

Problem 1

Kathryn Chamberlin

1208871114

HW #4

a) ~~100000~~

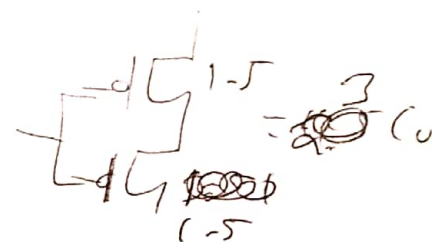
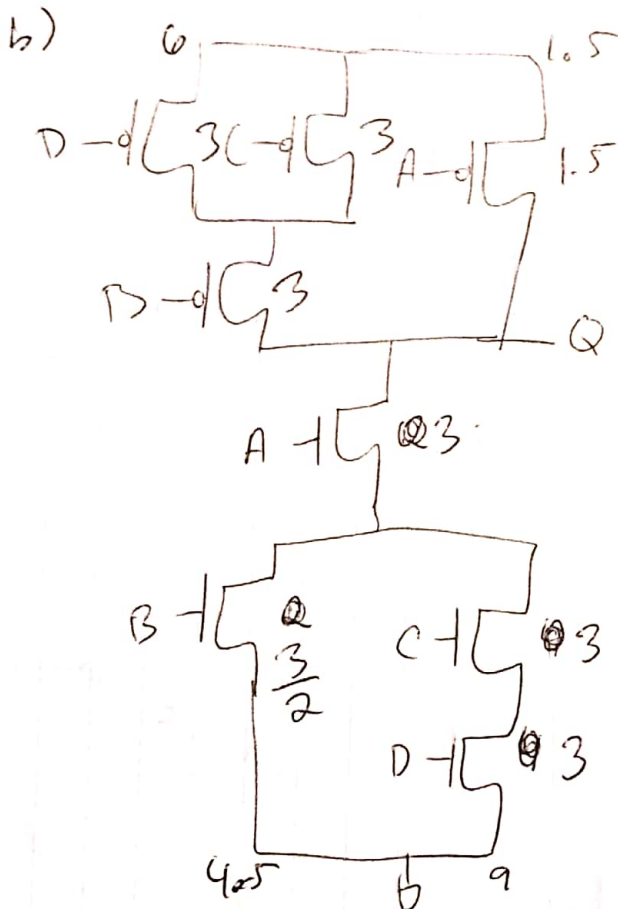
$$3() = 3R_U$$

$$P_A = \frac{3R_U}{R_U} \cdot \frac{3C_U}{2.5C_U} = \frac{9}{2.5} = \boxed{3.6}$$

$$g_A = \frac{3R_U}{R_U} \cdot \frac{2C_U}{2.5C_U} = \frac{6}{2.5} = \boxed{2.4}$$

$$P_B = \frac{3R_U}{R_U} \cdot \frac{3C_U}{2.5C_U} = \frac{9}{2.5} = \boxed{3.6}$$

$$g_B = \frac{3R_U}{R_U} \cdot \frac{2C_U}{2.5C_U} = \frac{6}{2.5} = \boxed{2.4}$$



$$C_{out} = 3 + 3 + 1.5$$

$$C_{in} = \text{all } A = 3 + 1.5 =$$

$$c) P_A = \frac{9R_U}{R_U} \cdot \frac{7.5}{3 \cdot 3R_U} = \boxed{22.5}$$

$$g_A = \frac{9R_U}{R_U} \cdot \frac{4.5C_U}{3C_U} = \boxed{13.5}$$

$$P_B = \frac{6R_U}{R_U} \cdot \frac{7.5C_U}{3} = \boxed{15}$$

$$g_B = \frac{6R_U}{R_U} \cdot \frac{4.5C_U}{3C_U} = \boxed{9}$$

Problem 2

a) $A=0$ $B=0$

PMOS on $\Rightarrow B \checkmark = 0$

A	B	F
0	0	0
0	1	1
1	0	1
1	1	0

b) $B=1$ $0 \text{ --- } 0$

1

$C=1$ $0 \text{ --- } 0$

1

A	B	C	F
0	0	0	1
0	0	1	1
0	1	0	0
0	1	1	0
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	0

c)

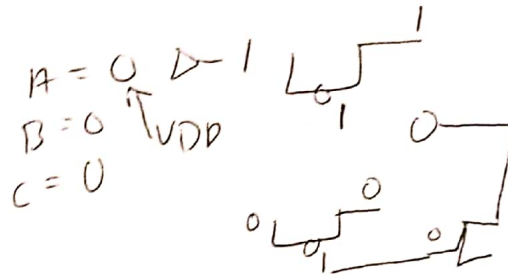
A	B	C	F
0	0	0	1
0	0	1	0
0	1	0	1
0	1	1	0
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	0

