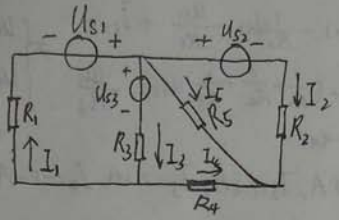
数学作业纸

（科目：　　）

班级：　　姓名：　　编号：　　第　　页

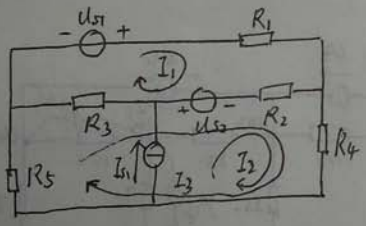
第三次作业

3-2.



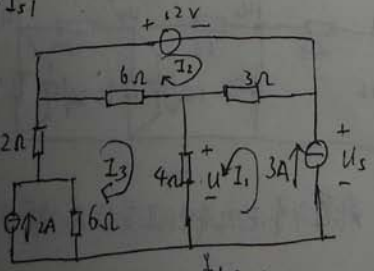
$$\begin{cases} I_1R_1 + I_3R_3 = U_{S1} - U_{S3} \\ -I_3R_3 - I_4R_4 + I_5R_5 = U_{S3} \\ -I_2R_2 + I_5R_5 = U_{S2} \\ I_2 + I_4 + I_5 = 0 \\ I_1 + I_4 = I_3 \end{cases}$$

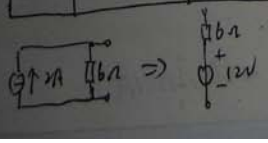
3-5.



$$\begin{cases} I_1(R_1+R_2+R_3) - I_2R_2 - I_3(R_2+R_3) = U_{S1} + U_{S2} \\ -I_1(R_2+R_3) + I_2(R_2+R_4) + I_3(R_2+R_3+R_4+R_5) = -U_{S2} \\ I_2 = I_{S1} \end{cases}$$

3-9.

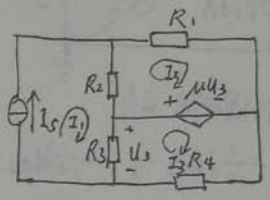




$$\begin{cases} 7I_1 + 8I_2 + 4I_3 = U_S \\ 3I_1 + 9I_2 - 6I_3 = -12 \\ 4I_1 - 6I_2 + 18I_3 = 12 \\ I_1 = 3A \end{cases} \Rightarrow \begin{cases} I_2 = 3A \\ I_3 = -1A \end{cases}$$

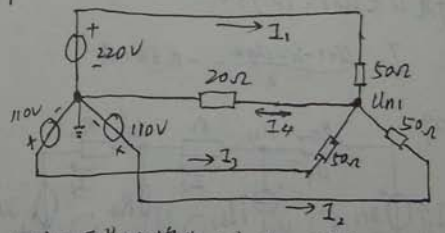
则 $U = 4(I_1 + I_3) = 8V$

3-13.



$$\begin{cases} -I_1R_2 + I_2(R_1+R_2) = \mu U_3 \\ -I_1R_3 + I_3(R_3+R_4) = -\mu U_3 \\ U_3 = R_3(I_1 - I_3) \\ I_1 = I_S \end{cases}$$

3-19.



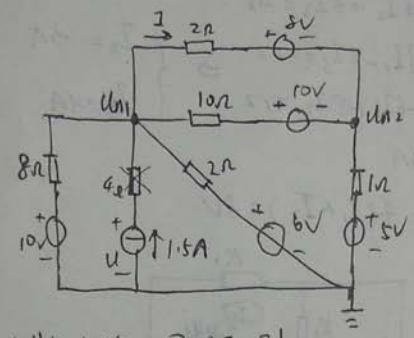
分别设两节点电势为 0 和 U_{n1}，则有：

$$\left(\frac{1}{50} + \frac{1}{50} + \frac{1}{50} + \frac{1}{20}\right) U_{n1} = \frac{220}{50} + \frac{110}{50} + \frac{110}{50}$$

$\Rightarrow U_{n1} = 80V$

于是可得：$\begin{cases} I_1 = 2.8A \\ I_2 = 0.6A \\ I_3 = 0.6A \\ I_4 = 4A \end{cases}$，电流方向如图所示。

3-20.



