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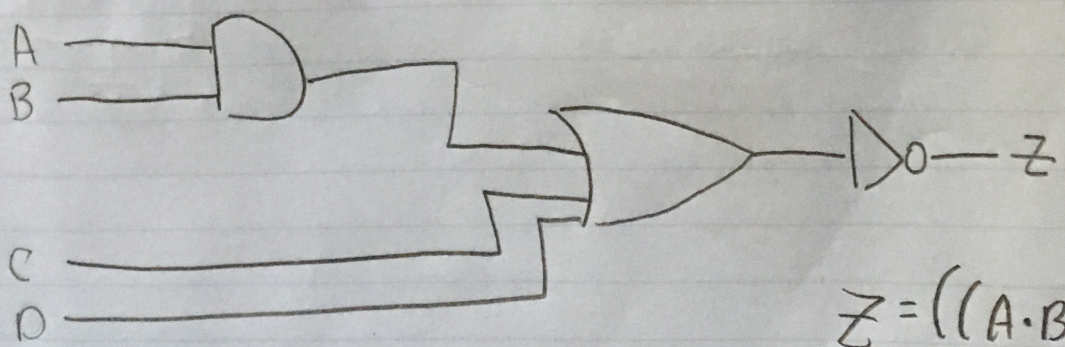
Digital Logic Design

September 20, 2017
HW 2:

HW 2: 11-15, 21, 40-41, 59-62, 78

11) Function Table:

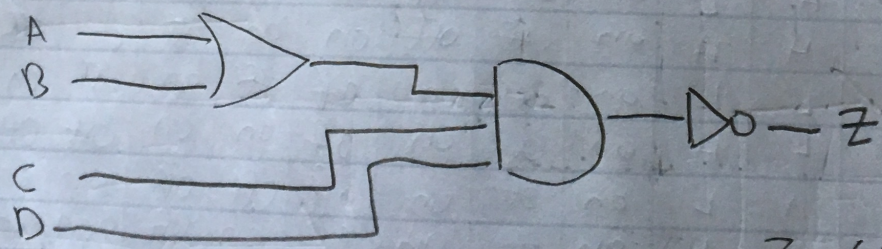
A	B	C	D	Q_1	Q_2	Q_3	Q_4	Q_5	Q_6	Q_7	Q_8	Z
L	L	L	L	off	on	off	on	off	on	off	on	H
L	L	L	H	off	on	off	on	on	on	off	off	L
L	L	H	L	off	on	off	on	off	off	on	on	L
L	L	H	H	off	on	off	on	on	off	on	off	L
L	H	L	L	off	on	on	off	off	on	off	on	H
L	H	L	H	off	on	on	off	on	on	off	off	L
L	H	H	L	off	on	on	off	off	off	on	on	L
L	H	H	H	off	on	on	off	on	off	on	off	L
H	L	L	L	on	off	off	on	off	on	off	on	H
H	L	L	H	on	off	off	on	on	on	off	off	L
H	L	H	L	on	off	off	on	off	off	on	on	L
H	L	H	H	on	off	off	on	on	off	on	off	L
H	H	L	L	on	off	on	off	off	on	off	on	L
H	H	L	H	on	off	on	off	on	on	off	off	L
H	H	H	L	on	off	on	off	off	off	on	on	L
H	H	H	H	on	off	on	off	on	off	on	off	L



$Z = ((A \cdot B) + (C + D)')$

12)

