

→ benign
→ benign

→ benign

→ benign

(work shown on next
five (!) pages)

↓ critical
↓ critical
↓ critical
↓ critical
↓ critical

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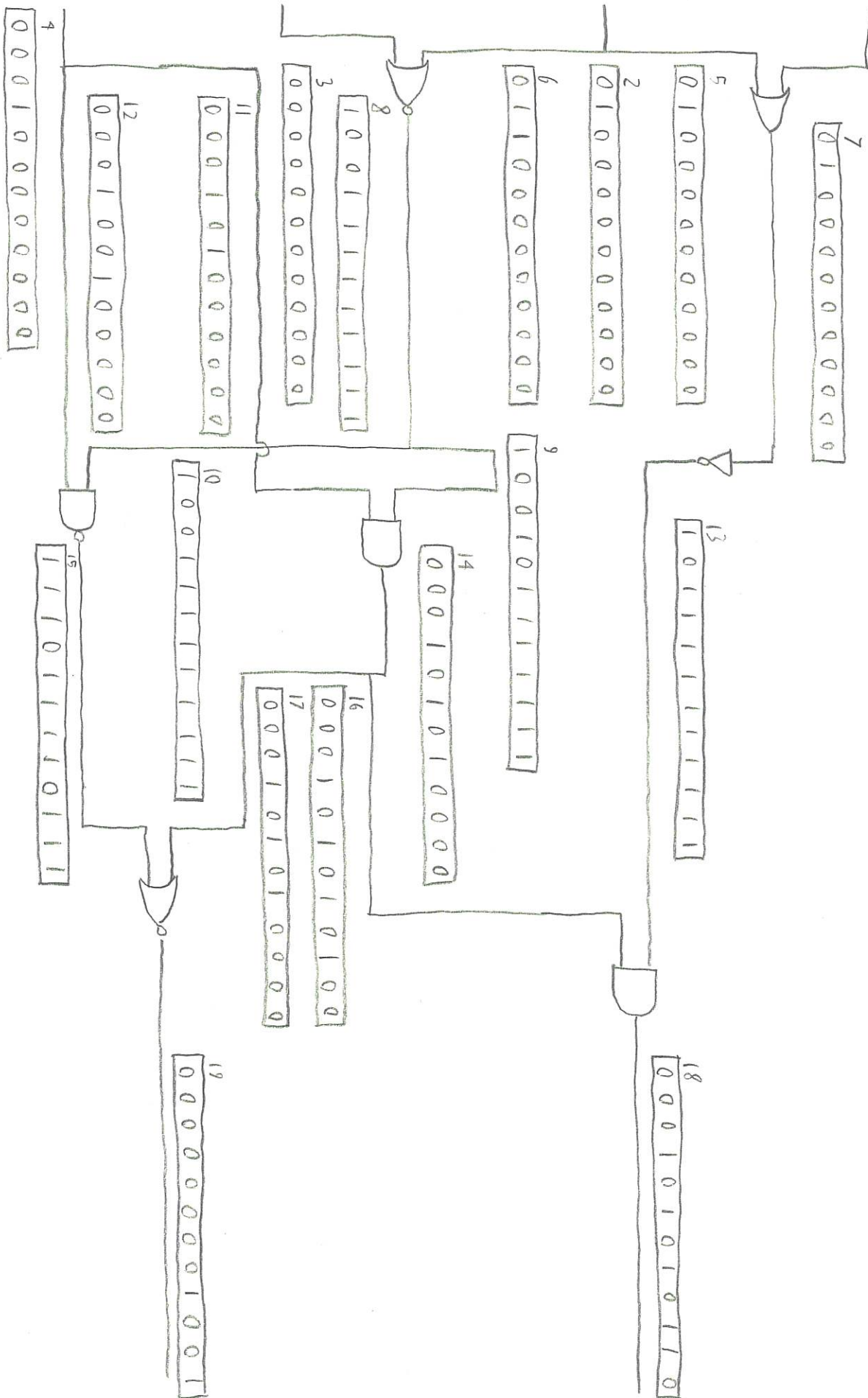
ECE 5480 HW2