设节点电势如图所示，则：

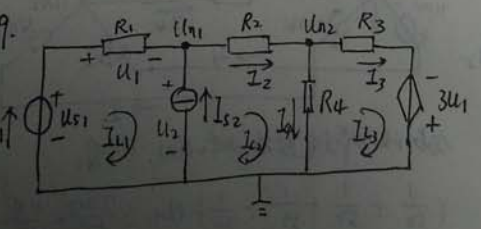
$$\begin{cases}\left(\frac{1}{8}+\frac{1}{4}+\frac{1}{2}+\frac{1}{10}\right)U_{n1}-\left(\frac{1}{2}+\frac{1}{10}\right)U_{n2}\\ =\frac{10}{8}+1.5+\frac{10}{10}+\frac{6}{2}+\frac{8}{2}\\ -\left(\frac{1}{2}+\frac{1}{10}\right)U_{n1}+\left(\frac{1}{2}+\frac{1}{10}+1\right)U_{n2}=-\frac{8}{2}-\frac{10}{10}+5\end{cases}$$

$$\Rightarrow\begin{cases}U_{n1}=10.75V\\ U_{n2}=4.03V\end{cases}$$

于是 $U=$ ~~$U_{n1}=10.75V$~~ $U_{n1}+6=16.75V$

$$I=\frac{U_{n1}-8-U_{n2}}{2}=-0.64A$$

3-29.



（回路电流法）

$$\begin{cases}I_{L1}R_1=U_{S1}-U_2\\ I_{L2}(R_2+R_4)-I_{L3}R_4=U_2\\ -I_{L2}R_4+I_{L3}(R_3+R_4)=3U_1\\ U_1=I_{L1}R_1,\ I_{L2}-I_{L1}=I_{S2}\end{cases}\Rightarrow\begin{cases}I_{L1}=0.8A\\ I_{L2}=1.8A\\ I_{L3}=2.2A\end{cases}$$

即 $I_1=0.8A,\ I_2=1.8A,\ I_3=2.2A,\ I_4=-0.4A,\ I_{S2}=1A$.

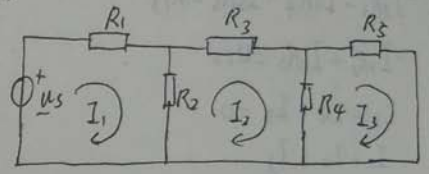
（节点电压法）

$$\begin{cases}\left(\frac{1}{R_1}+\frac{1}{R_2}\right)U_{n1}-\frac{1}{R_2}U_{n2}=\frac{U_{S1}}{R_1}+I_{S2}\\ -\frac{1}{R_2}U_{n1}+\left(\frac{1}{R_2}+\frac{1}{R_4}+\frac{1}{R_3}\right)U_{n2}=-\frac{3U_1}{R_3}\\ U_1=U_{S1}-U_{n1}\end{cases}\Rightarrow\begin{cases}U_{n1}=1.4V\\ U_{n2}=-0.4V\end{cases}$$

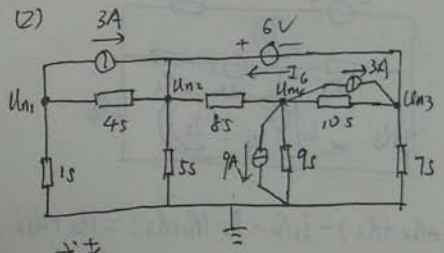
$$\Rightarrow I_1=0.8A,\ I_2=1.8A,\ I_3=2.2A,\ I_4=-0.4A,\ I_5=1A$$

3-36.

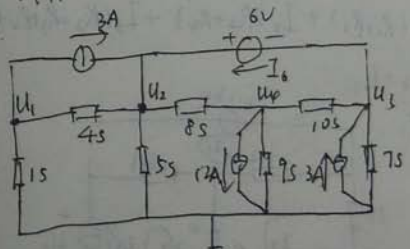
(1)



(2)



或者



或者叠电流源电阻变换成电压源电阻.

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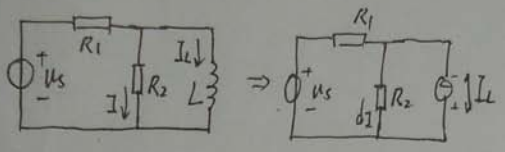
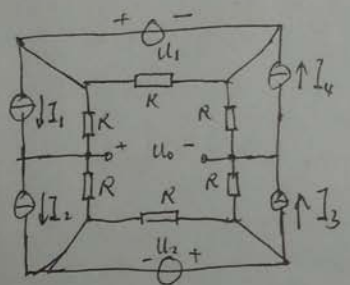
4-2.



$$I = \frac{U_S}{R_1+R_2} - \frac{I_L R_1}{R_1+R_2}$$

4-3.



