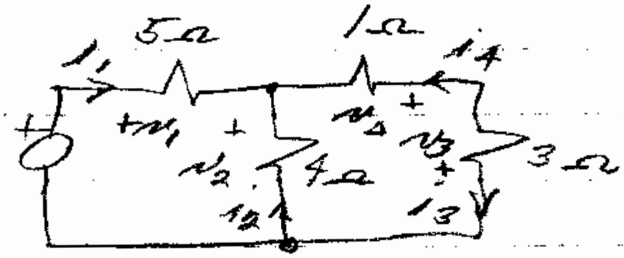
EE 332 Homework 1

1.8



a) $v_1 = 30V$ ∴ $\boxed{i_1 = \frac{30}{5} = 6A}$ ←

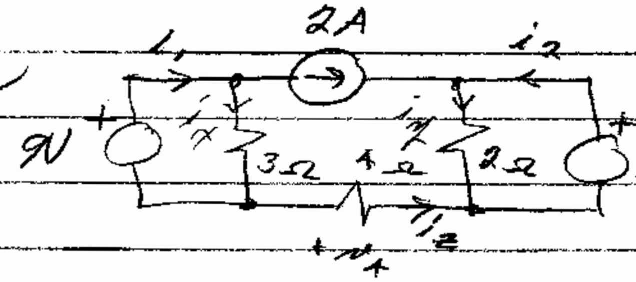
b) $v_2 = 12V$ ∴ $\boxed{i_2 = -\frac{12}{4} = -3A}$ ←

c) $v_3 = -9V$ ∴ $\boxed{i_3 = -\frac{-9}{3} = 3A}$ ←

d) $v_4 = -3V$ ∴ $\boxed{i_4 = -3A}$

ES 332 Homework 2

1.18



a) $v_s = 2V$; $i_x = \frac{9}{3} = 3A$; $i_y = \frac{2}{2} = 1A$

$\therefore i_2 + 2 - i_y = 0$ or $i_2 = i_y - 2 = -1$

$i_z + i_y - i_2 = 0$ or $i_z = i_2 - i_y = -2$ $\therefore \boxed{v_4 = -8V}$

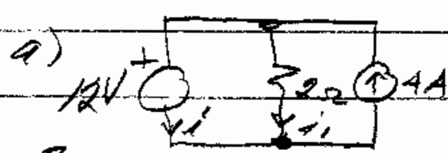
b) $v_s = 4V$; $i_y = 2A$, $i_x = 3A$

again $i_2 = i_y - 2 = 0$; $i_z = i_2 - i_y = -2A$; $\boxed{v_4 = i_z 4 = -8V}$

c) $v_s = 6V$; $i_x = 3A$, $i_y = 3A$

again $i_2 = i_y - 2 = 1A$; $i_z = i_2 - i_y = -2A$; $\boxed{\text{so } v_4 = -8V}$

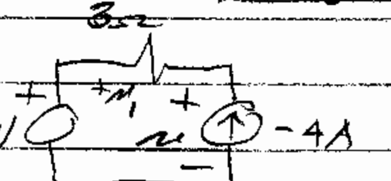
1.26 a)



$\boxed{i_1 = \frac{12}{2} = 6A}$

$i + i_1 - 4 = 0$ or $\boxed{i = 4 - 6 = -2A}$

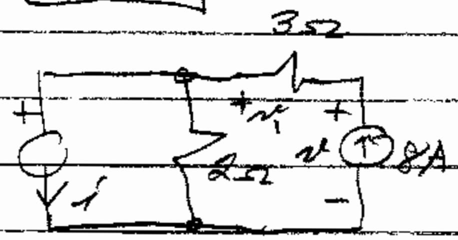
b)



$\boxed{v_1 = -(-4) \times 3 = 12V}$

$-12 + 12 + v = 0$ $\therefore \boxed{v = 0}$

c)

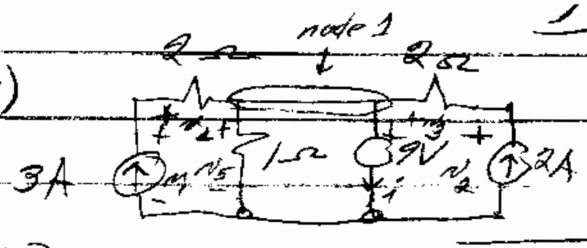


$\boxed{v_1 = -3 \times 8 = -24V}$

$-12 + v_1 + v = 0$ $\therefore \boxed{v = 36V}$

$\boxed{i = 8 - \frac{12}{2} = 2A}$

d)



$-9 + v_3 + v_2 = 0$ but $v_3 = -2 \times 2 = -4$

$\therefore \boxed{v_2 = 9 - v_3 = 13V}$

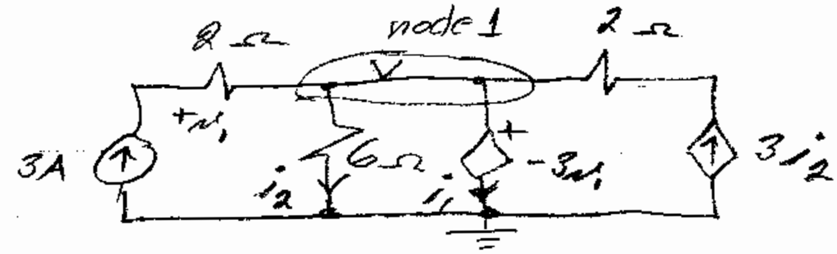
KCL @ node 1 $3 - 11 - i + 2 = 0$

$\boxed{i = -4A}$

$\left\{ \begin{array}{l} v_4 = 2 \times 3 = 6V \\ v_5 = 11V \end{array} \right\}$; $-v_1 + v_4 + v_3 + v_2 = 0$ $\therefore \boxed{v_1 = 15}$

ES 332 Homework 3

1.43 a) $K = -3$



$v_1 = 6V \quad \therefore -3v_1 = -18V \quad$ so $i_2 = \frac{-3v_1}{6} = -3A$

KCL @ node 1 $\begin{cases} -3 + i_2 + i_1 - 3i_2 = 0 \\ -3 - 3 + i_1 - 3(-3) = 0 \end{cases}$

$\boxed{i_1 = -3A} \leftarrow$

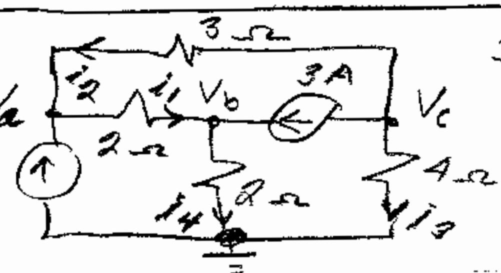
Node Voltage Solution

$-3 + \frac{V}{6} + i_1 - 3i_2 = 0 \Rightarrow -3 + \frac{V}{6} + i_1 - 3\frac{V}{6} = 0$

so $i_1 = 3 + V\left(\frac{1}{2} - \frac{1}{6}\right) = 3 + (-3v_1)\frac{1}{3} \quad$ but $v_1 = 6$