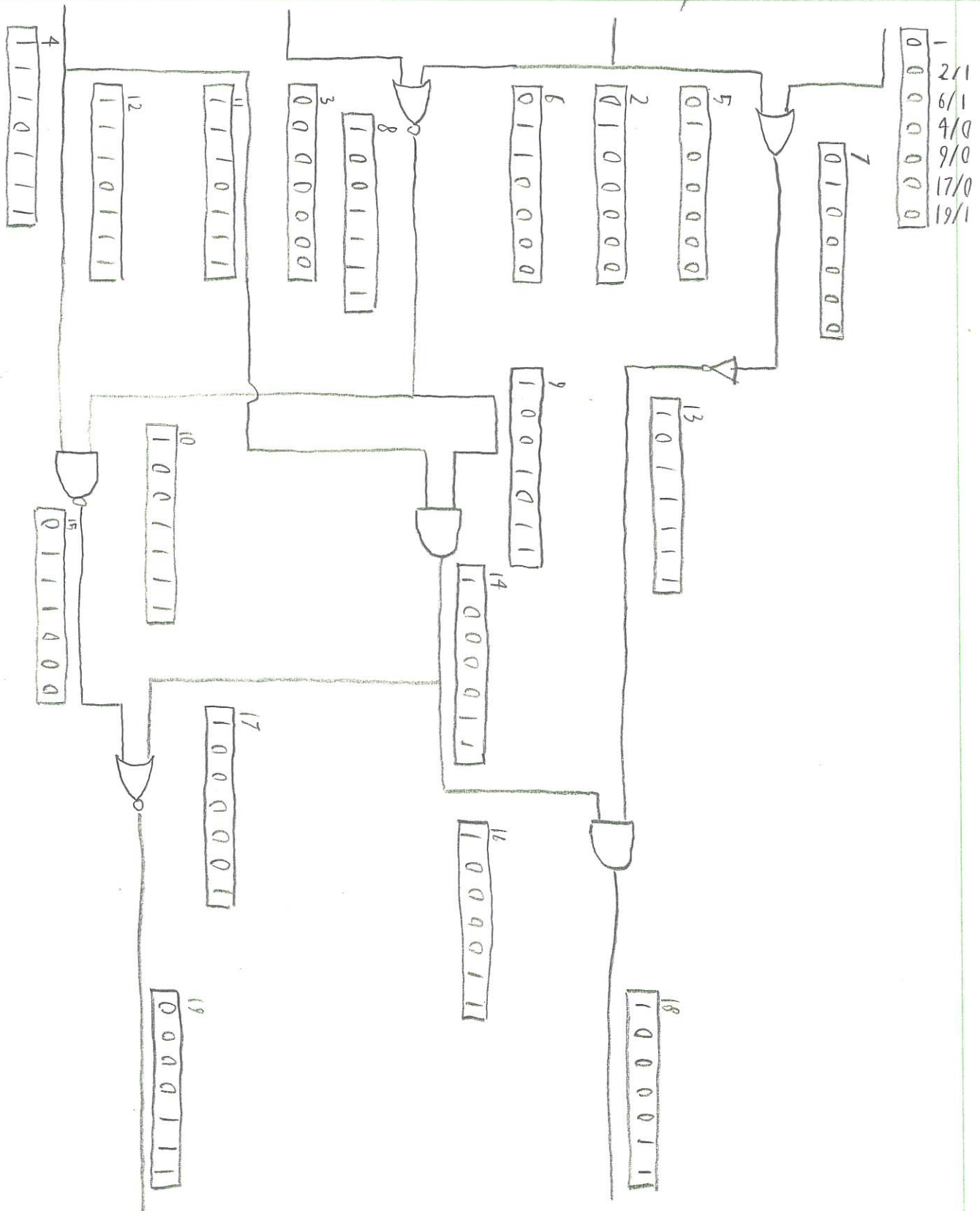
Henry Riker

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0000

1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0



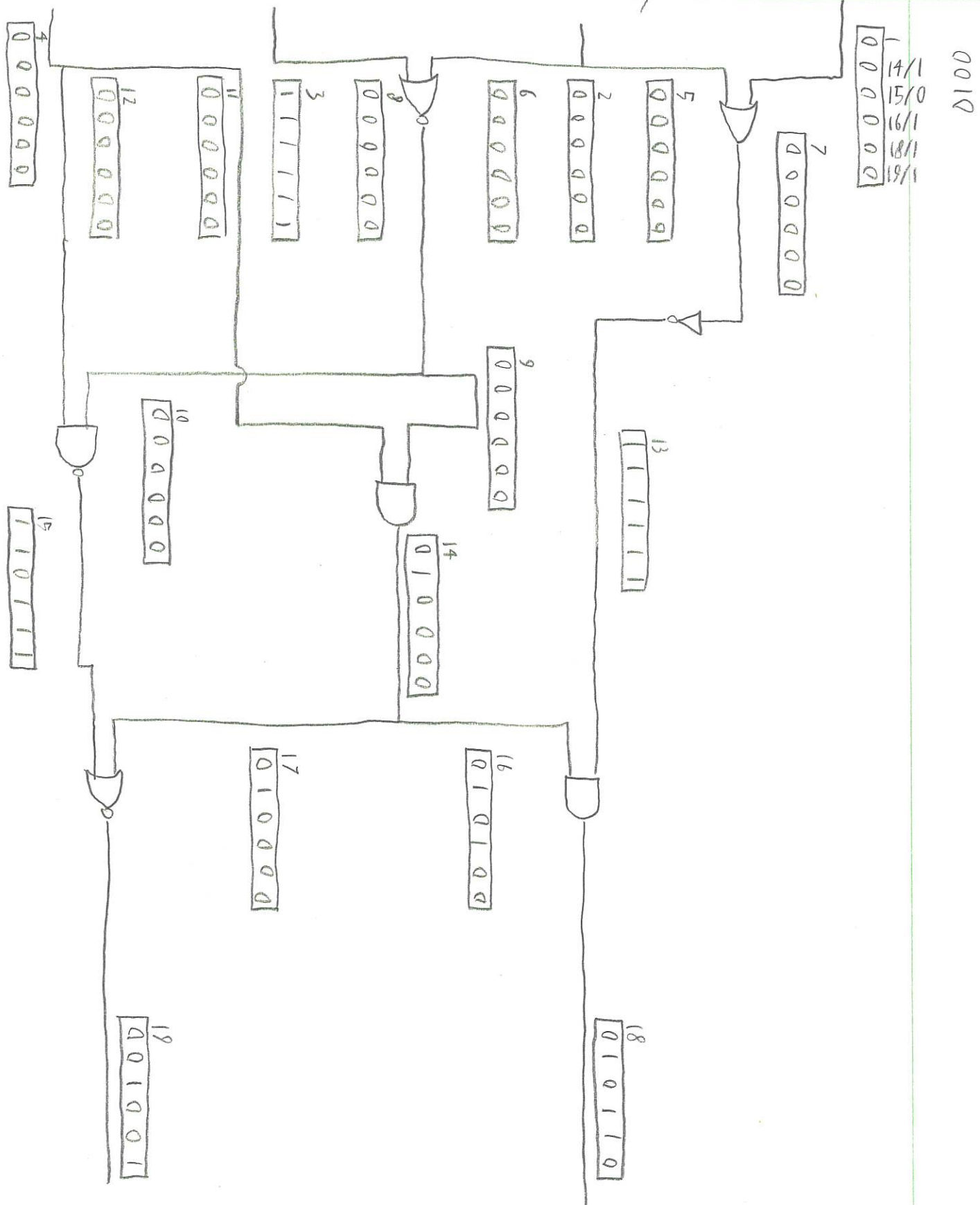


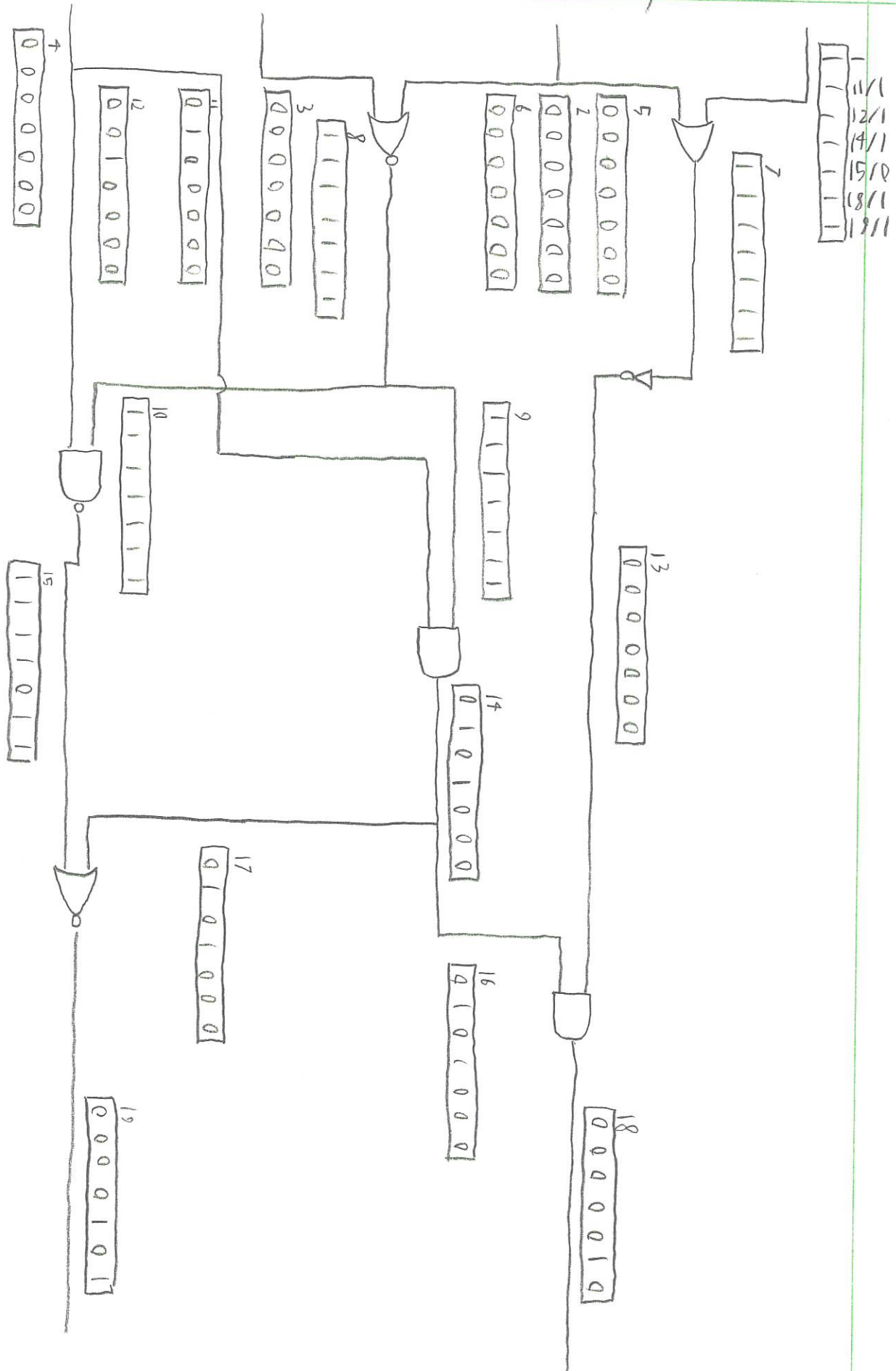
Feb 18 2025

ECE 5480 HW2

Henry Riker

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1001

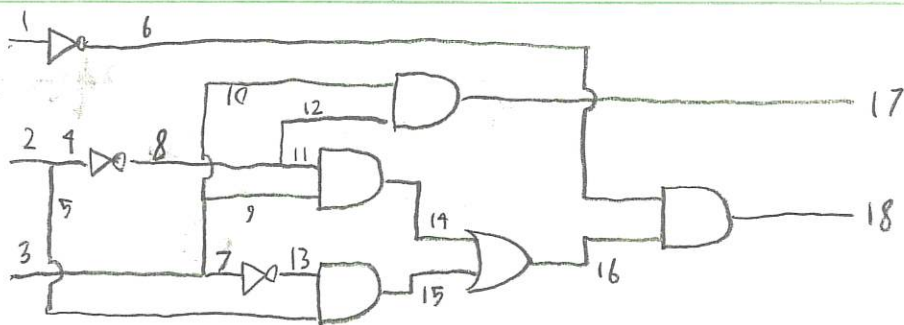
