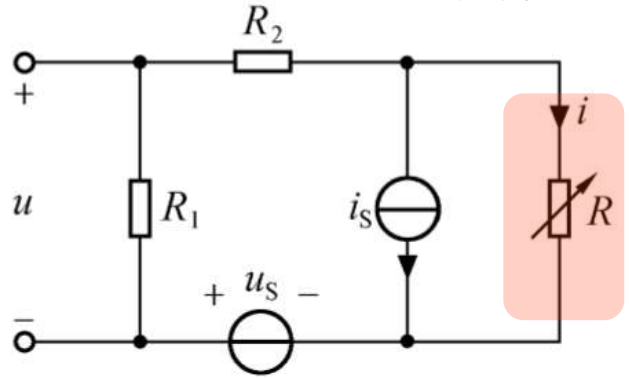
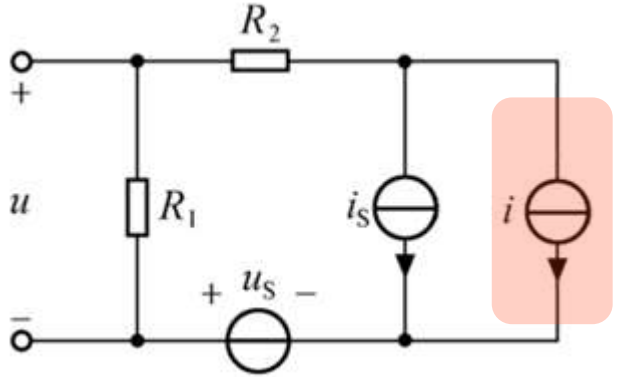
网络定理

习题讲解

1. 如题图所示电路，当改变电阻R值时，电路中各处电压和电流都将随之改变，已知当i=1A时，u=20V；i=2A时，u=30V。求当i=3A时，电压u为多少？



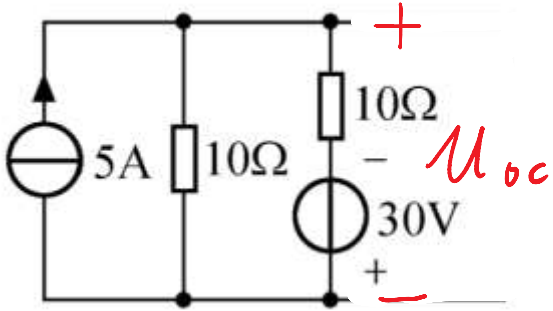


$$k_1u_s+k_2i_s+k_3i=u$$

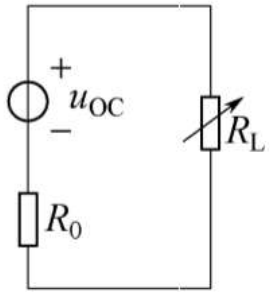
$$\begin{cases}k_1u_s+k_2i_s+k_3=20\\k_1u_s+k_2i_s+2k_3=30\end{cases}\qquad\begin{cases}k_3=10\\k_1u_s+k_2i_s=10\end{cases}$$