$\therefore i_1 = 3 - 6 = -3A \leftarrow$

2.1



Node Equations

$-1 + \frac{V_a - V_b}{2} + \frac{V_a - V_c}{3} = 0$

$\frac{V_b - V_a}{2} + \frac{V_b}{2} = 3$

$\frac{V_c - V_a}{3} + \frac{V_c}{4} = -3$

or

$$\left.\begin{aligned} V_a\left(\tfrac{5}{6}\right) - \tfrac{1}{2}V_b - \tfrac{1}{3}V_c &= 1 \\ -\tfrac{1}{2}V_a + V_b &= 3 \\ -\tfrac{V_a}{3} + V_c\left(\tfrac{7}{12}\right) &= -3 \end{aligned}\right\} \quad \begin{aligned} 5V_a - 3V_b - 2V_c &= 6 \\ -V_a + 2V_b &= 6 \\ -4V_a + 7V_c &= -36 \end{aligned}$$

$$V_a = \frac{\begin{vmatrix} 6 & -3 & -2 \\ 6 & 2 & 0 \\ -36 & 0 & 7 \end{vmatrix}}{\begin{vmatrix} 5 & -3 & -2 \\ -1 & 2 & 0 \\ -4 & 0 & 7 \end{vmatrix}} = \frac{-36(4) + 7(12+18)}{-4(4) + 7(10-3)} = \frac{-144+210}{-16+49} = \frac{66}{33} = \boxed{2V}$$

$$V_b = \frac{1}{33}\begin{vmatrix} 5 & 6 & -2 \\ -1 & 6 & 0 \\ -4 & -36 & 7 \end{vmatrix} = \frac{-2(36+24) + 7(30+6)}{33} = \frac{-120+252}{33} = \boxed{4V}$$

$$V_c = \frac{1}{33}\begin{vmatrix} 5 & -3 & 6 \\ -1 & 2 & 6 \\ -4 & 0 & -36 \end{vmatrix} = \frac{-4(-18-12) - 36(10-3)}{33} = \frac{120-252}{33} = \boxed{-4V}$$

ES 332 Homework 3 (continued)

2.1

b) $i_1 = \frac{V_a - V_b}{2} = \boxed{-1\,A}$

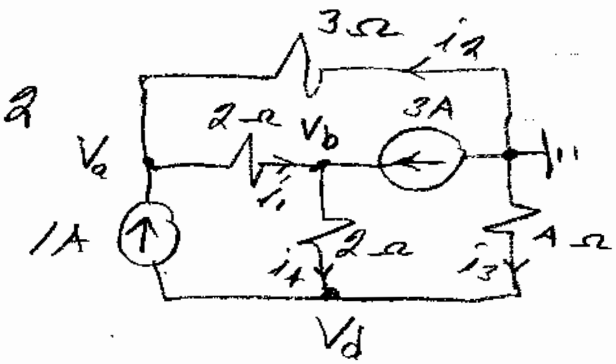
$i_2 = \frac{V_c - V_a}{3} = \frac{-6}{3} = \boxed{-2\,A}$

$i_3 = \frac{V_c}{4} = \boxed{-1\,A}$

$i_4 = \frac{V_b}{2} = \boxed{2A}$

ES 332 Homework 4

2.2



$$\frac{V_a}{3} + \frac{V_a - V_b}{2} = 1$$

$$\frac{V_b - V_a}{2} + \frac{V_b - V_d}{2} = 3$$

$$\frac{V_d - V_b}{2} + \frac{V_d}{4} = -1$$

or

$$\left.\begin{aligned} V_a \tfrac{5}{6} - V_b \tfrac{1}{2} &= 1 \\ -V_a \tfrac{1}{2} + V_b - \tfrac{V_d}{2} &= 3 \\ -V_b \tfrac{1}{2} + V_d \tfrac{3}{4} &= -1 \end{aligned}\right\} \quad \begin{aligned} 5V_a - 3V_b \quad &= 6 \\ -V_a + 2V_b - V_d &= 6 \\ -2V_b + 3V_d &= -4 \end{aligned}$$

$$V_a = \frac{\begin{vmatrix} 6 & -3 & 0 \\ 6 & 2 & -1 \\ -4 & -2 & 3 \end{vmatrix}}{\begin{vmatrix} 5 & -3 & 0 \\ -1 & 2 & -1 \\ 0 & -2 & 3 \end{vmatrix}} = \frac{6(6-2)+3(18-4)}{5(6-2)+3(-3)} = \frac{66}{11} = \boxed{6V}$$

$$V_b = \frac{1}{11}\begin{vmatrix} 5 & 6 & 0 \\ -1 & 6 & -1 \\ 0 & -4 & 3 \end{vmatrix} = \frac{1}{11}\{5(18-4) - 6(-3)\} = \boxed{8V}$$

$$V_d = \frac{1}{11}\begin{vmatrix} 5 & -3 & 6 \\ -1 & 2 & 6 \\ 0 & -2 & -4 \end{vmatrix} = \frac{1}{11}\{5(-8+12) + 1(12+12)\} = \boxed{4V}$$

so

$$i_1 = \frac{V_a - V_b}{2} = \boxed{-1A}$$

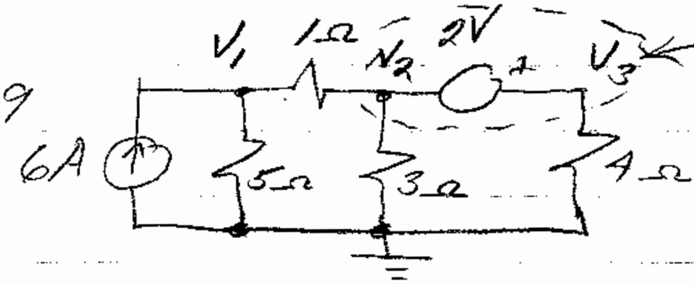
$$i_2 = -\frac{V_a}{3} = \boxed{-2A}$$

$$i_3 = -\frac{V_d}{4} = \boxed{-1A}$$

$$i_4 = \frac{V_b - V_d}{2} = \boxed{2A}$$

ES 332 Homework 4 (continued)