2C Vectors $[0000]$, $[0001]$, $[0011]$, $[0101]$, and $[1001]$ are critical for any minimum test set, as each one can detect a fault that no other vector can detect. We combine these five vectors and discover that they cover every malignant fault:

	1	2	3	4	total
1	0	0	0	0	1
2	0	0	0	1	0
3	0	0	1	0	0
4	0	1	1	1	1
1/0	0	0	0	0	1
1/1	0	1	0	0	0
2/0	0	0	0	1	0
2/1	0	1	0	0	0
6/1	0	1	0	0	0
3/0	0	0	1	0	0
4/0	0	1	0	0	0
4/1	1	0	0	0	0
7/0	0	0	0	0	1
8/1	0	0	1	0	0
9/0	0	1	0	0	1
9/1	0	0	1	0	0
10/1	0	0	0	1	0
11/1	1	0	0	0	0
14/1	1	0	0	0	0
15/0	1	0	0	0	0
16/1	1	0	0	0	0
17/0	0	1	0	0	1
18/1	1	0	0	1	1
19/1	1	1	0	1	1

Therefore, the minimum test set for this circuit is:

$[0000], [0001], [0011], [0101], [1001]$

3A



$$\begin{aligned}
 \# \text{ of fault sites} &= \# \text{ inputs} + \# \text{ gates} + \# \text{ fanout branches} \\
 &= 3 + 8 + 7 \\
 &= 18
 \end{aligned}$$

3B

Fault | Equiv.

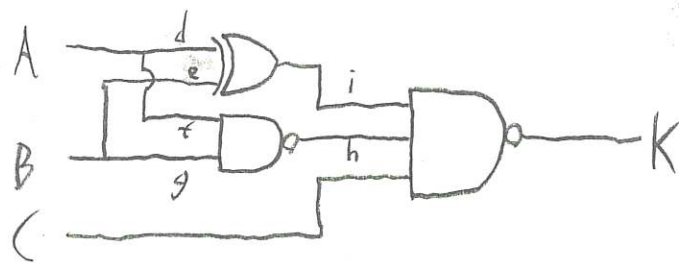
1/0	6/1	/
1/1	6/0, 16/0, 18/0	/
2/0	φ	/
2/1	φ	/
3/0	φ	/
3/1	φ	/
4/0	8/1	/
4/1	8/0	/
5/0	13/0, 15/0, 7/1	/
5/1	φ	/
7/0	13/1	/
9/0	11/0, 14/0	/
9/1	φ	/
10/0	12/0, 17/0	/
10/1	φ	/
11/1	φ	/
12/1	φ	/
14/1	15/1, 16/1	/
17/1	φ	/
18/1	φ	/

$$\text{Ratio is } \frac{20}{36} = \frac{5}{9} = 55.\bar{5}\%$$

3C [2/0, 2/1, 3/0, 3/1, 5/1, 6/1, 8/0, 8/1, 9/1, 10/1, 11/1, 12/1, 13/1, 14/0, 15/0, 16/1, 17/0, 17/1, 18/0, 18/1]

