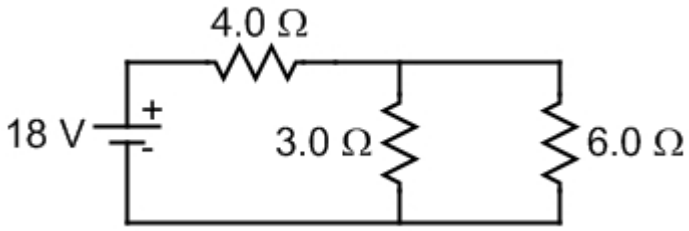
PROBLEM 1 – 15 points

Three resistors, of resistance 4.0 Ω, 3.0 Ω, and 6.0 Ω, are connected in the circuit shown at right with a battery that has a voltage of 18 volts.



[3 points] (a) Determine the equivalent resistance of this circuit.

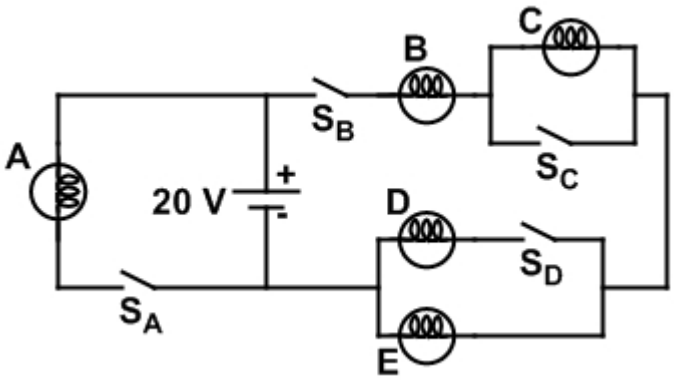
[3 points] (b) Calculate the current through the 3 Ω resistor.

[4 points] (c) Could you add a 5 Ω resistor to the circuit so that some current passes through it, while at the same time the currents through the original three resistors are unaffected? If so, re-draw the circuit to show how this could be done. If not, explain why not.

[5 points] (d) Could you add a 5 Ω resistor to the original circuit so that one or more of the currents through the original three resistors increases? If so, re-draw the circuit to show how this could be done. If not, explain why not.

PROBLEM 2 – 10 points

Five identical light bulbs, and four switches, are connected in the circuit shown. Assume the resistance of each bulb is constant no matter what the current is through it.



[4 points] (a) What is the minimum number of switches that should be closed so that at least one light bulb will turn on?

[ ] 0 [ ] 1 [ ] 2 [ ] 3 [ ] 4

Justify your answer. If you think one or more switches need to be closed then specify which need to be closed.

[3 points] (b) Explain which switches should be closed to maximize the brightness of bulb C. Are there any switches that, whether they are open or closed, do not affect the brightness of bulb C?

[3 points] (c) If every switch is closed, rank the bulbs based on their brightness, from brightest to dimmest.

[ ] All bulbs are equally bright [ ] A>B=D=E>C [ ] A>B=C>D=E

[ ] A=B>D=E>C [ ] A>B>D=E>C [ ] A=B=C>D=E [ ] A>B>C=D=E