$$\therefore u=k_1u_s+k_2i_s+3k_3=40\text{V}$$

2. 电路如题图所示，其中电阻R_L可调，试问R_L为何值时能获得最大功率，最大功率为多少？



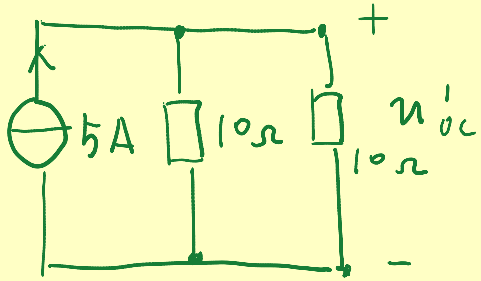
分析：

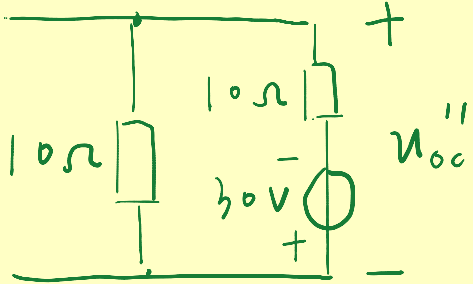


当$R_L = R_0$时

$$P_{max} = \frac{u_{oc}^2}{4R_0}$$

叠加定理



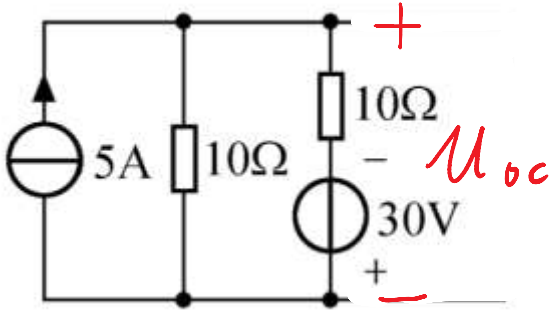


$$u_{oc}' = 5 \times \frac{10 \times 10}{10 + 10} = 25\text{V}$$

$$u_{oc}'' = -30 \times \frac{10}{10 + 10} = -15\text{V}$$

$$u_{oc} = u_{oc}' + u_{oc}'' = 10\text{V}$$

2. 电路如题图所示，其中电阻R_L可调，试问R_L为何值时能获得最大功率，最大功率为多少？



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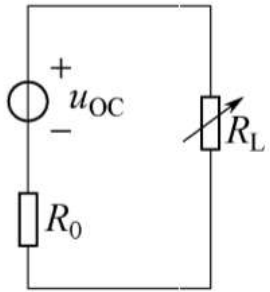
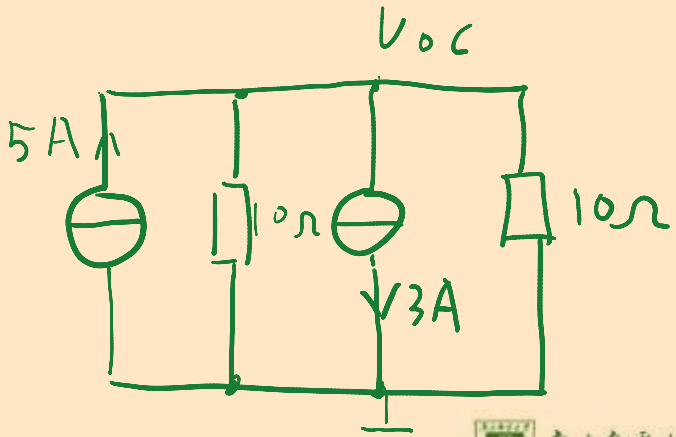


当$R_L = R_0$时

$$P_{\max} = \frac{u_{oc}^2}{4R}$$

节点电位法 $$(\frac{1}{10}+\frac{1}{10})u_{oc} = 5 - \frac{30}{10}$$

$$u_{oc} = 10\text{V}$$



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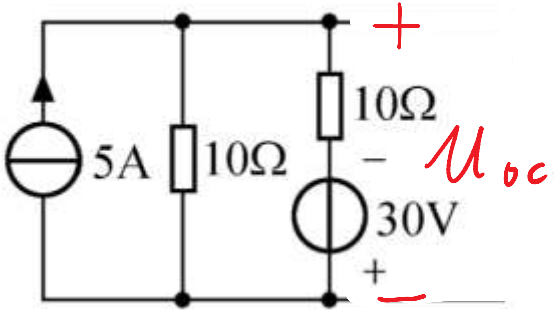

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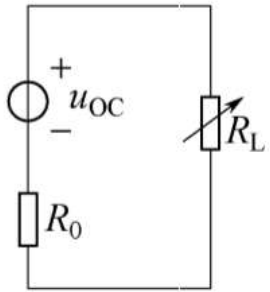
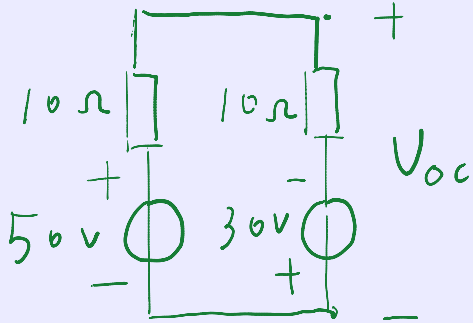