$A=0$ $B=1$

PMOS $\Rightarrow B \checkmark = 1$

$A=1$ $B=0$

NMOS on $\Rightarrow D \checkmark = 1$



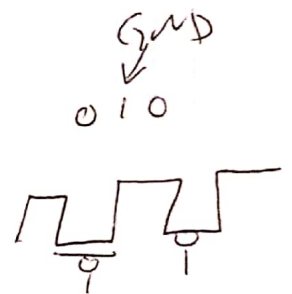
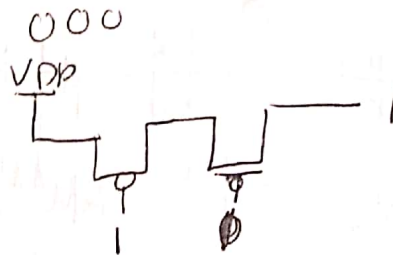
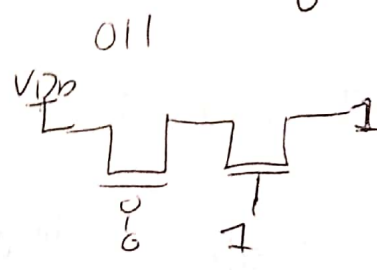
$0 \rightarrow 1 = \text{VDD pull up}$