2.9



$V_3 - V_2 = 2$

$$\frac{V_1}{5} + \frac{V_1 - V_2}{1} = 6$$

$$\frac{V_2 - V_1}{1} + \frac{V_2}{3} + \frac{V_3}{4} = 0 \qquad V_3 = (V_2 + 2)$$

$$\frac{6}{5}V_1 - V_2 = 6$$

$$-V_1 + \underbrace{\left(\frac{4}{3} + \frac{1}{4}\right)}_{\frac{19}{12}} V_2 = -\frac{1}{2}$$

or
$$\begin{bmatrix} 6V_1 - 5V_2 = 30 \\ -12V_1 + 19V_2 = -6 \end{bmatrix}$$

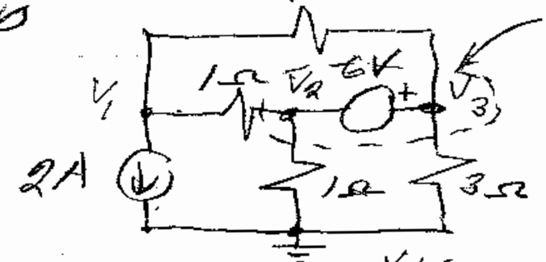
$$\therefore V_1 = \frac{\begin{vmatrix} 30 & -5 \\ -6 & 19 \end{vmatrix}}{\begin{vmatrix} 6 & -5 \\ -12 & 19 \end{vmatrix}} = \frac{540}{54} = \boxed{10V}$$

$$V_2 = \frac{\begin{vmatrix} 6 & 30 \\ -12 & -6 \end{vmatrix}}{54} = \frac{324}{54} \boxed{= 6V}$$

$$V_3 = V_2 + 2 = \boxed{8V}$$

EE 332 Homework 5

2.10



supernode ⇒ $V_3 - V_2 = 6$

$$\frac{V_1 - V_2}{1} + \frac{V_1 - V_3}{1} = -2$$

$$\frac{V_2 - V_1}{1} + \frac{V_2}{1} + \frac{V_3 - V_1}{1} + \frac{V_3}{3} = 0$$

or

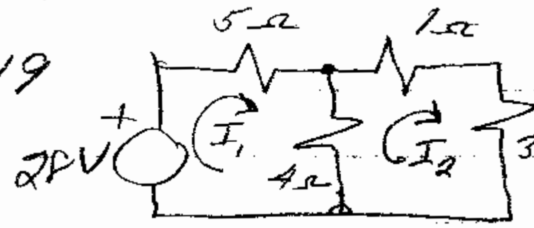
$$\left.\begin{aligned} 2V_1 - V_2 - \overset{V_2+6}{V_3} &= -2 \\ -2V_1 + 2V_2 + \tfrac{4}{3}V_3 &= 0 \\ -V_2 + V_3 &= 6 \end{aligned}\right\} \begin{aligned} 2V_1 - 2V_2 &= 4 \\ -2V_1 + \tfrac{10}{3}V_2 &= -8 \end{aligned}$$

$$V_1 = \frac{\begin{vmatrix} 4 & -2 \\ -8 & \frac{10}{3} \end{vmatrix}}{\begin{vmatrix} 2 & -2 \\ -2 & \frac{10}{3} \end{vmatrix}} = \frac{\frac{40}{3} - 16}{\frac{20}{3} - 4} = \frac{40-48}{20-12} = \frac{-8}{8} = \boxed{-1\,V}$$

$$V_2 = \frac{\begin{vmatrix} 2 & 4 \\ -2 & -8 \end{vmatrix}}{\frac{8}{3}} = \frac{-16+8}{\frac{8}{3}} = \boxed{-3\,V}$$

$$V_3 = V_2 + 6 = \boxed{3\,V}$$

2.19



$$5I_1 + 4(I_1 - I_2) = 28$$

$$4(I_2 - I_1) + 4I_2 = 0$$

or

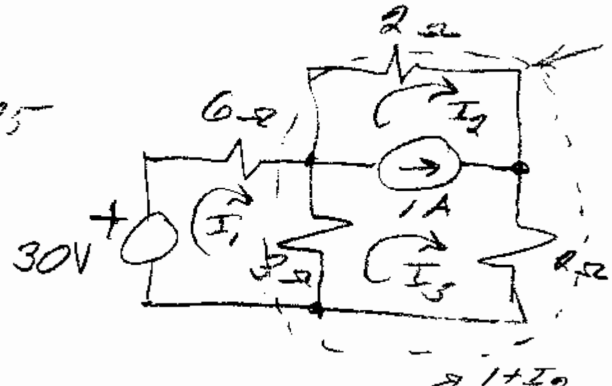
$$\left\{\begin{aligned} 9I_1 - 4I_2 &= 28 \\ -4I_1 + 8I_2 &= 0 \end{aligned}\right\}$$

$$I_1 = \frac{\begin{vmatrix} 28 & -4 \\ 0 & 8 \end{vmatrix}}{\begin{vmatrix} 9 & -4 \\ -4 & 8 \end{vmatrix}} = \frac{224}{72-16} = \frac{224}{56} = \boxed{4A}$$

$$I_2 = \frac{\begin{vmatrix} 9 & 28 \\ -4 & 0 \end{vmatrix}}{56} = \frac{4 \times 28}{56} = \boxed{2A}$$

ES 332 Homework 6

2.25



supermesh $\Rightarrow I_3 - I_2 = 1$

$$6I_1 + 3(I_1 - I_3) = 30$$
$$3(I_3 - I_1) + 2I_2 + 2I_3 = 0$$

$\rightarrow 1 + I_2$

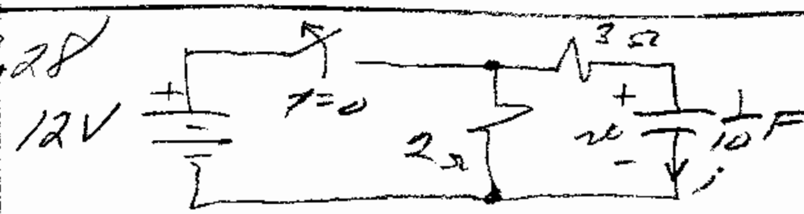
or
$$\left.\begin{aligned} 9I_1 \quad - 3I_3 &= 30 \\ -3I_1 + 2I_2 + 5I_3 &= 0 \\ -I_2 + I_3 &= 1 \end{aligned}\right\} \quad \begin{aligned} 9I_1 - 3I_2 &= 33 \\ -3I_1 + 7I_2 &= -5 \end{aligned}$$

$$I_1 = \frac{\begin{vmatrix} 33 & -3 \\ -5 & 7 \end{vmatrix}}{\begin{vmatrix} 9 & -3 \\ -3 & 7 \end{vmatrix}} = \frac{231-15}{63-9} = \frac{216}{54} = \boxed{4A}$$

$$I_2 = \frac{\begin{vmatrix} 9 & 33 \\ -3 & -5 \end{vmatrix}}{54} = \frac{-45+99}{54} = \boxed{1A}$$

$$I_3 = 1 + I_2 = \boxed{2A}$$

3.28



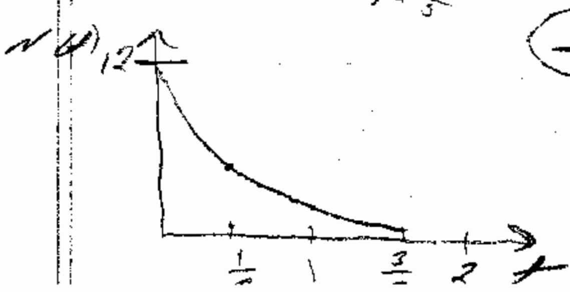
$v(0) = 12$

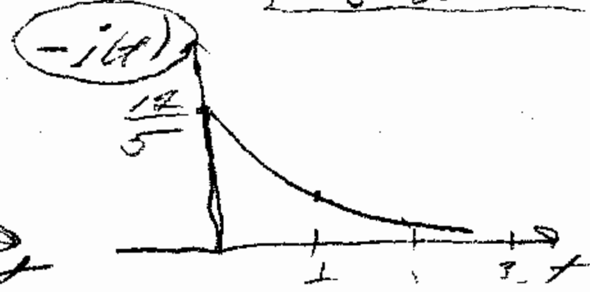
$$\frac{v}{5} + \frac{1}{10}\frac{dv}{dt} = 0$$

or $\frac{dv}{dt} + 2v = 0$; $v = Ae^{st}$; $s = -2$

but $v(0) = 12$ $\therefore$ $\boxed{v = 12e^{-2t}}$

$$i(t) = C\frac{dv}{dt} = \frac{1}{10_5}12(-2)e^{-2t} = \boxed{-\frac{12}{5}e^{-2t}}$$