Ratio is still 55.5%

4A



$$\begin{aligned}
 \# \text{ of fault sites} &= \# \text{ inputs} + \# \text{ gates} + \# \text{ fanout branches} \\
 &= 3 + 3 + 4 \\
 &= 10
 \end{aligned}$$

7 check points

14 s-d faults:

A/0	A/1	B/0	B/1	C/0
C/1	d/0	d/1	e/0	e/1
f/0	f/1	g/0	g/1	

4B Faults d/0 and g/1 are NOT equivalent.

Fault d/0 is between a fanout and an XOR gate, neither of which propagates faults.

Fault g/1 is between a fanout, which does not propagate faults, and a NOR gate, which does not propagate s-d faults forwards.

$$5 \quad C = 0.7$$

$$\sigma = 0.02$$

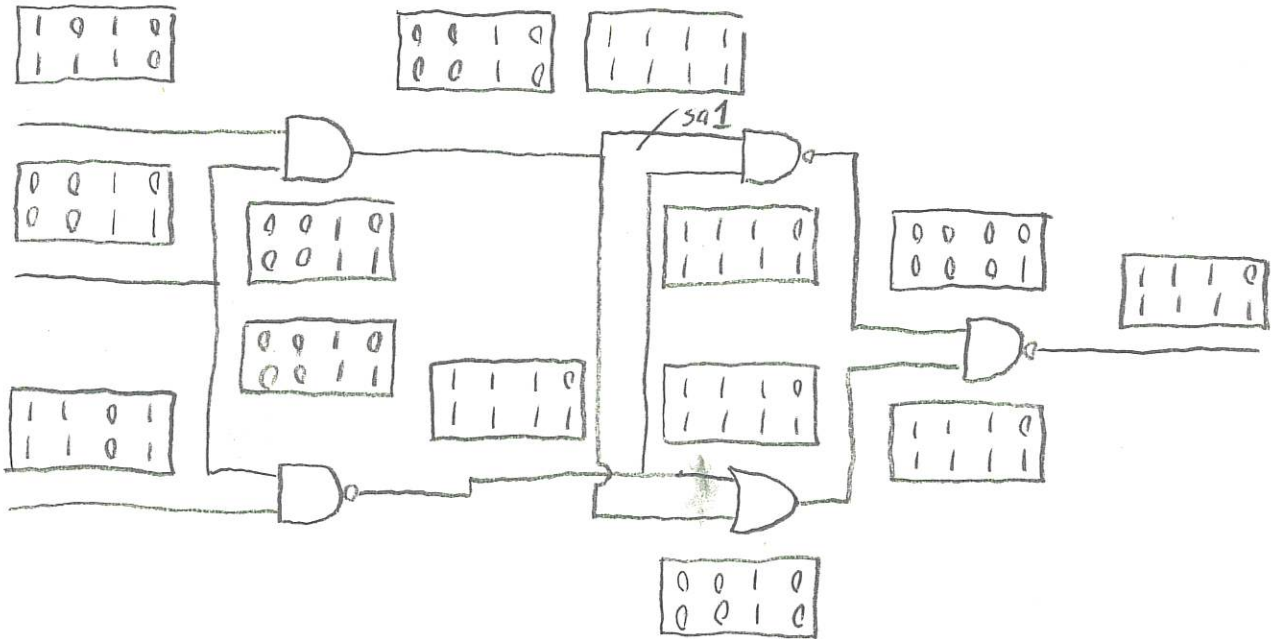