I_1 单独作用，$U_{o1} = \frac{1}{2} I_1 R$

I_2 单独作用，$U_{o2} = -\frac{1}{2} I_2 R$

I_3 ----，$U_{o3} = -\frac{1}{2} I_3 R$

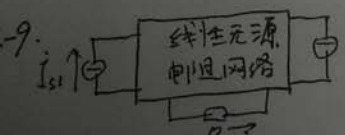
I_4 ----，$U_{o4} = \frac{1}{2} I_4 R$

U_1 ----，$U_{o5} = \frac{1}{2} U_1$

U_2 ----，$U_{o6} = -\frac{1}{2} U_1$.

由叠加定理得：$U_o = \frac{U_1 - U_2}{2} + \frac{1}{2}(I_1 + I_4 - I_2 - I_3)R$

4-9.

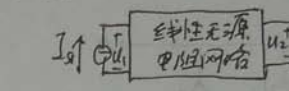


设 $i = K_1 i_{S1} + K_2 i_{S2}$　（叠加定理，齐次性定理）

则 $\begin{cases} 5K_1 + 5K_2 = 0 \\ 8K_1 + 6K_2 = 4 \end{cases}$

$\Rightarrow \begin{cases} K_1 = 2 \\ K_2 = -2 \end{cases}$，当 $i_{S1} = 3A$，$i_{S2} = 4A$ 时，$i = -2A$

4-10.



当电流源 I_{S1} 单独作用时，$I_{S1} = 2A$，$U_1 = 14V$，$U_2 = 8V$

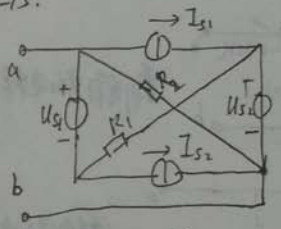
当电流源 I_{S2} 单独作用时，$I_{S2} = 3A$，$U_1 = 12V$，$U_2 = 18V$

则当两个电流源同时作用时，由叠加定理，

$U_1 = 26V$，$U_2 = 26V$.

此时 $P_{S1} = 52W$，$P_{S2} = 78W$.

4-15.



a、b 端等效电阻（电压源短路，电流源开路）

$$R = \frac{R_1 R_2}{R_1 + R_2}$$

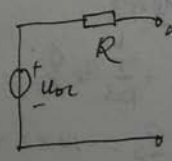
U_{S1} 单独作用时，$U_{oc}' = \frac{R_2}{R_1+R_2} U_{S1}$

U_{S2} ------，$U_{oc}'' = \frac{R_2}{R_1+R_2} U_{S2}$

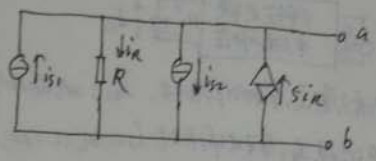
I_{S1} ------，$U_{oc}''' = -\frac{R_1 R_2}{R_1+R_2} I_{S1}$

I_{S2} ------，$U_{oc}'''' = -\frac{R_1 R_2}{R_1+R_2} I_{S2}$

由叠加定理，$U_{oc} = \frac{R_2(U_{S1}+U_{S2})}{R_1+R_2} - \frac{R_1 R_2 (I_{S1}+I_{S2})}{R_1+R_2}$



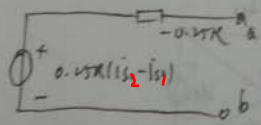
4-45.



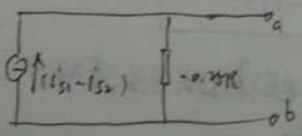
由 KCL 得 $i_R = 0.5(i_{s2} - i_{s1})$

则 $U_{ab} = i_R \cdot R = \frac{R}{4}(i_{s2} - i_{s1})$

$R_{in} = -\frac{R}{2}$（加压求电阻）

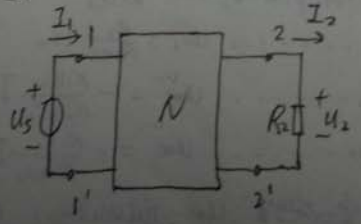


受控源等效电路



诺顿等效电路

4-45.



由特勒根定理得：

$$-\hat{U}_S\hat{I}_1 + \hat{U}_2\hat{I}_2 + \sum_{k=3}^{b}\hat{U}_k\hat{I}_k = -\hat{U}_S\hat{I}_1 + \hat{U}_2\hat{I}_2 + \sum_{k=3}^{b}\hat{U}_k\hat{I}_k$$

即：$6\times(-3) + 2\hat{I}_2 = -10\times 2 + 4\hat{I}_2\times 1$

$\Rightarrow \hat{I}_2 = 1A$，$U_2 = 4V$.