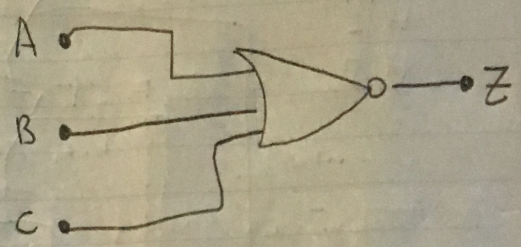
A	B	C	D	Q_1	Q_2	Q_3	Q_4	Q_5	Q_6	Q_7	Q_8	Z
L	L	L	L	0	1	0	1	0	1	0	1	H
L	L	L	H	0	1	0	1	0	1	1	0	H
L	L	H	L	0	1	0	1	1	0	0	1	H
L	L	H	H	0	1	0	1	1	0	1	0	H
L	H	L	L	0	1	1	0	0	1	0	1	H
L	H	L	H	0	1	1	0	0	1	1	0	H
L	H	H	L	0	1	1	0	1	0	0	1	H
L	H	H	H	0	1	1	0	1	0	1	0	L
H	L	L	L	1	0	0	1	0	1	0	1	H
H	L	L	H	1	0	0	1	0	1	1	0	H
H	L	H	L	1	0	0	1	1	0	0	1	H
H	L	H	H	1	0	0	1	1	0	1	0	L
H	H	L	L	1	0	1	0	0	1	0	1	H
H	H	L	H	1	0	1	0	0	1	1	0	H
H	H	H	L	1	0	1	0	1	0	0	1	H
H	H	H	H	1	0	1	0	1	0	1	0	L

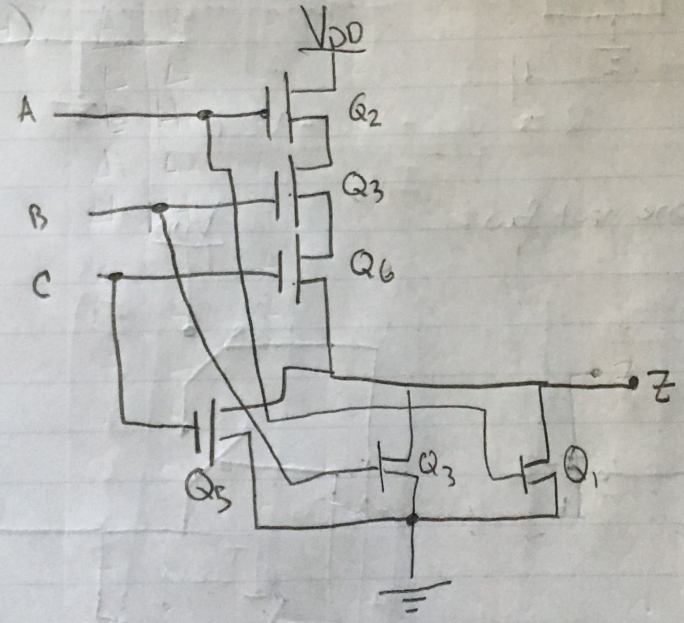


$$Z = ((A+B) \cdot C \cdot D)'$$

13)

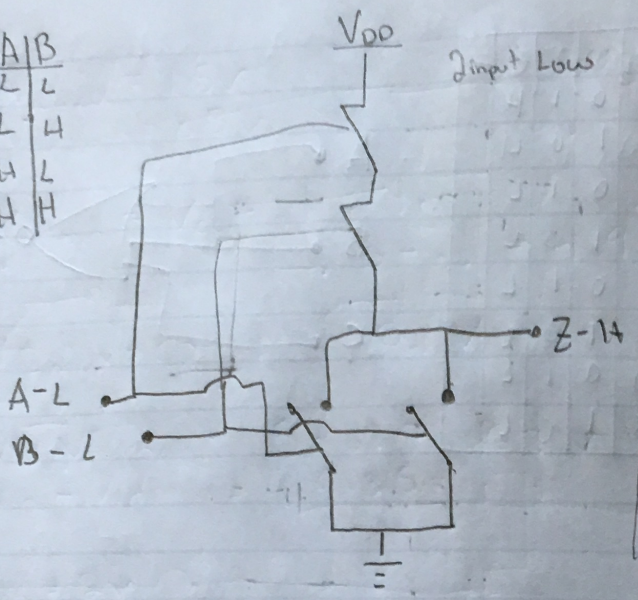
A	B	C	Q_1	Q_2	Q_3	Q_4	Q_5	Q_6	Z
L	L	L	0	1	0	1	0	1	H
L	L	H	0	1	0	1	1	0	L
L	H	L	0	1	1	0	0	1	L
L	H	H	0	1	1	0	1	0	L
H	L	L	1	0	0	1	0	1	L
H	L	H	1	0	0	1	1	0	L
H	H	L	1	0	1	0	0	1	L
H	H	H	1	0	1	0	1	0	L

