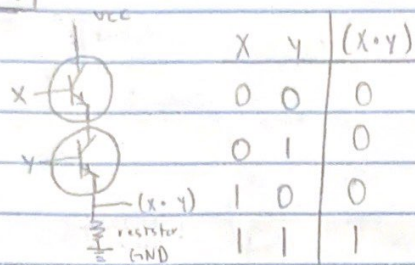I completed this assignment entirely on my own,
except for discussions with Franklin Choi.

Ethan Wong
CS M51A
Dis 1B
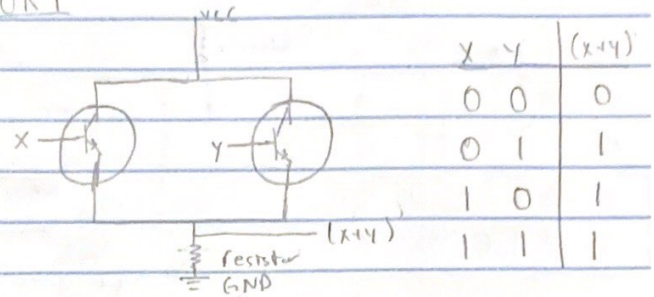
Assignment 3

1.
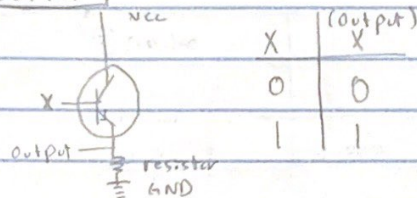
AND

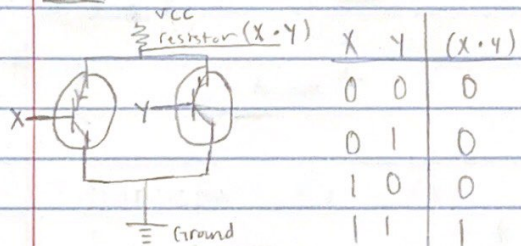| X	y	(x·y)
0	0	0
0	1	0
1	0	0
1	1	1

OR

X	y	(x+y)
0	0	0
0	1	1
1	0	1
1	1	1

Buffer

X	(output) X
0	0
1	1

2.