all $00 \rightarrow 1$ $1 \rightarrow 1$

$B=0 \rightarrow$ closest to $F=1$

$B=1 \rightarrow 00$ closest to $F=0$

active PMOS

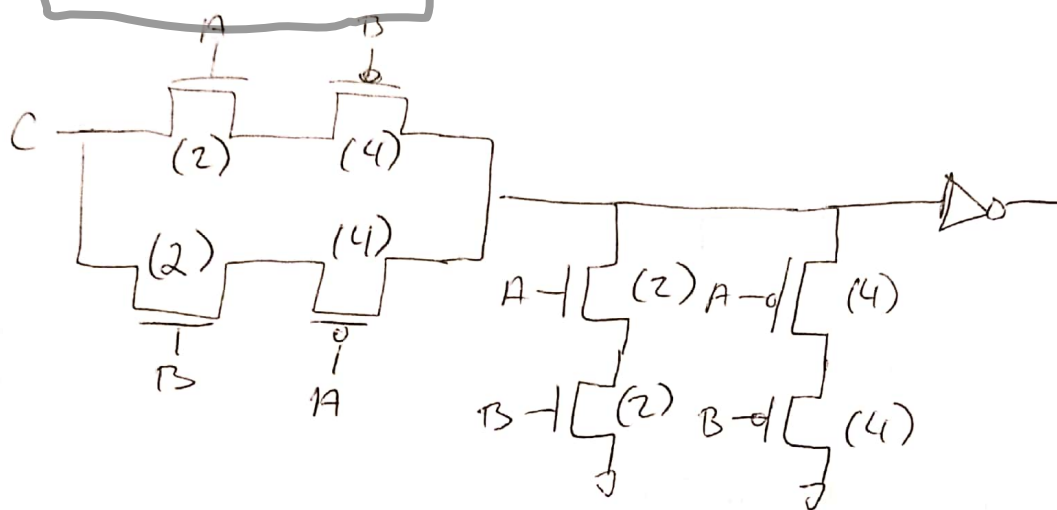


Problem 3

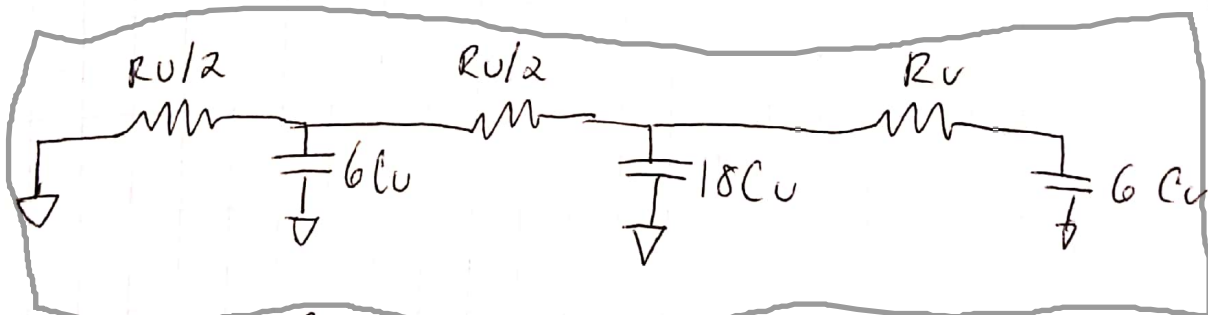
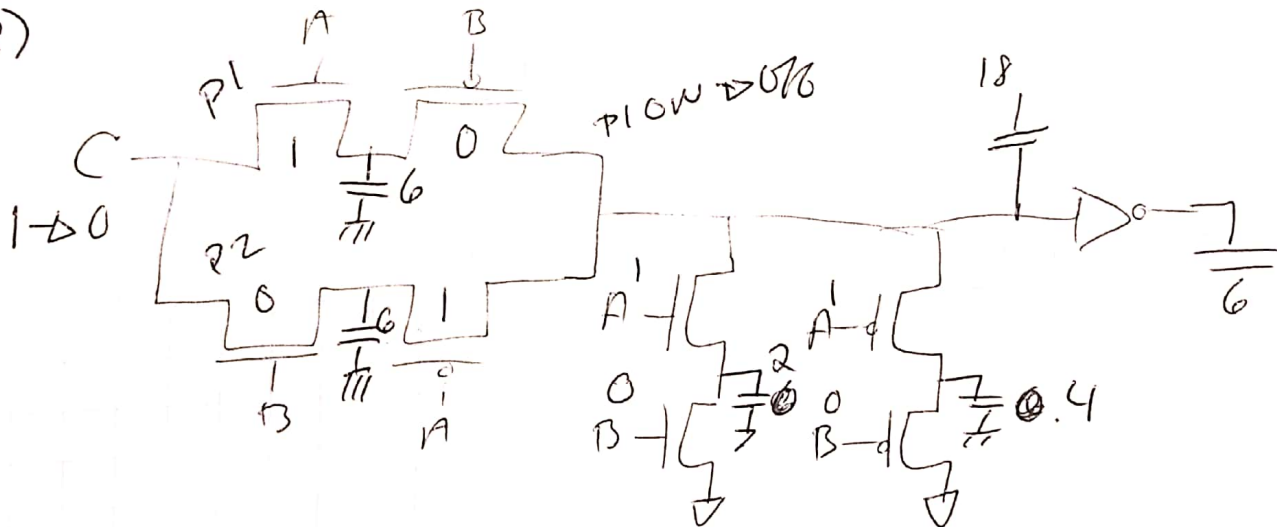
a) $(A\bar{B} + B\bar{A})C + 0AB + 0\bar{A}\bar{B}$

$$F = (A\bar{B} + B\bar{A})C$$

b)



c)



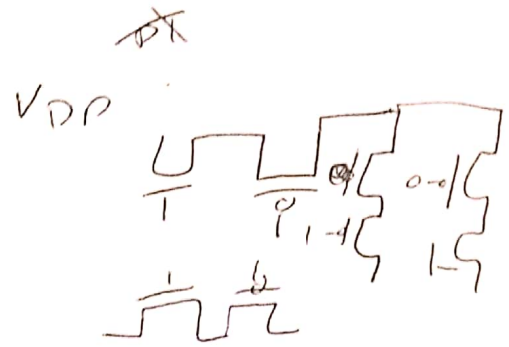
d) $t_p = 0.7 \left(\frac{R_U}{2} (6 + 18 + 6) + \frac{R_U}{2} (18 + 6) \right) + R_U [6]$

$$= 0.7 (15 + 12 + 6)$$

$$= \boxed{23.1 \text{ ps}}$$

e)

	000	F 0 V
	110	0 V
V _{DD}	011	2.5 - 0.6 = 1.9 V
gnd	100	0.6 V



Problem 41

$$\begin{aligned}
 a) \quad t_p &= 0.7 \left(t_{B10} \left(\frac{1}{10} \right) (1 \mu) + t_{p1} \left(\frac{1}{2} \right) (1 f) \right) \\
 &= 0.7 (1.0 \text{ ns}) \\
 &= \boxed{1.0 \text{ ns}}
 \end{aligned}$$

$$\begin{aligned}
 b) \quad t_p &= 0.7 \left(\frac{1}{4} (4) + \frac{1}{4} (4) \right) \\
 &= 0.7 \left(\frac{1}{4} (4 + 4 + 4) + \frac{1}{2} (1) \right) \\
 &= 0.7 (3.5) \\
 &= \boxed{2.45 \text{ ns}}
 \end{aligned}$$