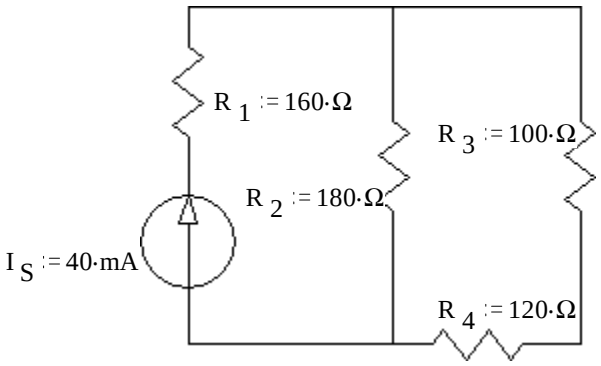
ECE 2210 / 00 homework DC6

Thevenin & Norton equivalent circuits

1. For the circuit shown at right, use Thevenin's theorem to find the current through the 120-Ω resistor, R_4.



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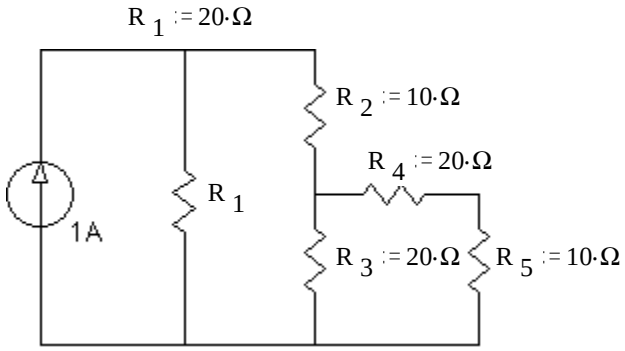
2. For the circuit shown, use Norton's theorem to find the value of the current in R_5. Hint: You can find I_N either by calculation of the open circuit voltage (V_{OC}) and R_N or by direct calculation of the short-circuit current (I_{SC}), however, there is something about the values of the resistors which makes the second method easier than it would at first appear.



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3. The terminal voltage of a car's battery drops from $12.5\ \mathrm{V}$ to 8.5 volts when starting. The starter motor draws $80\ \mathrm{A}$ of current.

   a) Draw the voltage-source model (Thevenin equivalent) of this battery. Include the values of V_S and R_S.

   b) Draw the current-source model (Norton equivalent) of this battery. Include the values of I_S and R_S.

   c) Which of these two models is more appropriate for the car battery?

   d) What terminal voltage would you expect if this battery were being charged at $20\ \mathrm{A}$?

Answers 1. $18 \cdot \mathrm{mA}$ 2. $0.19 \cdot \mathrm{A}$
3. a) $V_S = 12.5 \cdot \mathrm{V}$ $R_S := 0.05 \cdot \Omega$ b) $I_S = 250 \cdot \mathrm{A}$ $R_S := 0.05 \cdot \Omega$ c) Thevenin d) $13.5 \cdot \mathrm{V}$