AND

X	Y	(x·y)
0	0	0
0	1	0
1	0	0
1	1	1

OR

X	y	(x+y)
0	0	0
0	1	1
1	0	1
1	1	1

NAND

X	y	(x·y)'
0	0	1
0	1	1
1	0	1
1	1	0

NOR

X	y	(x+y)'
0	0	1
0	1	0
1	0	0
1	1	0

3. | XOR |

X	Y	Out
0	0	0
0	1	1
1	0	1
1	1	0

OR, NAND, AND

0 1 0
1 1 1
1 1 1
1 0 0

X
Y

OR
NAND
AND

(XOR)
Output

VCC
VCC
Ground
VCC
VCC
X
VCC
Y

Ground
Ground
Ground

| X XOR Y |
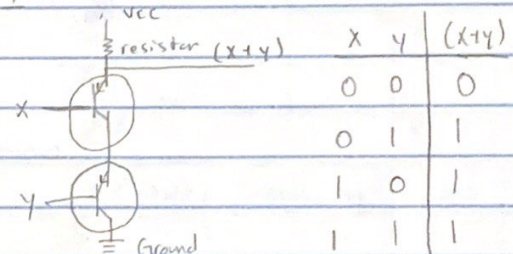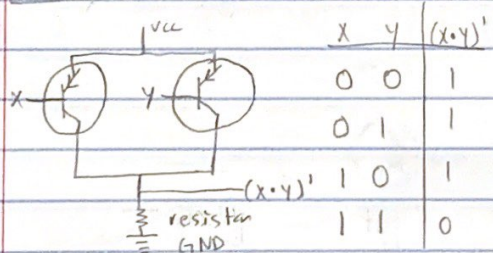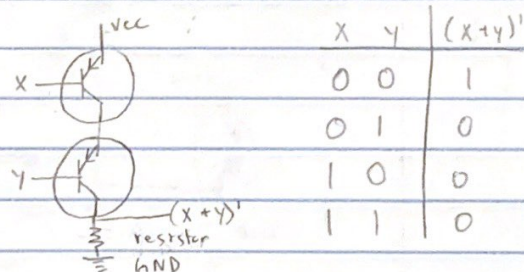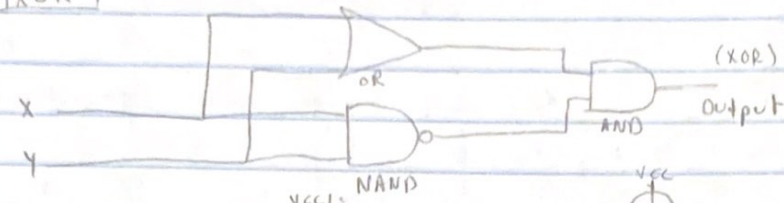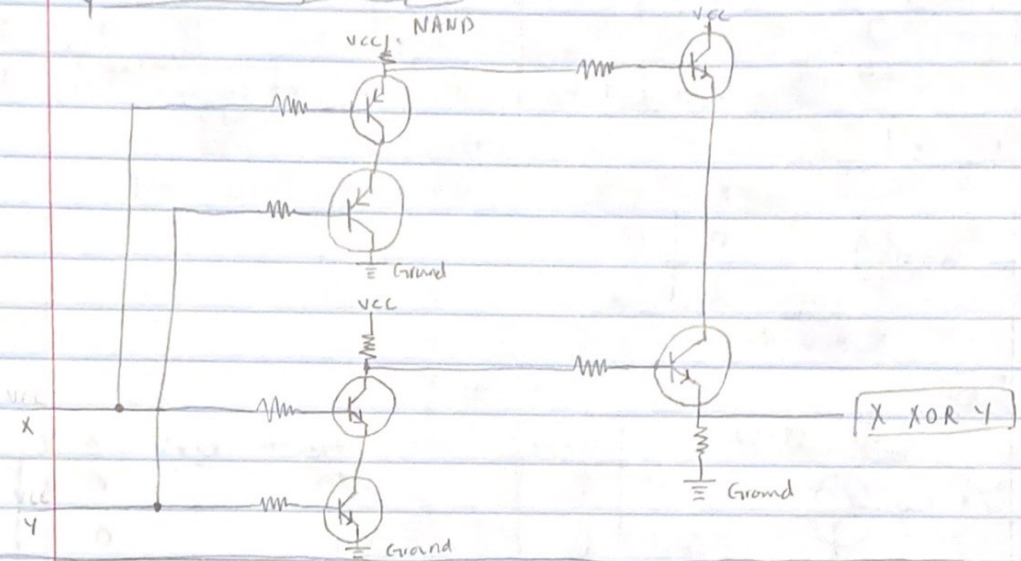
X	Y	Out
0	0	1
0	1	0
1	0	0
1	1	1

Equivalence (XNOR)