当$R_L = R_0$时

$$P_{\max} = \frac{u_{oc}^2}{4R}$$

等效变换



$$i = \frac{50+30}{10+10} = 4\text{A}$$

$$u_{oc} = 10\times 4 - 30 = 10\text{V}$$

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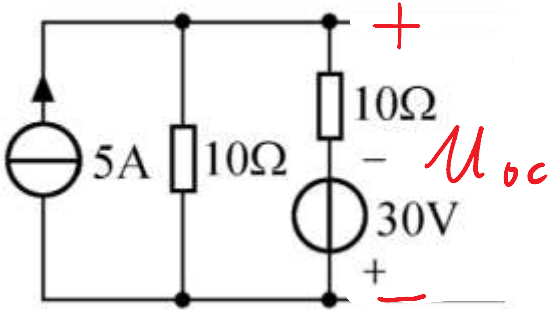

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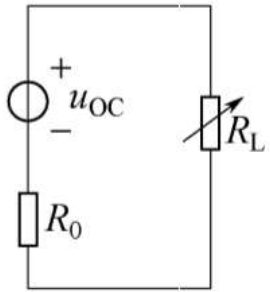

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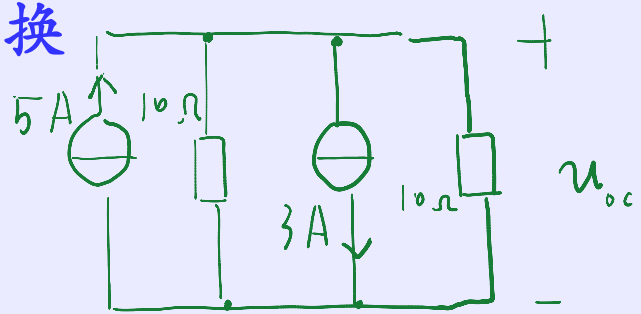
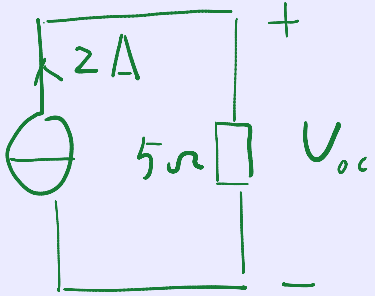
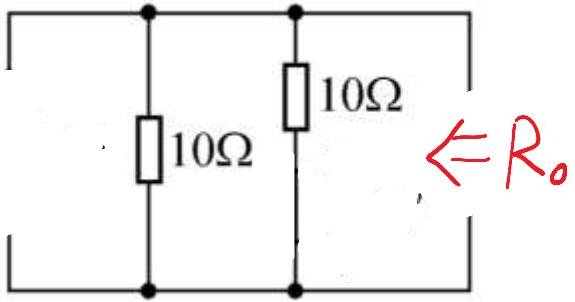




$$u_{oc} = 2 \times 5 = 10V$$

2. 电路如题图所示，其中电阻R_L可调，试问R_L为何值时能获得最大功率，最大功率为多少？



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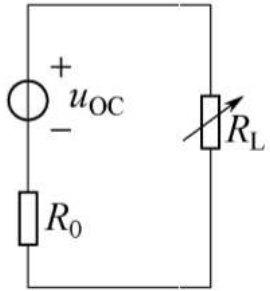