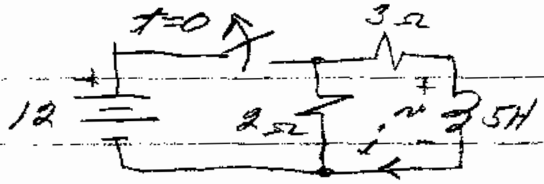




3.29
3.34

ES 332 Homework 7

3.29

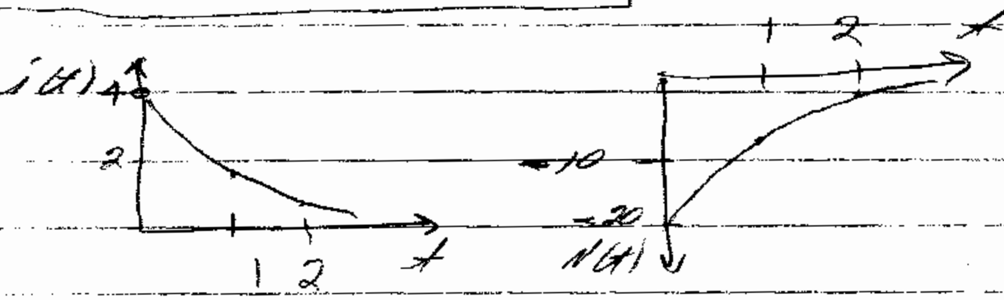


$i(0) = 4A$

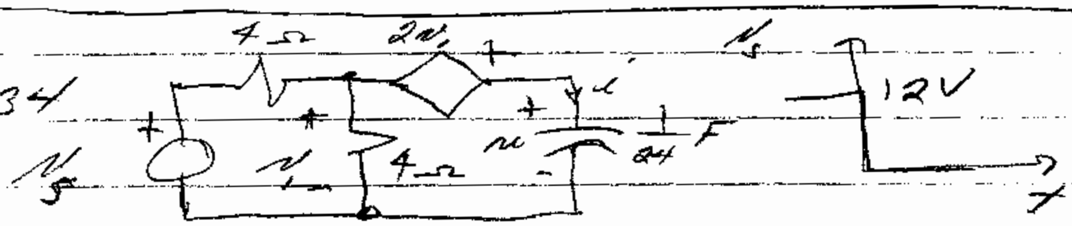
for $t > 0$ $\quad 5i + 5\frac{di}{dt} = 0$; $i = Ae^{st}$ so $s = -1$

and since $i(0) = 4$ $\quad \boxed{i(t) = 4e^{-t}}$

$\boxed{v(t) = -5\,i(t) = -20e^{-t}}$



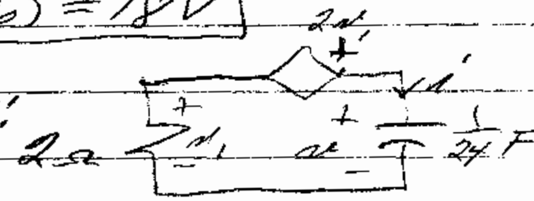
3.34



for $t < 0$ $\quad i = 0 \quad \therefore v_1 = \frac{12}{2} = 6V$

$\boxed{v(0) = 3v_1(0) = 18V}$

for $t > 0$ we have:



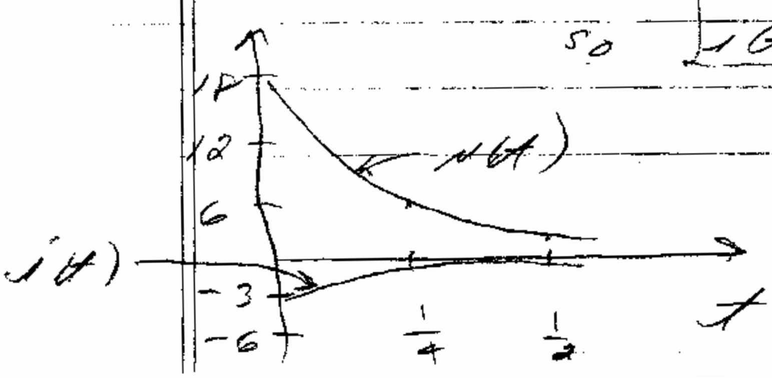
$2i - 2v_1 + 24\int_0^t i\,dt + 18 = 0$ $\quad$ but $v_1 = -2i$

(1) $\quad \therefore 2i + 4i + 24\int_0^t i\,dt + 18 = 0$ or $6\frac{di}{dt} + 24i = 0$

$i = Ae^{st}$; $s = -4$ $\quad$ from (1) $i(0) = -3$

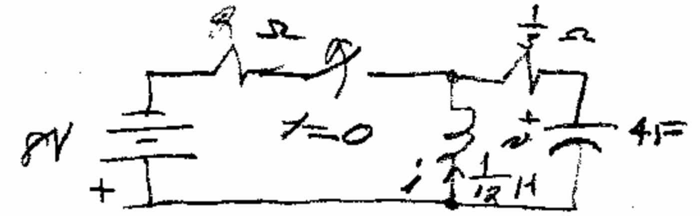
so $\quad \boxed{i(t) = -3e^{-4t}}$

$\boxed{v(t) = 3v_1 = -6i = 18e^{-4t}}$



ES 332 Homework 8

3.5-7



$v(0)=0$

$i(0)=4A$

for $t>0$ $\quad \frac{1}{3}i + \frac{1}{4}\int_0^t i\,dt + \frac{1}{12}\frac{di}{dt} = 0 \quad (1)$

or $\frac{d^2 i}{dt^2} + 4\frac{di}{dt} + 3i = 0$; $i = Ae^{st}$; $s_{1,2} = \frac{-4 \pm \sqrt{16-12}}{2}$

$\boxed{i = A_1 e^{-3t} + A_2 e^{-t}}$ but $i(0)=4$ so $\boxed{4 = A_1 + A_2}$

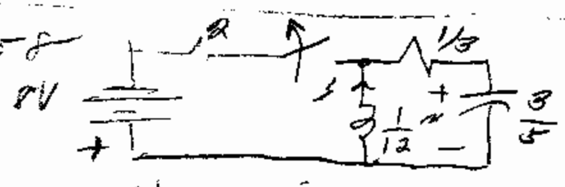
from (1) $\left.\frac{di}{dt}\right|_{t=0} = -\frac{4}{3}\times 12 = -16 = -3A_1 - A_2 = -3A_1 - (4 - A_1)$