$$N_s = ?$$

$$\sigma^2 = \frac{C(1-C)}{N_s}$$

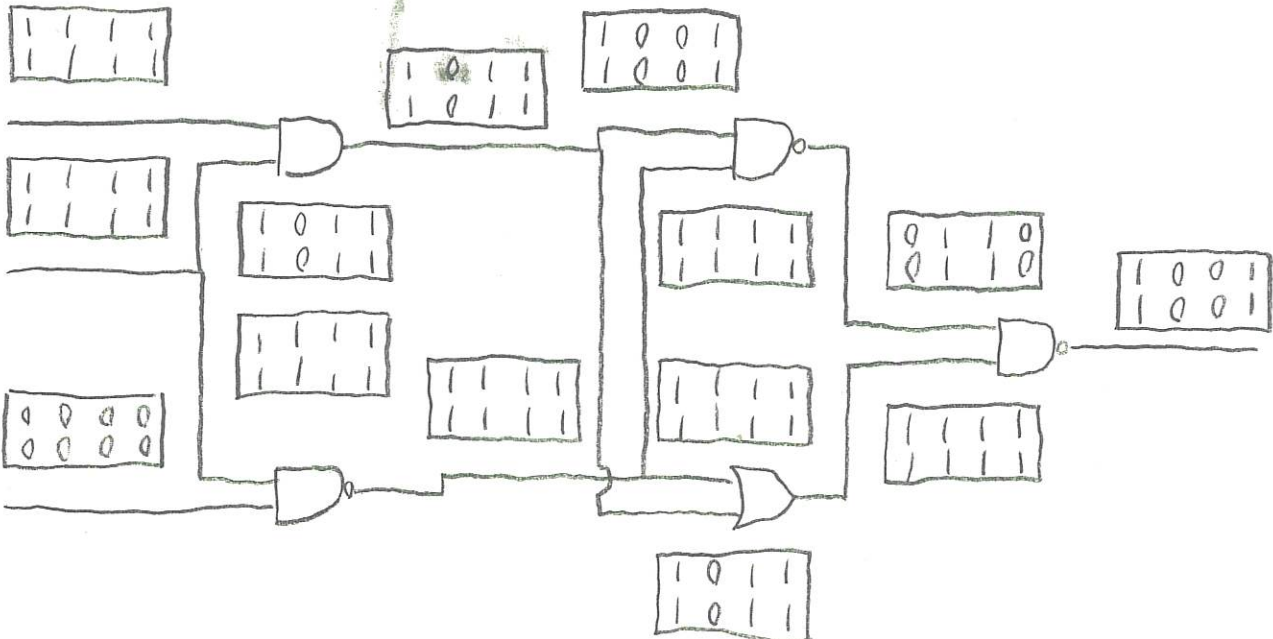
$$N_s = \frac{C(1-C)}{\sigma^2}$$

$$= 525$$

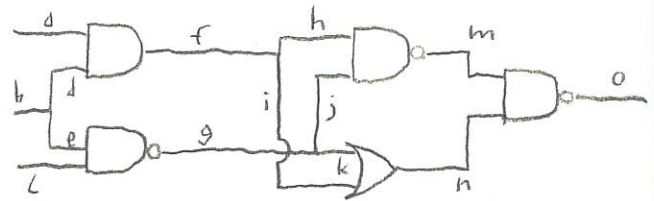
6A



6B



7 Fault	Equiv	
a/0	d/0, f/0	/
a/1	ϕ	/
b/0	ϕ	/
b/1	ϕ	/
c/0	e/0, g/1	/
c/1	ϕ	/
d/1	ϕ	/
e/1	ϕ	/
f/1	ϕ	/
g/0	ϕ	/
h/0	j/0, m/1	/
h/1	ϕ	/
i/0	ϕ	/
i/1	k/1, n/1	/
j/1	ϕ	/
k/0	ϕ	/
m/0	n/0, o/1	/
o/0	ϕ	/



Fault (dominant) | Detected by [1 0 1]?

a/1	no
b/0	no
b/1	no
c/1	no
d/1	yes
e/1	yes
f/0	no
f/1	yes
g/0	yes
g/1	no
h/1	yes
i/0	no
j/1	no
k/0	yes
m/1	no
h/1	no
e/0	no
o/1	yes

proof on next page

7 (cont.)