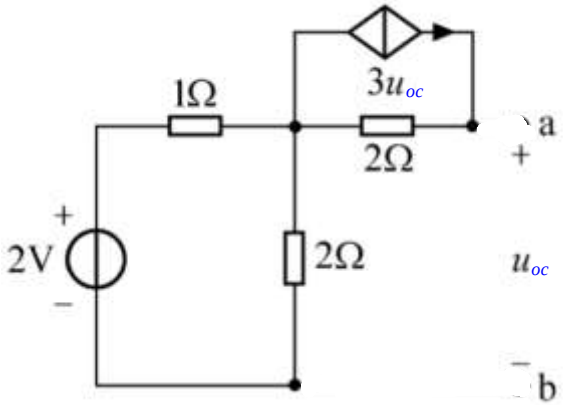
当$R_L = R_0$时

$$P_{\max} = \frac{u_{oc}^2}{4R}$$

当$R_L = R_0 = 5\Omega$时

$$P_{\max} = \frac{u_{oc}^2}{4R} = 5\text{W}$$

3. 试求题图所示二端网络的戴维南等效电路。

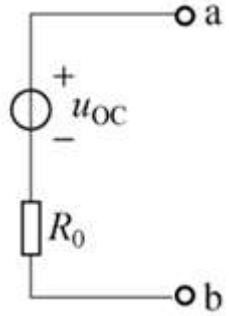


戴维南定理

（1）求u_{oc}

$$u_{oc}=2\times 3u_{oc}+2\times\frac{2}{2+1}$$

$$u_{oc}=-\frac{4}{15}\text{V}$$



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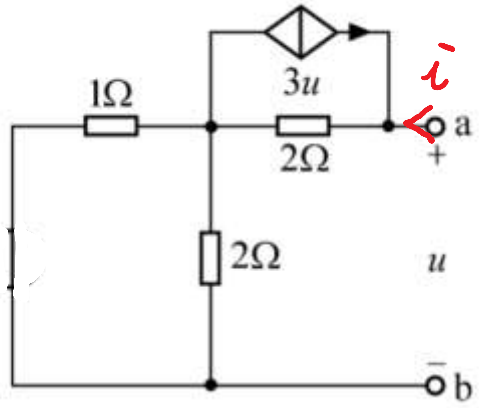
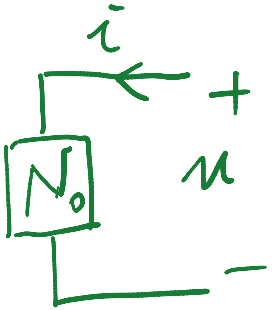
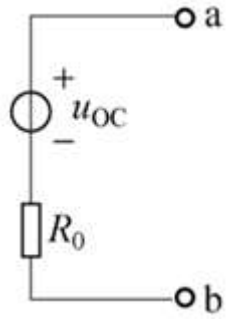