$\therefore A_1 = 6$ & $A_2 = 4 - 6 = -2$

$\boxed{i(t) = 6e^{-3t} - 2e^{-t}}$ $\quad v = -\frac{1}{3}i - \frac{1}{12}\frac{di}{dt}$

$v = -2e^{-3t} + \frac{2}{3}e^{-t} - \frac{1}{12}(-18e^{-3t} + 2e^{-t}) = \boxed{-\frac{1}{2}e^{-3t} + \frac{1}{2}e^{-t}}$

3.5-8



$\frac{1}{3}i + \frac{1}{12}\frac{di}{dt} + \frac{5}{3}\int_0^t i\,dt = 0 \quad (1)$

$\frac{d^2 i}{dt^2} + 4\frac{di}{dt} + 20i = 0$; $i = Ae^{st}$

$v(0)=0$; $i(0)=4$

$s_{1,2} = \frac{-4 \pm \sqrt{16-80}}{2} = -2 \pm j4$

so $i(t) = A_1 e^{-2t}\cos 4t + A_2 e^{-2t}\sin 4t$

but $i(0) = 4$ $\therefore$ $\boxed{4 = A_1}$

from (1) $= \left.\frac{di}{dt}\right|_{t=0} = -16 = 4(-2) + 4A_2$ $\therefore$ $\boxed{A_2 = -2}$

$\boxed{i(t) = 4e^{-2t}\cos 4t - 2e^{-2t}\sin 4t}$

as above $v(t) = -\frac{1}{3}i - \frac{1}{12}\frac{di}{dt}$

giving $\boxed{v(t) = \frac{5}{3}e^{-2t}\sin 4t}$

ES 332 Homework 9

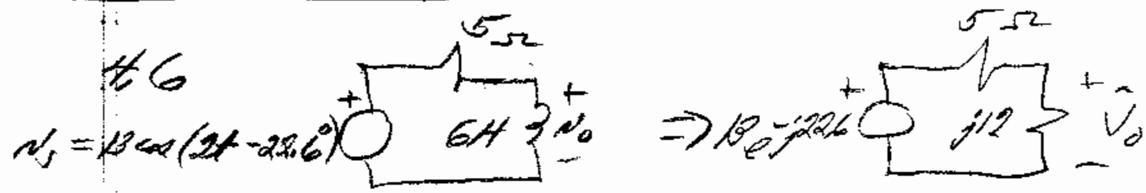
4.1 a) $4+j7 = 8.06\,e^{j60.25°}$ e) $4 = 4e^{j0°}$

b) $3-j5 = 5.83\,e^{-j59.04°}$ f) $-5 = 5e^{j180°}$

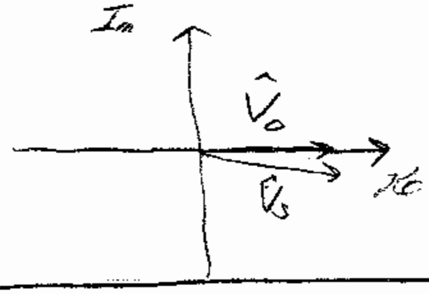
c) $-2+j3 = 3.6\,e^{j123.7°}$ g) $j7 = 7e^{j90°}$

d) $-1-j6 = 6.08\,e^{j260.5°}$ h) $-j2 = 2e^{-j90°}$

4.6



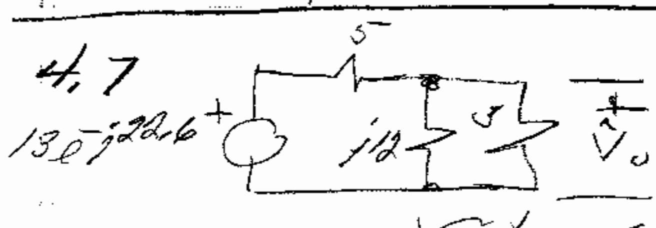
$$\hat{V}_0 = \frac{j12}{5+j12}\cdot 13e^{-j22.6°} = \frac{156\,e^{j67.4°}}{13\,e^{j67.38°}} \cong \boxed{12}$$



$\boxed{\hat{V}_0 \text{ leads } \hat{V}_s}$

$\boxed{v_0(t) = 12\cos(2t)}$

4.7

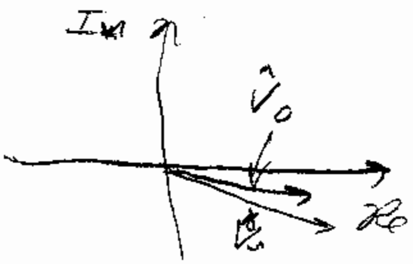


$$Z_{eq} = \frac{j60}{5+j12}$$

$$\hat{V}_0 = \frac{Z_{eq}}{5+Z_{eq}}\cdot 13e^{-j22.6°} = \frac{\frac{j60\cdot 13e^{-j22.6}}{5+j12}}{\frac{25+j60+j60}{5+j12}} = \frac{j60\hat{V}_s}{25+j120} = \frac{j12\hat{V}_s}{5+j24}$$

$$\hat{V}_0 = \frac{12e^{j90°}\,13e^{-j22.6°}}{24.515\,e^{j78.23°}} = 6.36\,e^{-j10.83°}$$

or $v_0(t) = Re\{\hat{V}_0 e^{j2t}\} = \boxed{6.36\cos(2t - 10.83°)}$



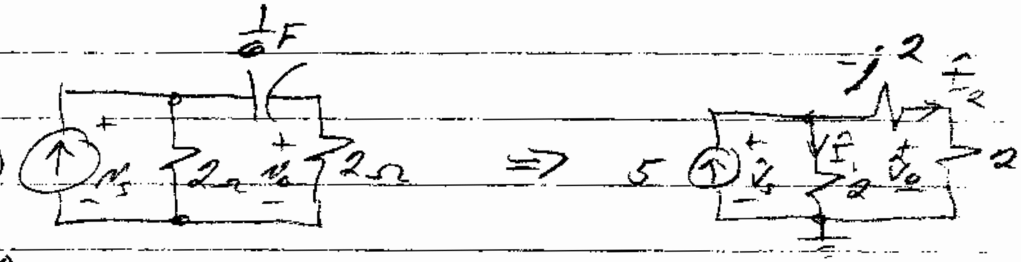
$\hat{V}_0$ leads $\hat{V}_s$

4.9
4.28

ES 332 Homework 10

4.9

$i_s(t)$



$i_s(t) = 5\cos 3t$

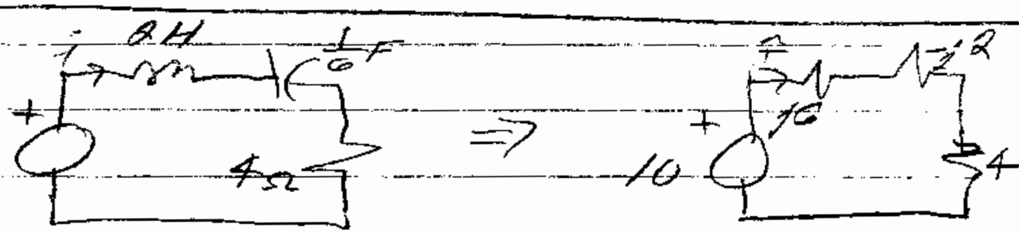
$\hat I_1 = 5\,\frac{2-j2}{4-j2}$ ∴ $\hat V_s = 10\,\frac{1-j}{2-j} = 10\,\frac{\sqrt{2}\,e^{-j45^\circ}}{\sqrt{5}\,e^{-j26.56^\circ}} = 6.32\,e^{-j18.4}$