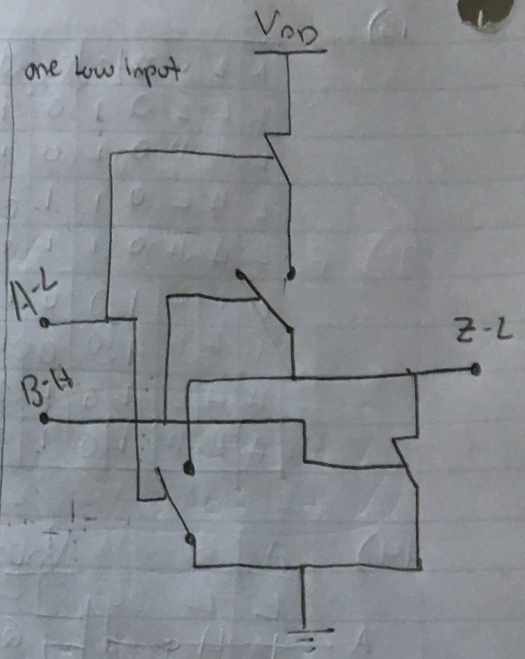


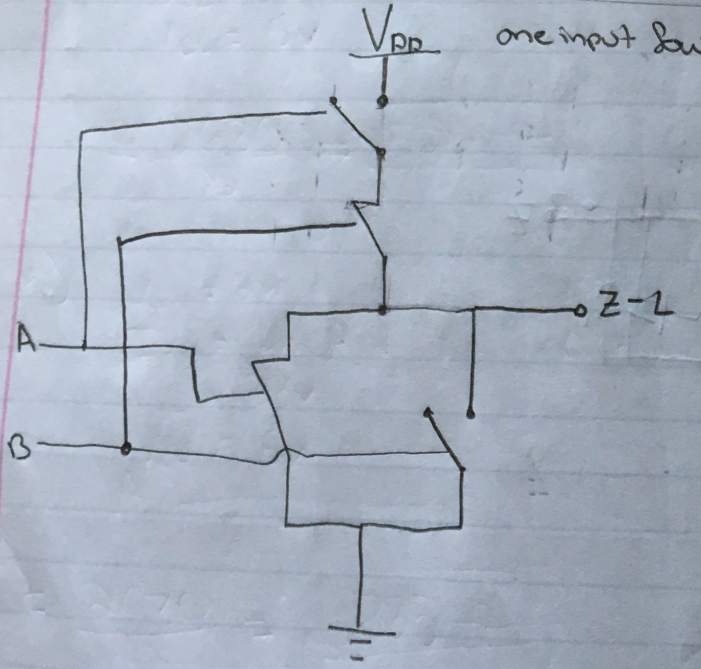


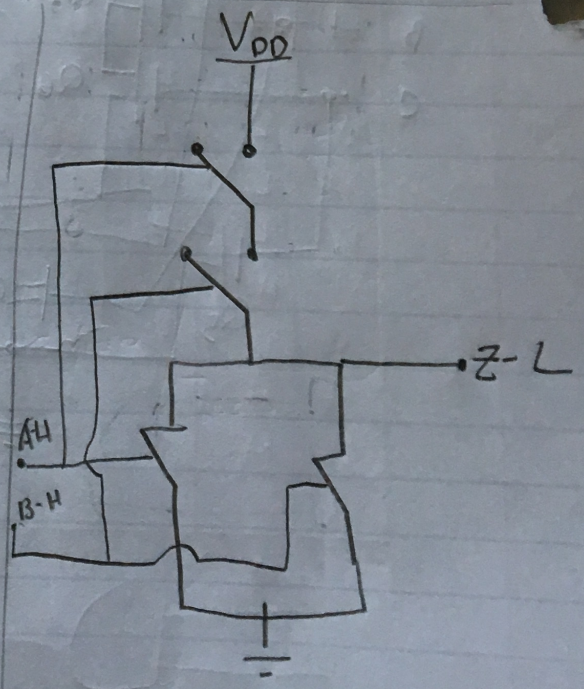
14)