NOT
NOT
AND
AND
OR

(XNOR)
output

1 1 1 0 1
1 0 0 0 0
0 1 0 0 0
0 0 0 1 1

X
Y

VCC
GND
VCC
GND
VCC
GND
VCC

| X XNOR Y |

GND

VCC
X
VCC
Y
GND
GND
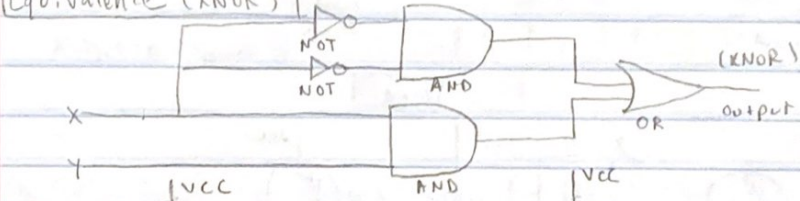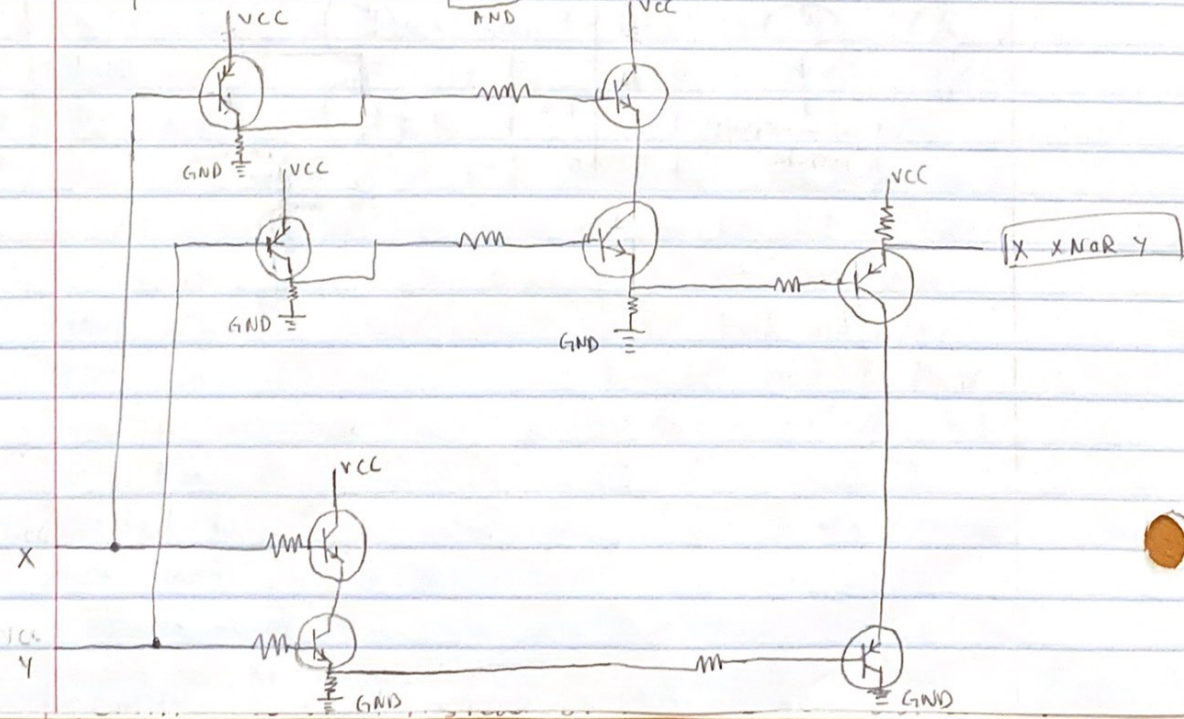
0 - open
1 - closed

0 - closed
1 - open

4.

Buffer
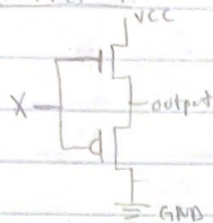
X	out
0	0
1	1

AND
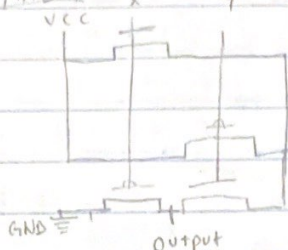
X	Y	Out	
0	0	0	✓
0	1	0	✓
1	0	0	✓
1	1	1	✓

