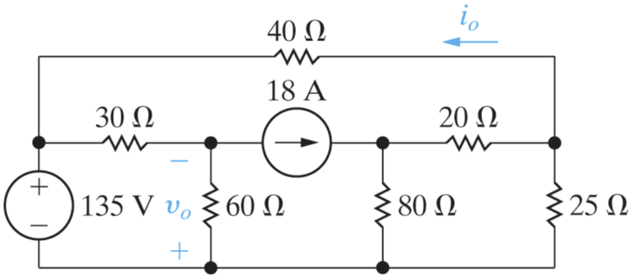
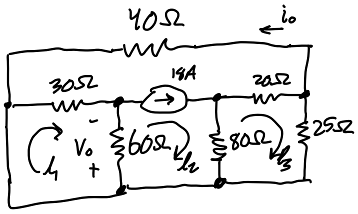
4.93 Use superposition to solve for i_o and v_o in the circuit in **Fig. P4.93**.

Figure P4.93



Only current



loop 1

$$\frac{V_1}{30}+\frac{V_1}{60}+18=0 \Rightarrow V_1=360=V_0$$

loop 2

$$\frac{V_2-V_1}{60}+18+\frac{V_2}{80}=0$$

$$140V_2-80V_1=-86400$$

$$V_2=-411.43$$

loop 3

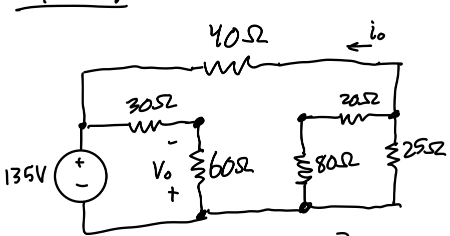
$$\frac{V_3}{40}+\frac{V_3}{25}+\frac{V_3-V_2}{20}=0$$

$$V_3=192$$

$$i_o=\frac{192}{40}=4.8A$$

$$\boxed{\begin{array}{l} i_o = 4.8+2.25=2.55A \\ V_o=-90+360=270V \end{array}}$$

Only Voltage



$$R_{outer\,loop}=40+[(20+80)||25]=60\Omega$$

$$i_o=\frac{-135}{60\Omega}=-2.25A$$

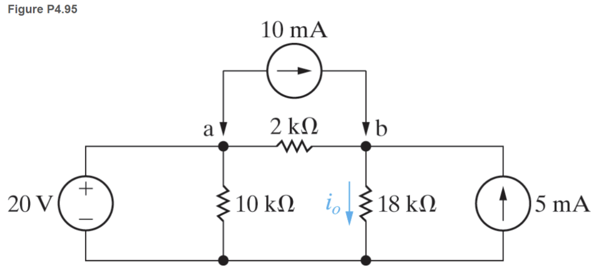
$$V=\frac{60}{30+60}(-135)=-90V$$

4.95 PSPICE MULTISIM

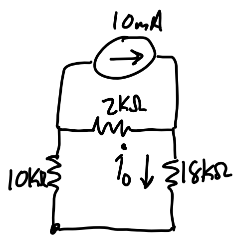
a. a) In the circuit in **Fig. P4.95**, before the 10 mA current source is attached to the terminals a, b, the current i_o is calculated and found to be 1.5 mA. Use superposition to find the value of i_o after the current source is attached.

b. b) Verify your solution by finding i_o when all three sources are acting simultaneously.

Figure P4.95



a)



$$i_o=10mA\,\frac{2k\Omega}{(2+18)k\Omega}=1mA$$

$$\boxed{i_o \text{ After} = 1+1.5=2.5mA}$$

b)

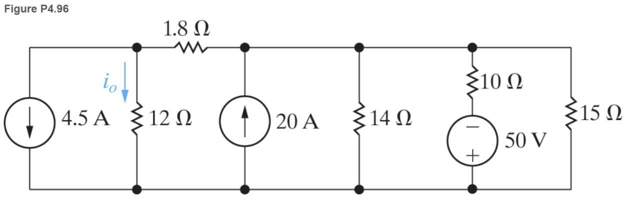
$$\frac{V_b-20}{2}+\frac{V_b}{18}-15=0$$

