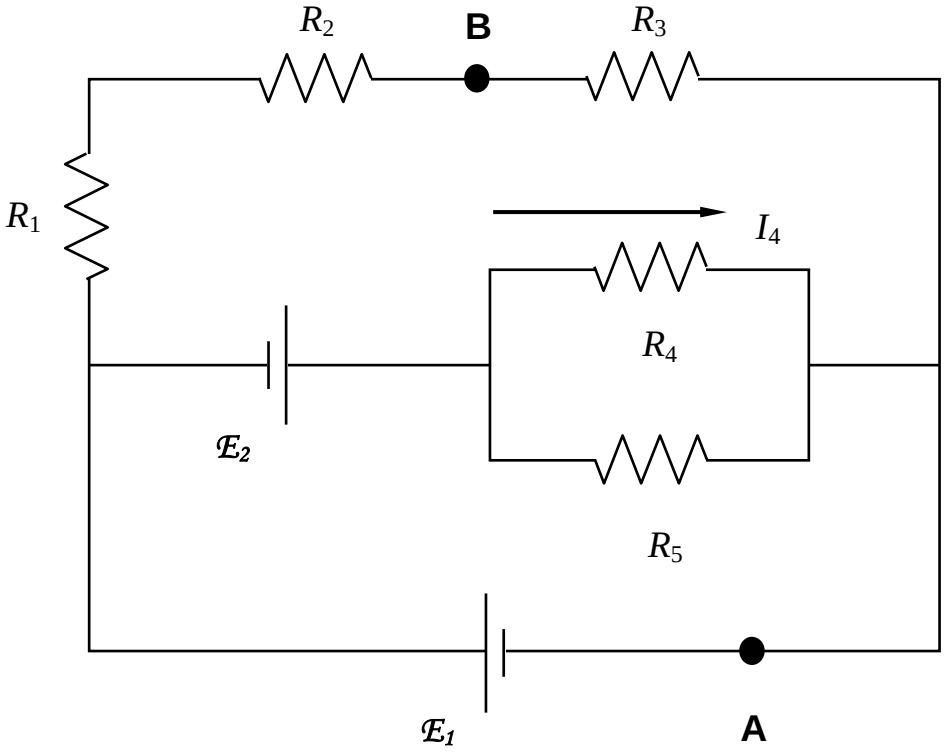
Discussion Question 6C
P212, Week 6
Mixing Methods in Resistor Network Analysis

In the previous question, you analyzed a "2-loop" circuit. In such cases, the linear algebra is relatively easy. But circuits of 3 loops or more are another story, the linear algebra can become really time consuming! Consider the circuit below. Your tasks are:



$\mathcal{E}_1$ = 10 V
$\mathcal{E}_2$ = 20 V
all R_i = 10 Ω

(a) Find the **current I_4** through resistor R_4.

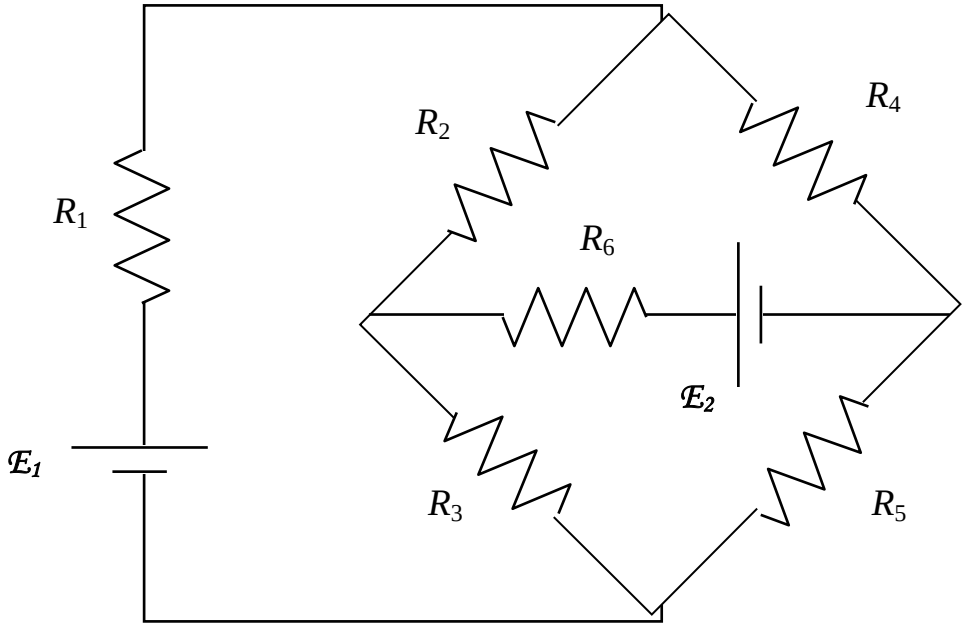
(b) Find the **potential difference $V_B - V_A$**.