戴维南定理



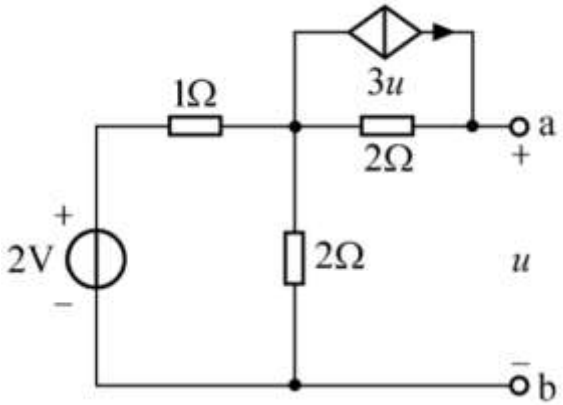
（2）求R_0　　加压求流法

$$u = 2\times(3u+i)+\frac{2\times1}{2+1}i$$

$$u = -\frac{8}{15}i$$

$$R_0 = -\frac{8}{15}\Omega$$　（有源性）

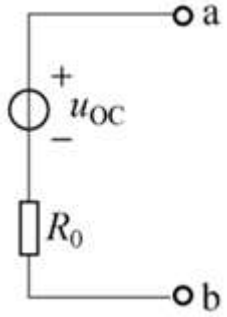
3. 试求题图所示二端网络的戴维南等效电路。

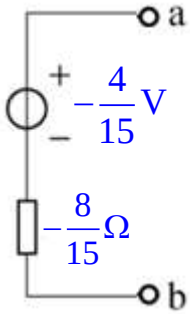


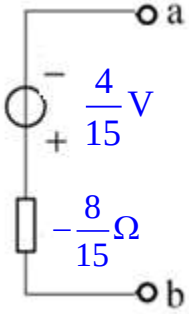
戴维南定理

(3) 作戴维南等效电路

$$u_{oc} = -\frac{4}{15} \qquad R_0 = -\frac{8}{15}\Omega$$







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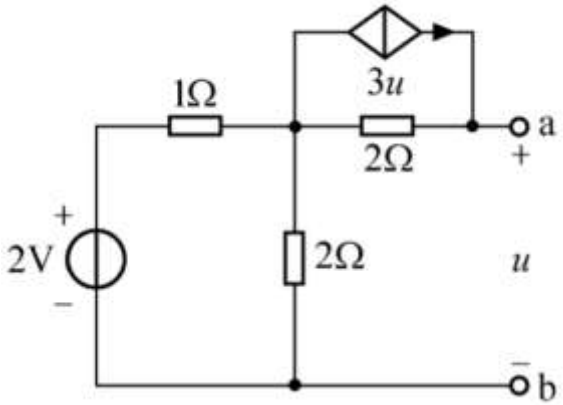
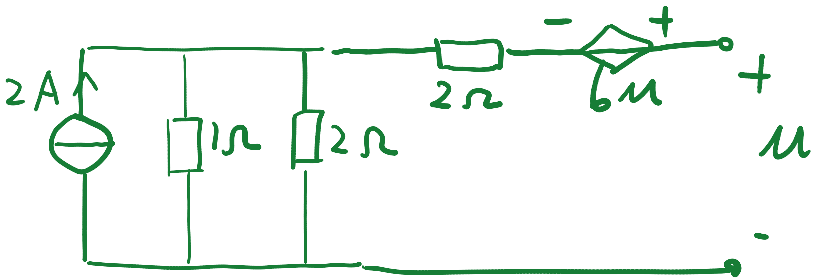
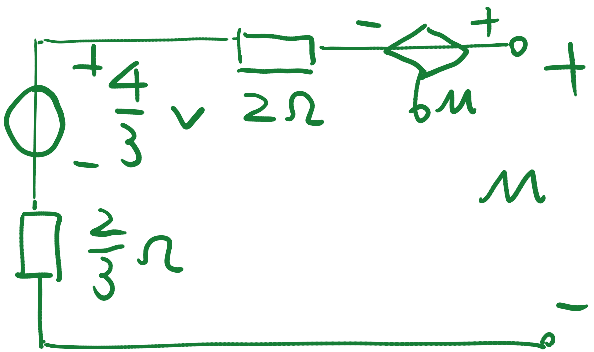
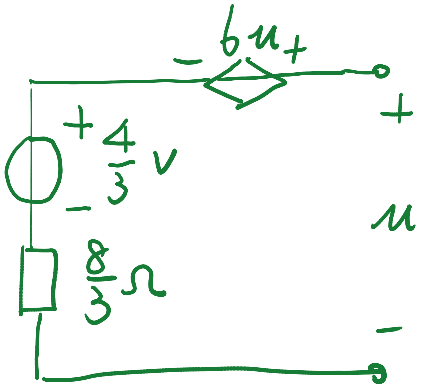


方法二：等效简化电路







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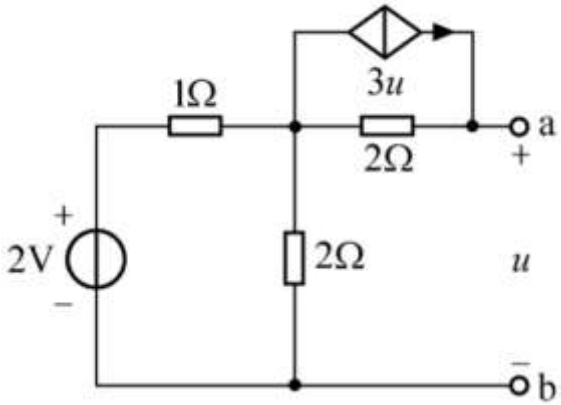
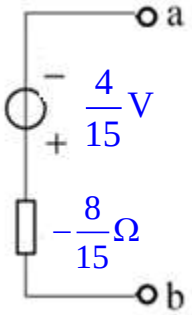
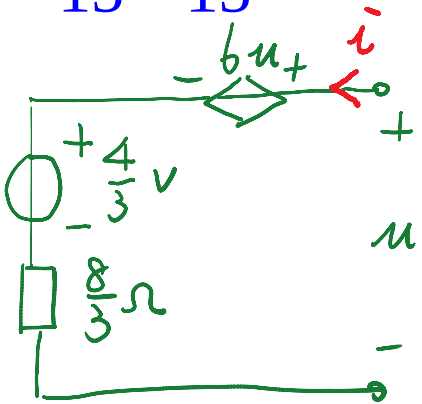