$$V_b=45V$$

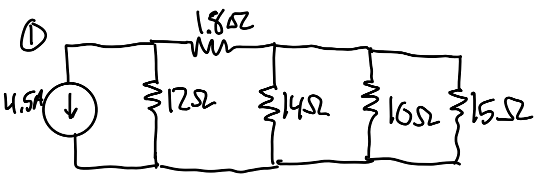
$$\boxed{i_o=\frac{45}{18K}=2.5mA}$$

4.96 PSPICE MULTISIM Use the principle of superposition to find the current i_o in the circuit shown in Fig. P4.96.

Figure P4.96



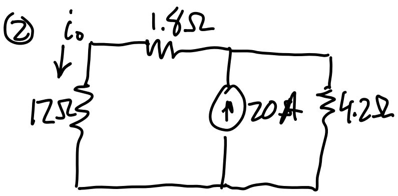
①



$14 \| 10 \| 15 = 4.2\ \Omega$

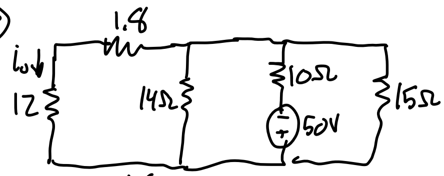
$$i_o = -4.5\ \frac{1.8+4.2}{12+1.8+4.2} = -1.5A$$

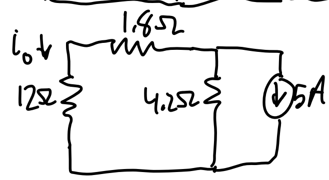
②



$$i_o = 20\ \frac{4.2}{18} = 4.67A$$

③



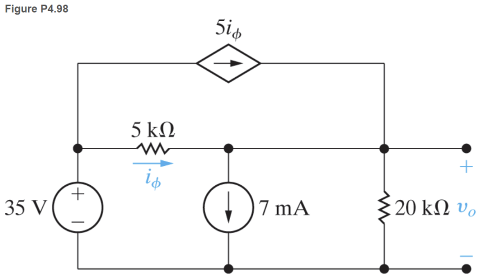


$$i_o = -5\ \frac{4.2}{18} = -1.17A$$

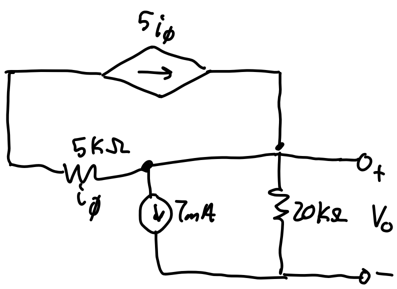
$$\boxed{i_o = 4.67 - 1.5 - 1.17 = 2A}$$

4.98 PSPICE MULTISIM Use the principle of superposition to find v_o in the circuit in Fig. P4.98.

Figure P4.98



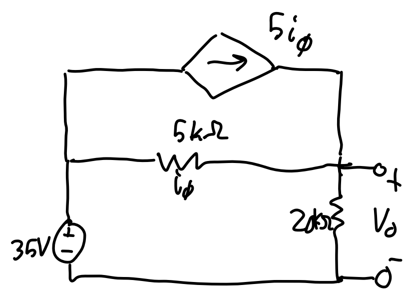
①



$$\frac{V_o}{20} + \frac{V_o}{5} + V_o + 7 = 0$$

$$V_o = -5.6V$$

②



$$\frac{V_o}{20} + \frac{V_o - 35}{5} + 35 - V_o = 0$$

$$V_o = 33.6V$$

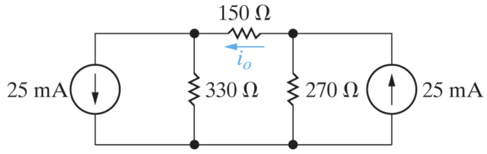
$$\boxed{V_o = 33.6 - 5.6 = 28V}$$

4.59 PSPICE MULTISIM

a) Use source transformations to find the current i_o in the circuit in Fig. P4.59.

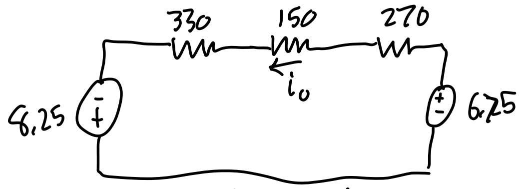
b) ~~Verify your solution by using the node-voltage method to find i_o.~~