or $v_s(t) = \boxed{6.32\cos(3t - 18.44^\circ)}$

$\hat I_2 = 5\,\frac{2}{4-j2}$ ∴ $\hat V_o = 10\,\frac{1}{2-j} = \frac{10}{\sqrt{5}}\,e^{j26.56^\circ}$

or $v_o(t) = \boxed{4.472\cos(3t + 26.56^\circ)}$

4.28 a)



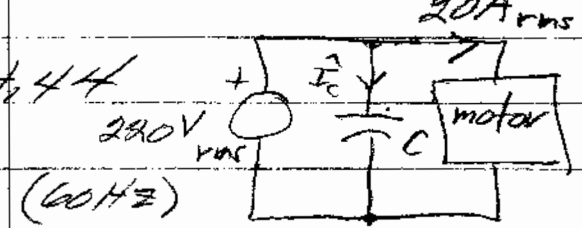
$v_s(t) = 10\cos 3t$

$\hat I = \frac{10}{4+j4} = \frac{10}{4\sqrt{2}\,e^{j45^\circ}} = 1.767\,e^{-j45^\circ}$

∴ $P_{ave,\,4\Omega} = \frac{1}{2}|\hat I|^2\,4 = \boxed{6.25 \text{ Watts}}$

ES 332 Homework 11

4.44



a) $P_{ave} = V_{rms} I_{rms}\, pf$

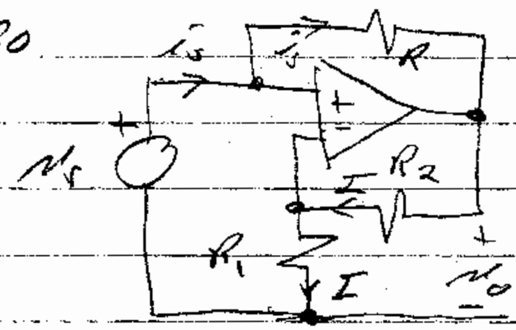
$\therefore P_{ave} = 220 \times 20 \times 0.75 = \boxed{3{,}300\,W}$

b) $\hat{I}_{M_{rms}} = 20\, e^{-j\cos^{-1}(0.75)} = 20\, e^{-j41.41^\circ} = 15 - j13.23$

so for $pf = 1$ $\hat{I}_c = +j13.23 = j\omega C \cdot 220$

$\therefore C = \dfrac{13.23}{2\pi \times 60 \times 220} = 1.595 \times 10^{-4} \approx \boxed{160\,\mu F}$

2.30



a) $I = \dfrac{v_s}{R_1}$; $v_o = I(R_1 + R_2)$

$\therefore v_o = \dfrac{v_s}{R_1}(R_1 + R_2)$

$\boxed{v_o = v_s\left(1 + \frac{R_2}{R_1}\right)}$

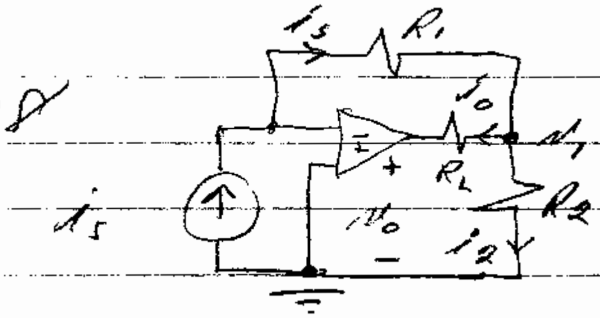
b) $i_s = \dfrac{v_s - v_o}{R} = \dfrac{v_s}{R} - \dfrac{v_s\left(1 + \frac{R_2}{R_1}\right)}{R}$

$i_s = v_s\left[\dfrac{1}{R} - \dfrac{R_1 + R_2}{RR_1}\right] = v_s\left[\dfrac{\cancel{R_1} - \cancel{R_1} - R_2}{RR_1}\right]$

$\therefore \boxed{\dfrac{v_s}{i_s} = -\dfrac{RR_1}{R_2}}$

ES 332 Homework 12

2.28



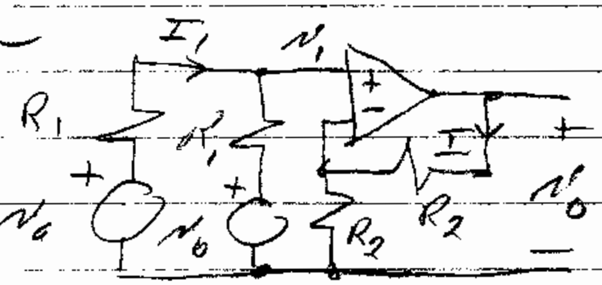
$v_1 = -i_s R_1$

$i_2 = \frac{v_1}{R_2}$

$$i_o = i_s - i_2 = i_s - \frac{v_1}{R_2} = i_s + i_s\frac{R_1}{R_2} = i_s\left(1+\frac{R_1}{R_2}\right)$$

$$v_o = -i_o R_L + v_1 = -i_s R_L\left(1+\frac{R_1}{R_2}\right) - i_s R_1 = \underline{-i_s\left(R_L + R_1 + \frac{R_L R_1}{R_2}\right)}$$

2-35



$I = \frac{v_o}{2R_2}$

$v_1 = \frac{v_o}{2} \quad (1)$

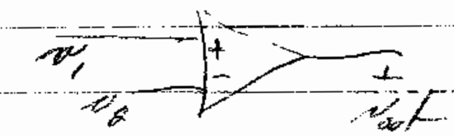
$$-v_a + I_1 R_1 + I_1 R_1 + v_b = 0 \quad \therefore \; I_1 = \frac{v_a - v_b}{2R_1}$$

$$v_1 = I_1 R_1 + v_b = \frac{v_a - v_b}{2} + v_b = \frac{v_a + v_b}{2}$$

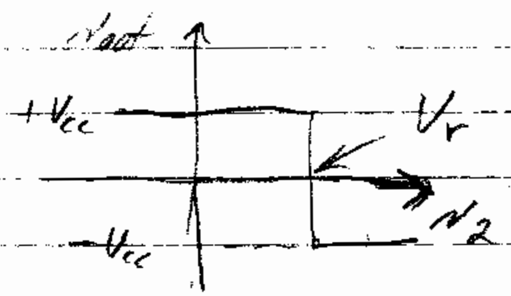
$\therefore$ from (1) have $\boxed{v_o = 2v_1 = v_a + v_b}$