This circuit *looks* like a truly *horrible* 3-loop affair … but it isn't! With two batteries arranged as shown, we will need to use method 2 = Kirchhoff's Laws. But we can greatly *simplify* our lives by first applying method 1 = the "collapse" of series and parallel resistor combinations as much as possible.

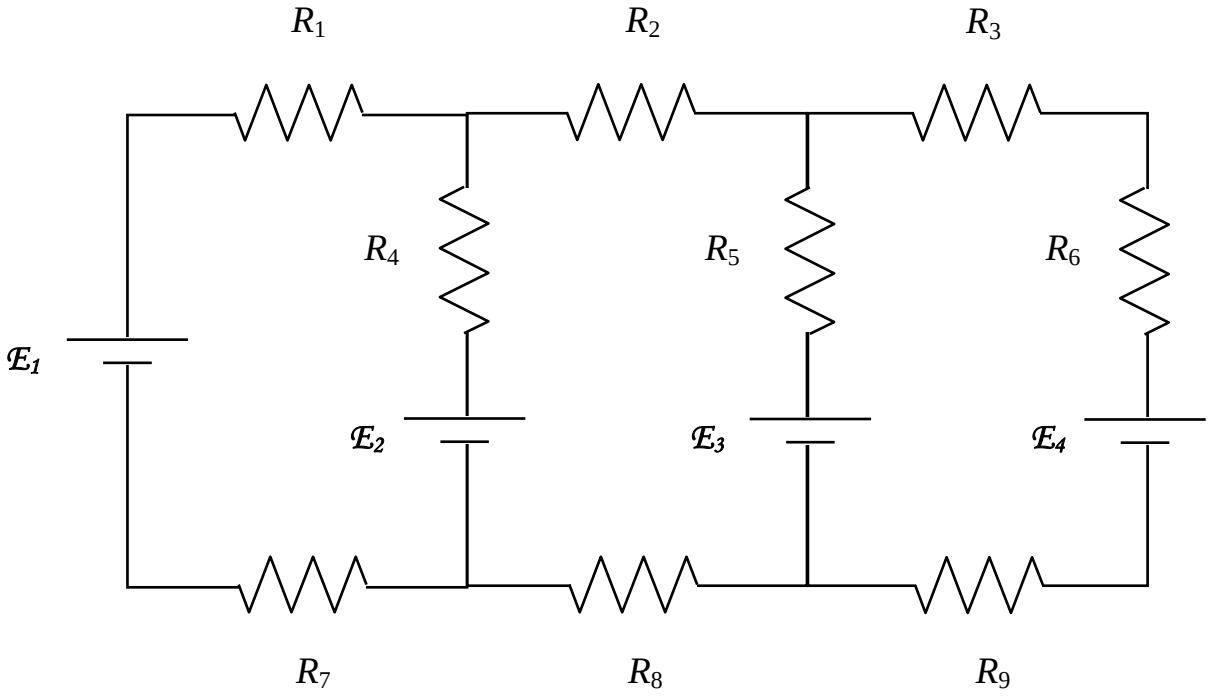
Go for it! Solve for the quantities requested in (a) and (b) using a *combination* of methods 1 and 2.

Finally, for practice, here are two examples of real "3-loop" circuits. In these rather complex cases, your task is merely to (c) identify all the different branch currents and (d) write down enough equations to solve for all of them. You may assume that all resistors R_i have the same value R. Solving the equations is just algebra … we won't bother with that part here.

(c)



(d)


R_1
R_2
R_3
R_4
R_5
R_6
$\mathcal{E}_1$
$\mathcal{E}_2$
$\mathcal{E}_3$
$\mathcal{E}_4$
R_7
R_8
R_9