Figure P4.59



$25mA\,(330\Omega) = 8.25V$

$25mA\,(270\Omega) = 6.75V$



$$i_o = \frac{(6.75+8.25)}{330+150+270}$$

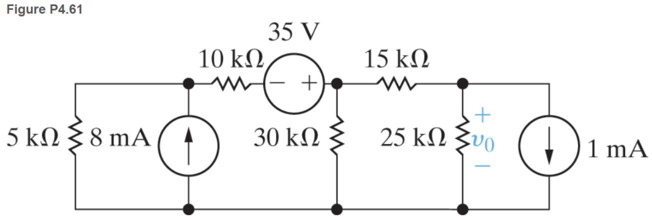
$$\boxed{i_o = 20mA}$$

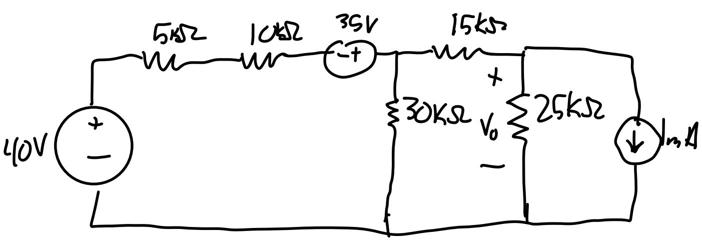
4.61

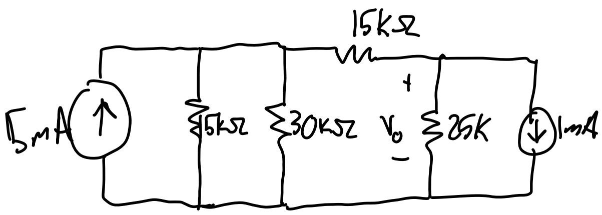
a) Make a series of source transformations to find the voltage v_0 in the circuit in Fig. P4.61.

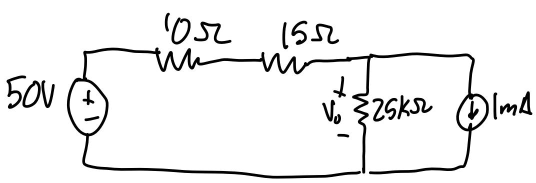
b) Verify your solution using the mesh-current method.

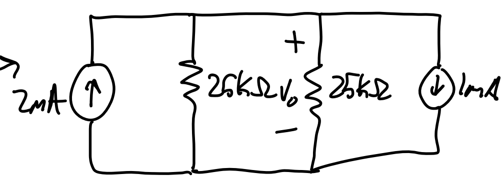
Figure P4.61

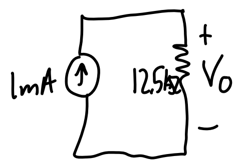












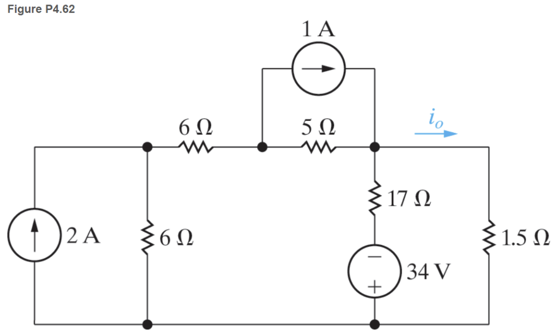
$$\boxed{V_o = (12.5k\Omega)(1mA) = 12.5V}$$

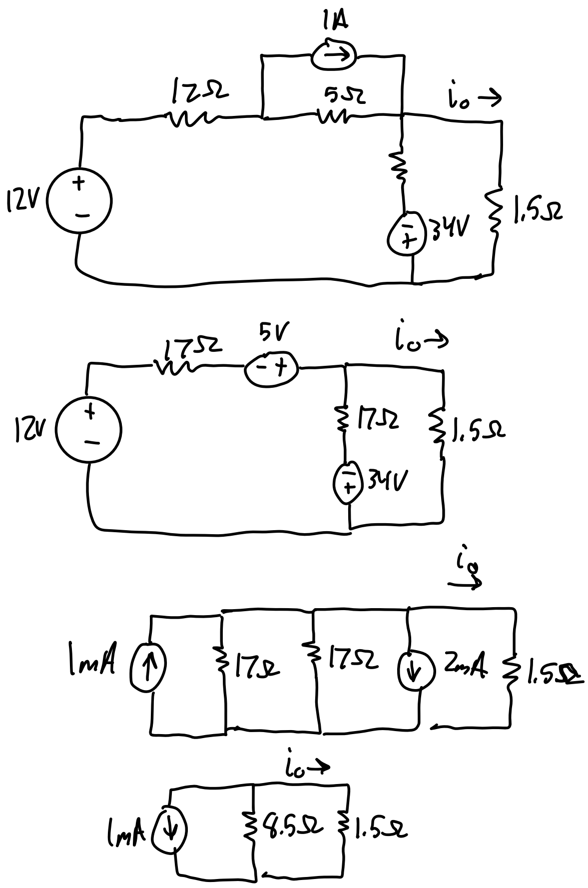
4.62 PSPICE MULTISIM

a) Use a series of source transformations to find i_o in the circuit in **Fig. P4.62**.

b) ~~Verify your solution by using the mesh-current method to find i_o.~~

Figure P4.62





$$i_o = (-1mA)\frac{8.5\Omega}{(8.5+1.5)\Omega}$$

$$\boxed{i_o = -0.85A}$$