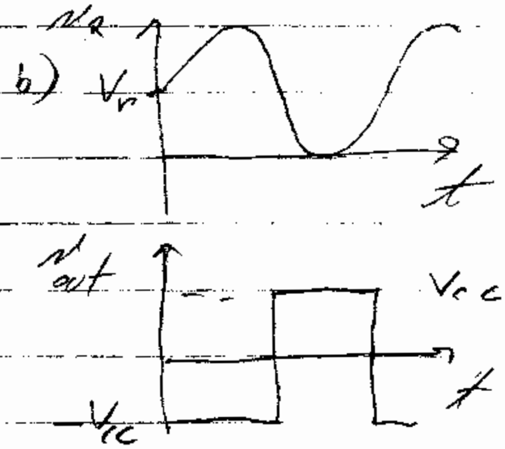
ES 332 Homework 13

10.67



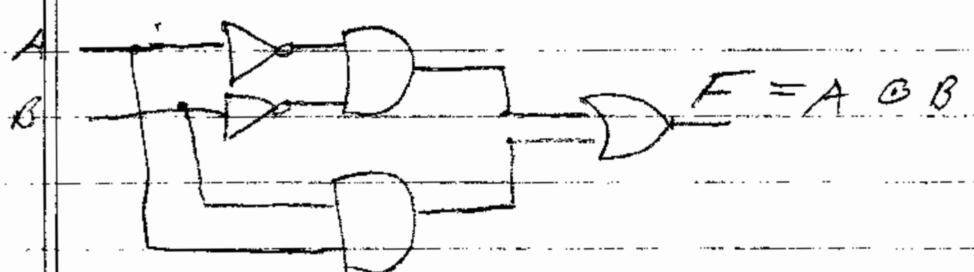
$v_1 = V_r > 0$





11.26

A	B	$A \odot B = \overline{A+B} = F = \bar{A}\bar{B} + AB$
0	0	1
0	1	0
1	0	0
1	1	1



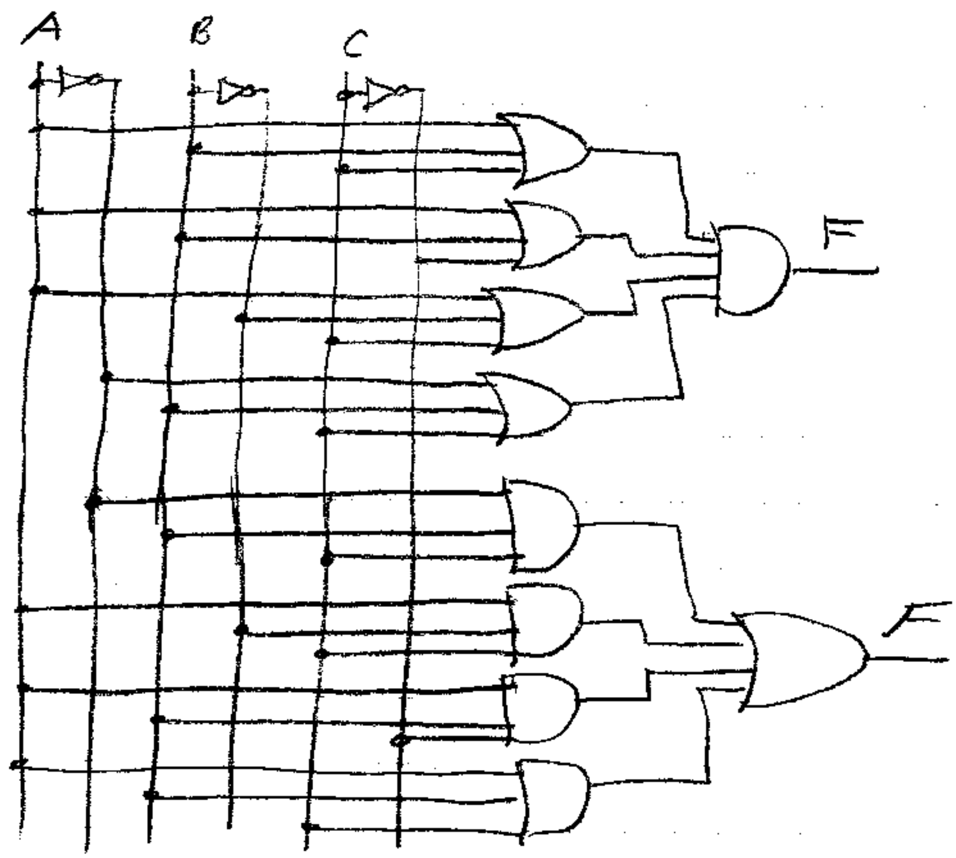
ES 338 Homework 14

4.44

A	B	C	F	m	M
0	0	0	0	m_0	M_0
0	0	1	0	m_1	M_1
0	1	0	0	m_2	M_2
0	1	1	1	m_3	M_3
1	0	0	0	m_4	M_4
1	0	1	1	m_5	M_5
1	1	0	1	m_6	M_6
1	1	1	1	m_7	M_7

$F = M_0 \cdot M_1 \cdot M_2 \cdot M_4 = (A+B+C)\cdot(A+B+\bar{C})\cdot(A+\bar{B}+C)\cdot(\bar{A}+B+C)$

$F = m_3 + m_5 + m_6 + m_7 = \bar{A}BC + A\bar{B}C + AB\bar{C} + ABC$



4.53 a)

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

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

b)

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

$F = A\bar{C} + AB + B\bar{C}$

c)

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

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

11.56

ES 332 Homework 15

11.54 a)

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

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

b)

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

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

c)

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

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

11.56 a)

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

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

b)

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

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

c)

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

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

ES 332 Homework 16

1157 a)

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

$F = \bar{A}B + BD + AC\bar{D}$

b)

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

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

c)