A	B
L	L
L	H
H	L
H	H

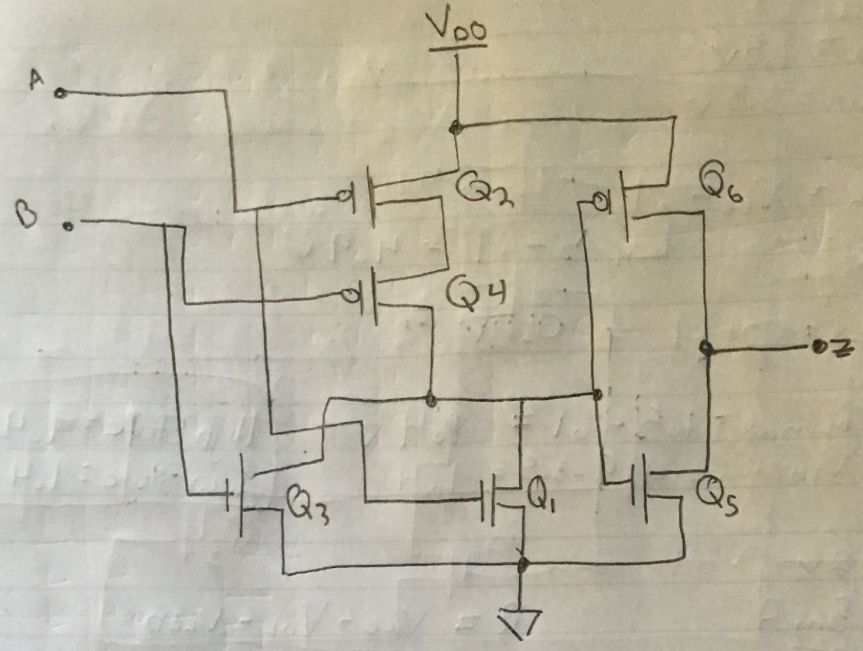




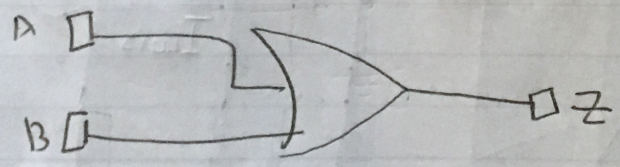




15)



A	B	Q_1	Q_2	Q_3	Q_4	Q_5	Q_6	Z
L	L	0	1	0	1	1	0	L
L	H	0	1	1	0	0	1	H
H	L	1	0	0	1	0	1	H
H	H	1	0	1	0	0	1	H



21.