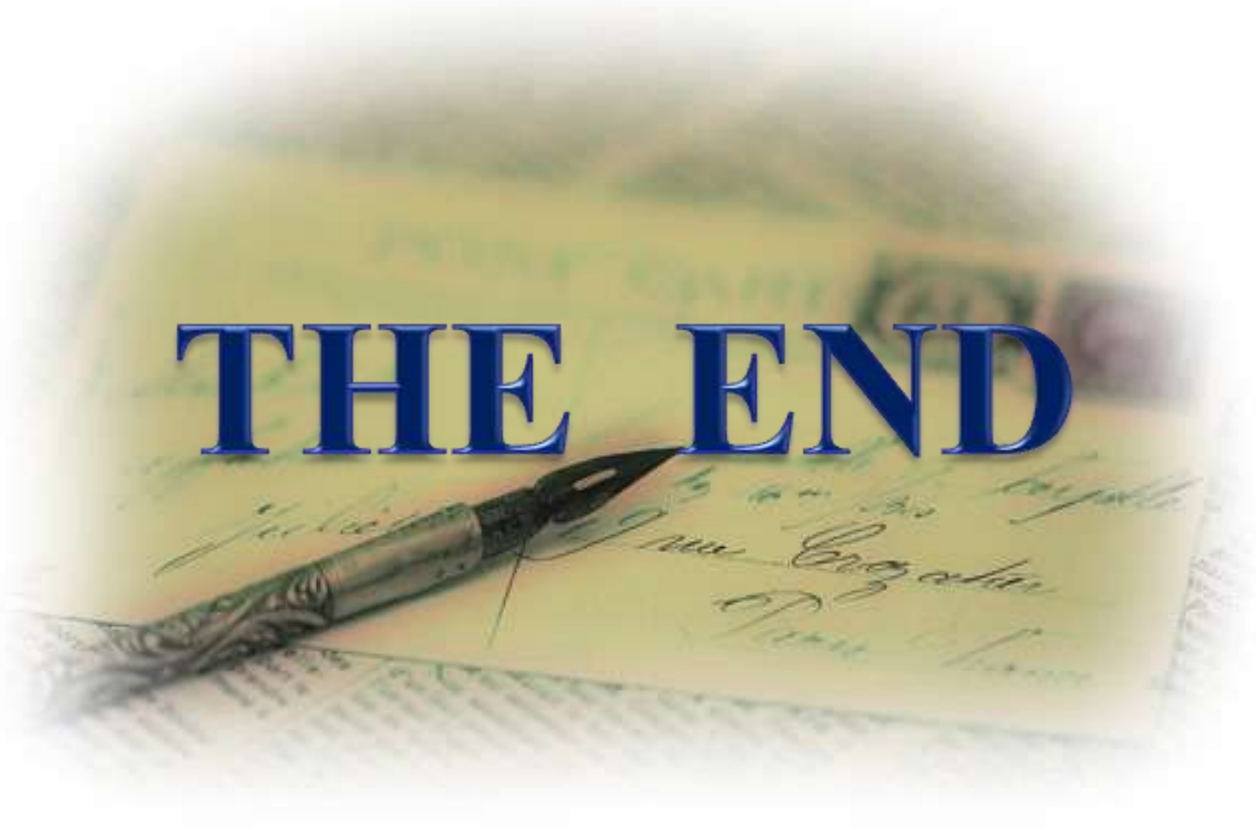
方法二：等效简化电路

$$u = 6u + \frac{4}{3} + \frac{8}{3}i$$

$$u = -\frac{4}{15} - \frac{8}{15}i$$



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