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

$F = \bar{B}\bar{C}\bar{D} + AC\bar{D} + \bar{A}BC + \bar{A}CD$
$+ AB\bar{C}D$

many possible combinations

12,17

A	B	C	D	E	F
0	0	0	0	0	0
0	0	1	0	0	1
0	1	0	0	1	1
0	1	1	0	1	0
1	0	0	1	1	0
1	0	1	1	1	1
1	1	0	1	0	1
1	1	1	1	0	0

D

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

$\boxed{D = A}$

E

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

$E = \bar{A}B + A\bar{B}$

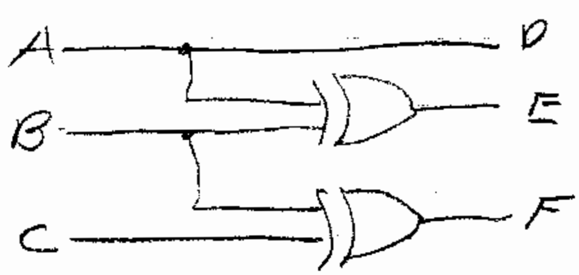
$E = A \oplus B$

F

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

$F = \bar{B}C + B\bar{C}$

$F = B \oplus C$



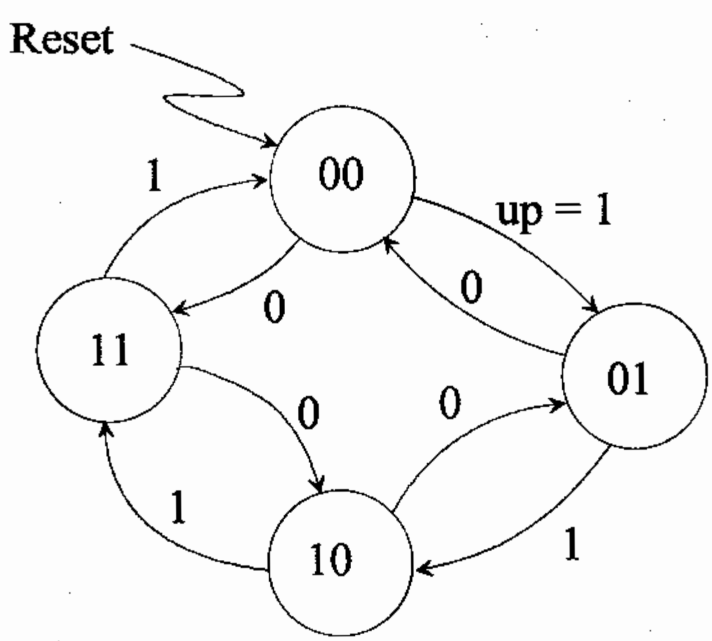
Assignment 17

a) Draw a state transition table for the two bit up-down counter described by the state diagram shown below.

b) If this counter is to be realized using D flip-flops add the D inputs necessary to produce the proper state transitions to your transition table.

c) Find minimized Boolean expressions that will produce the necessary D inputs found in b).

d) Draw a logic circuit that realizes this two bit up down counter.



ES 332 Homework 17 (special)

a)

Up	Present Q_0	Present Q_1	Next Q_0^+	Next Q_1^+	D_0	D_1
1	0	0	0	1	0	1
1	0	1	1	0	1	0
1	1	0	1	1	1	1
1	1	1	0	0	0	0
0	0	0	1	1	1	1
0	1	1	1	0	1	0
0	1	0	0	1	0	1
0	0	1	0	0	0	0

(D_0)

$Up \backslash Q_0Q_1$	00	01	11	10
0	1	0	1	0
1	0	1	0	1

(D_1)

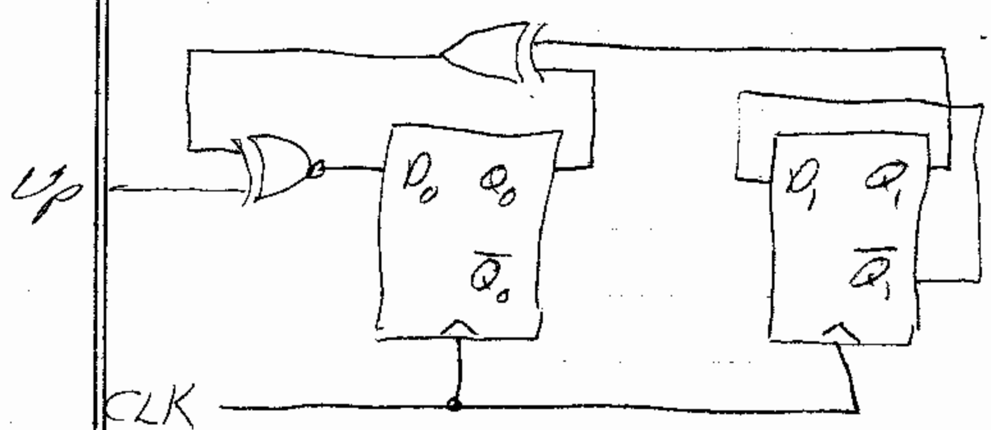
$Up \backslash Q_0Q_1$	00	01	11	10
0	1	0	0	1
1	1	0	0	1

$$D_0 = \overline{Up}\,\overline{Q_0}\,\overline{Q_1} + \overline{Up}\,Q_0Q_1 + Up\,\overline{Q_0}\,Q_1 + Up\,Q_0\overline{Q_1}$$

$$\boxed{D_1 = \overline{Q_1}}$$

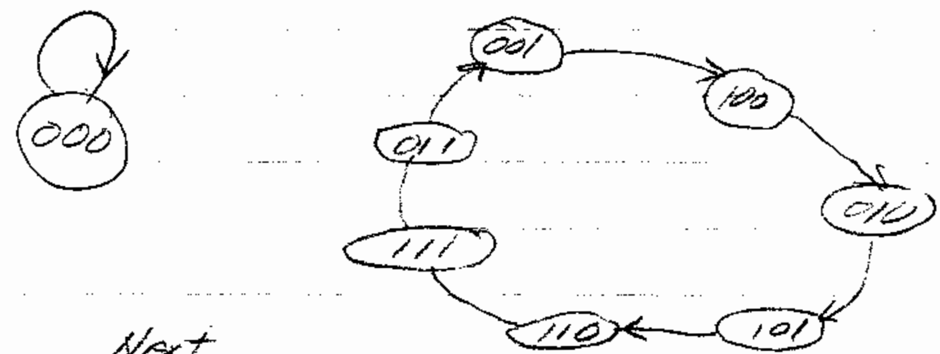
$$D_0 = \overline{Up}\,(\overline{Q_0}\,\overline{Q_1} + Q_0Q_1) + Up\,(\overline{Q_0}\,Q_1 + Q_0\overline{Q_1})$$

$$D_0 = \overline{Up}\,(\overline{Q_0 \oplus Q_1}) + Up\,(Q_0 \oplus Q_1) = \overline{Up \oplus (Q_0 \oplus Q_1)} \longleftarrow$$



ES 332 Homework 18

13.3



Present Q_0	Q_1	Q_2	Next Q_0^+	Q_1^+	Q_2^+	D_0	D_1	D_2
0	0	0	0	0	0	0	0	0
0	0	1	1	0	0	1	0	0
1	0	0	0	1	0	0	1	0
0	1	0	1	0	1	1	0	1
1	0	1	1	1	0	1	1	0
1	1	0	1	1	1	1	1	1
1	1	1	0	1	1	0	1	1
0	1	1	0	0	1	0	0	1

D_0

$Q_0 \backslash Q_1Q_2$	00	01	11	10
0	0	1	0	1
1	0	1	0	1

D_1

$Q_0 \backslash Q_1Q_2$	00	01	11	10
0	0	0	0	0
1	1	1	1	1

D_2

$Q_0 \backslash Q_1Q_2$	00	01	11	10
0	0	0	1	1
1	0	0	1	1

$D_0 = \overline{Q}_1 Q_2 + Q_1 \overline{Q_2}$; $D_1 = Q_0$; $D_2 = Q_1$

$D_0 = Q_1 \oplus Q_2$