$V_{ILmax} = 1.5V$

$V_{IH\,min} = 3.5V$

$V_{OH\,min} = V_{cc} - .1$

↳ $5 - .1 = 4.9V$

$V_{OLmax} = 0 + .1 = 0.1V$

$V_{ILmax} - V_{OLmax} = 1.5 - .1 = 1.4V$

$V_{OH\,min} - V_{IH\,min} = 4.9 - 3.5 = 1.4$

High State = 1.4 V
Low State = 1.4 V

40) $V_{LED} = 2V$

$I_{LED} = 5mA$

$V_{OL} = .37$

$V_{CC} = 5V$

$$R = \frac{V_{CC} - V_{OL} - V_{LED}}{I_{LED}}$$

$$= \frac{2630}{5} = \boxed{526\,\Omega}$$

41) $V_{LED} = 2V$

$I_{LED} = 2mA$

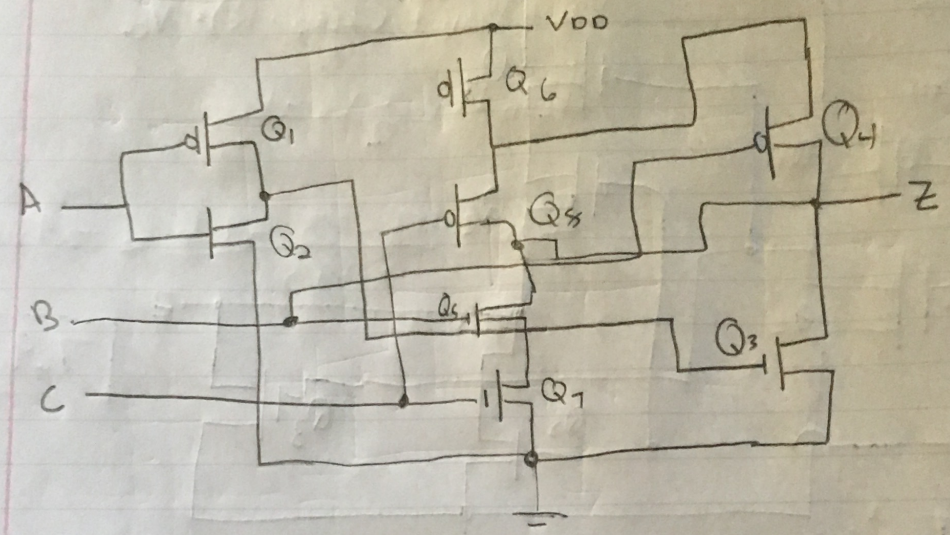
$V_{OL} = .33V$

$V_{CC} = 5V$

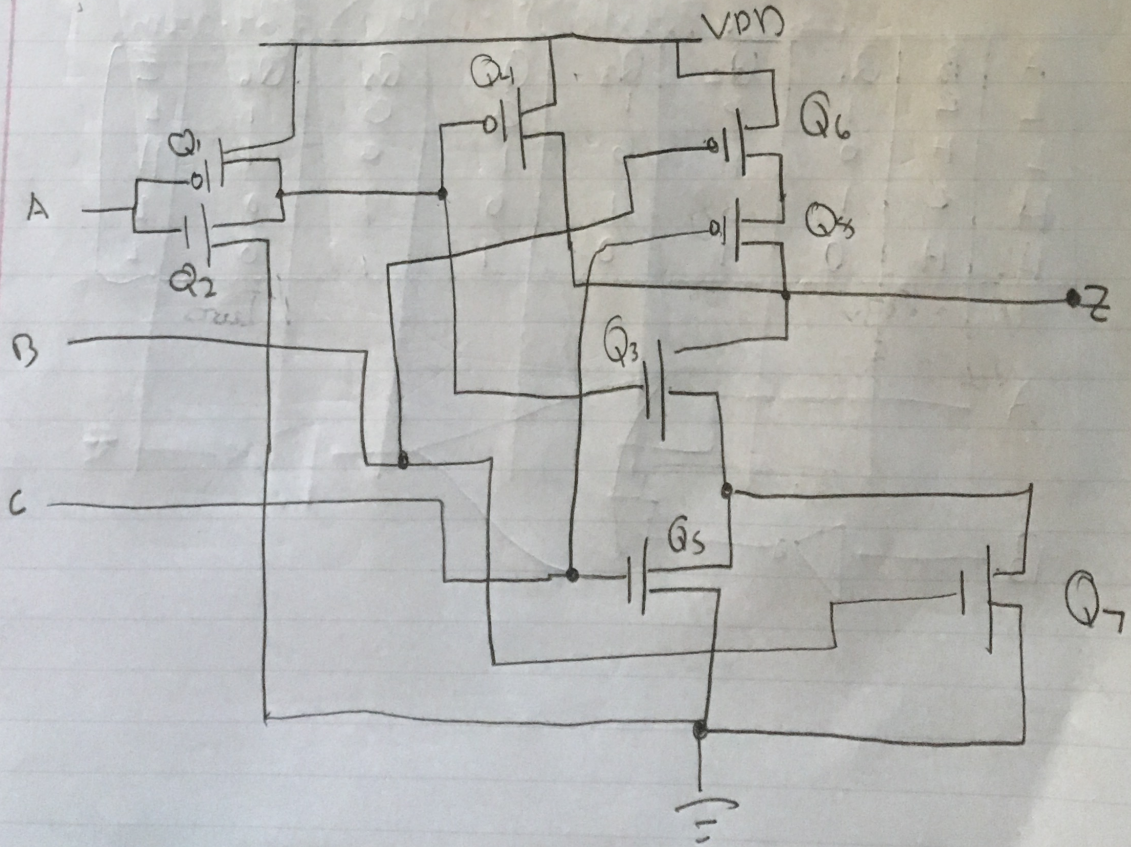
$$R = V_{CC} - V_{OL} - V_{LED} \Big/ I_{LED}$$