OR
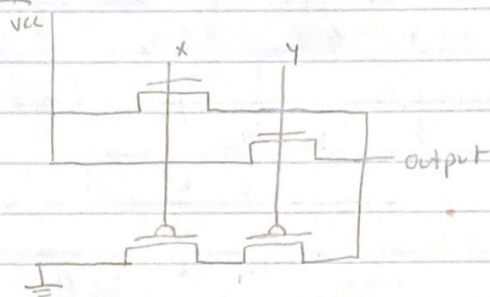
X	Y	Out
0	0	0
0	1	1
1	0	1
1	1	1

5.   "transistor" for water

Base
water flows down

Emitter   water flows in   Collector
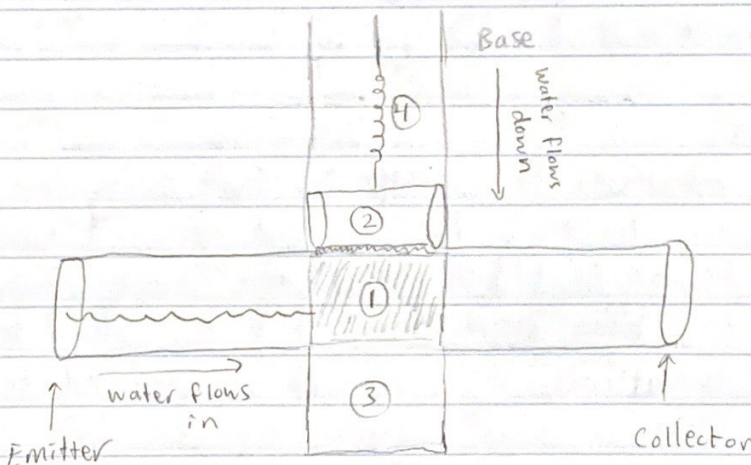
① This is a hollow, lightweight block. It is attached to ②

② This is a small hollow tube. It's attached to ①

③ This is a gap that ① can fit into when pushed down.

④ This is a spring that lowers/raises ① and ② into ③.

The logic behind this "transistor" is that water flows
down from the Base pipe. Once there is enough
water pressure in the Base pipe, ① and ②
get lowered down by the spring. ① gets lowered
into ③. Once this happens, ② is at the
level of the emitter and collector pipes, Since
② is hollow, the water flowing from the
emitter can now flow through to the collector.

Base pipe
(filled with water)

④

Water flows freely from
emitter to collector

②

emitter

①

collector
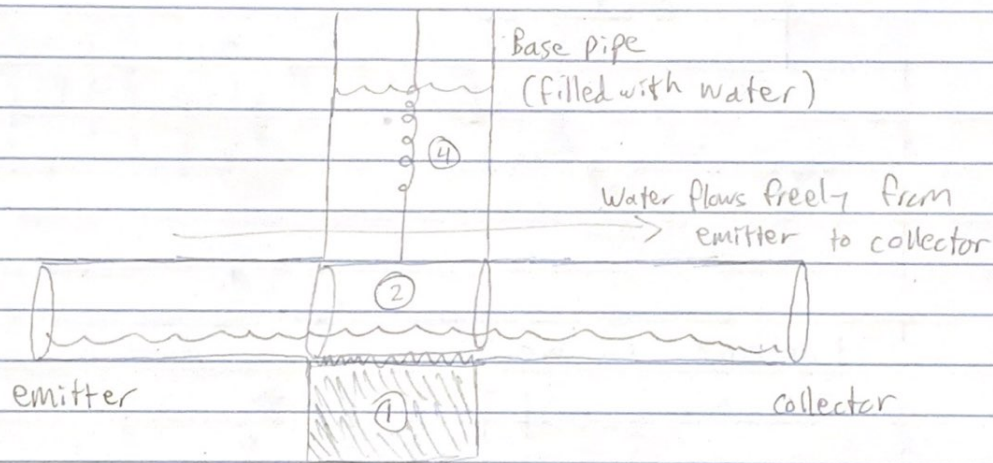
One drawback of this design is that there isn't a
great way to empty the base pipe after it fills up.
This means that once ① and ② get lowered,
they will stay there and won't be able to go back
up automatically. One possible workaround to this
is to have a small drain from the base pipe
that lets the accumulated water leak out over
time so ① and ② are brought back to their
original positions. This system isn't perfect, but
it's the best I could think of because I
wanted to "strive for simplicity" in my design
and limit it to three pipes. I hope this
implementation is satisfactory. I think a much better
version could be implemented if no water pressure on "base" allowed
emitter to flow, instead of how we were asked to do it.