$$= \frac{2670}{2} = \boxed{1335\,\Omega}$$

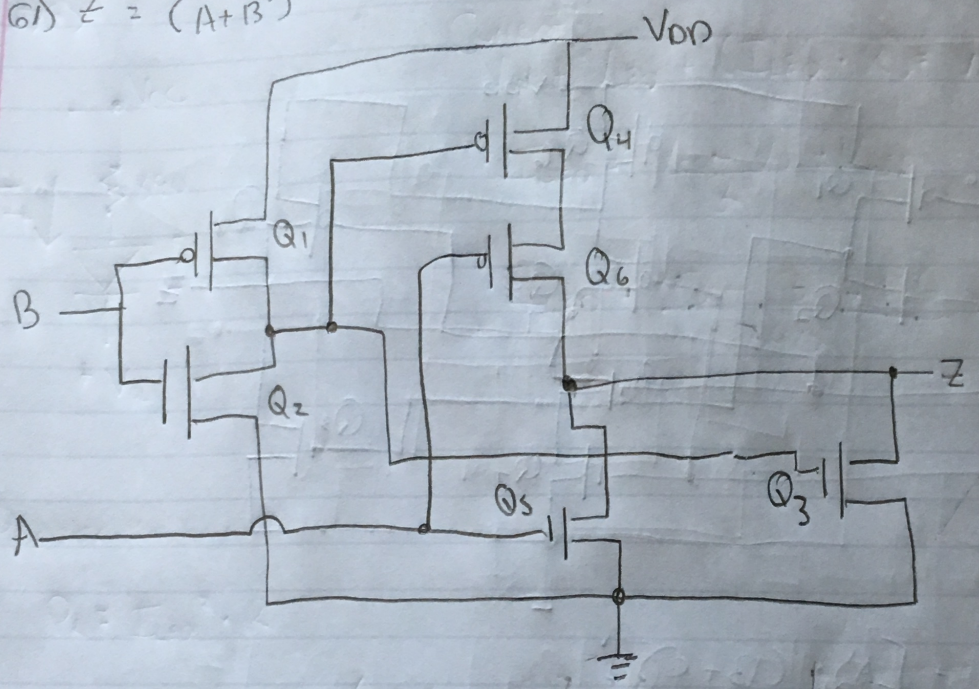
5) $Z = [A' + (B \cdot C)]'$



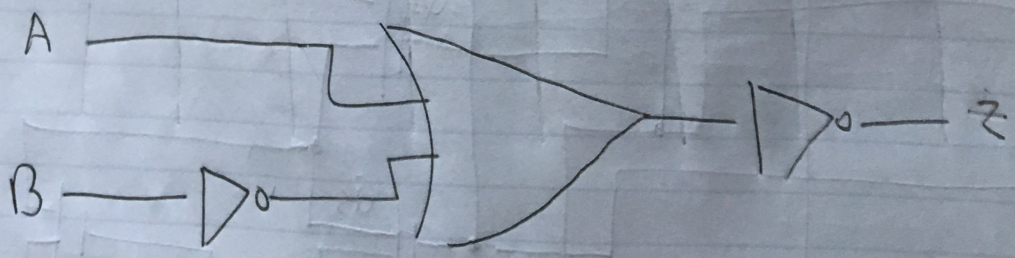
6) $Z = [A' \cdot (B + C)]'$



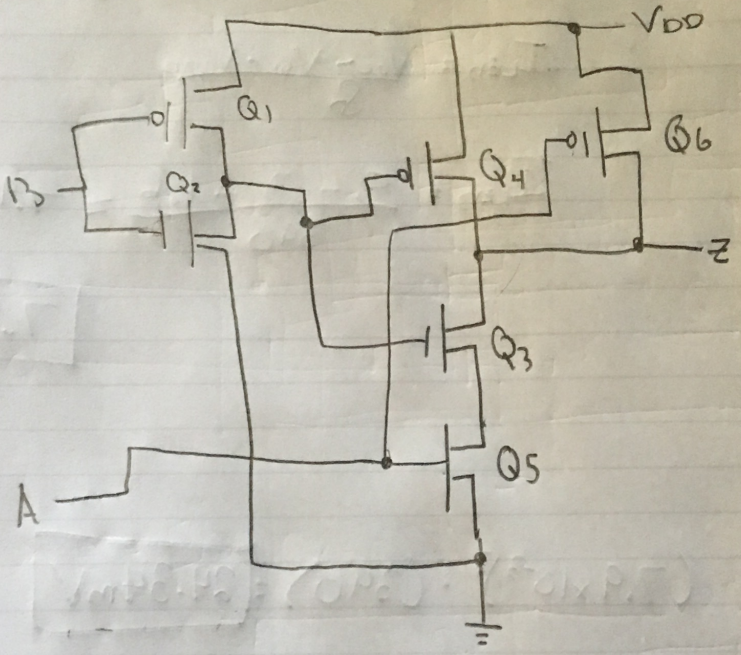
6) $Z = (A + B')'$



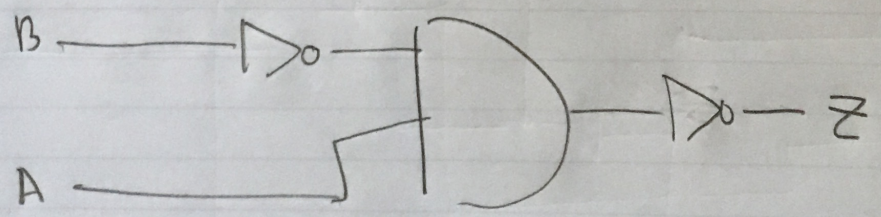
A	B	Q_1	Q_2	Q_3	Q_4	Q_5	Q_6	Z
L	L	1	0	1	0	0	1	L
L	H	0	1	0	1	0	1	H
H	L	1	0	1	0	1	0	L
H	H	0	1	0	1	1	0	L



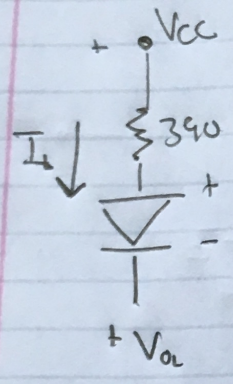
(G2) $Z = (AB')'$



A	B	Q_1	Q_2	Q_3	Q_4	Q_5	Q_6	Z
L	L	1	0	1	0	0	1	H
L	H	0	1	0	1	0	1	H
H	L	1	0	1	0	1	0	L
H	H	0	1	0	1	1	0	L



>9)



Current:

$$V_{OL} + V_{LED} + (I_{LED} \cdot R) = V_{CC}$$

$$I_{LED} = \frac{V_{CC} - V_{OL} - V_{LED}}{R}$$

$$I_{LED} = \frac{5 - .3 - 1.6}{390} = 7.9 \times 10^{-3}$$

7.9mA

Power:

$$P_L = I_{LED}^2 \cdot R$$

$$(7.9 \times 10^{-3})^2 \cdot (390) = \boxed{24.34 mV}$$