Catch up on the reading on the course website.

1. (2-13) For how many seconds will a 6.9 V battery with 2.7 kJ capacity power a flash light consuming 6.3 mW?

2. (2-14) Rechargeable batteries are often rated in "Ampere-hours", the number of hours that the battery can deliver a current of 1 A at its nominal voltage. Note that in reality the voltage would drop gradually, and small batteries cannot even deliver 1 A. Despite these shortcomings, the measure is convenient and popular.

   A 12 V car battery is rated for 57 Ah. Assuming that the battery is initially fully charged and needs to be 20 percent full to start the engine, how long can the lights consuming 25 W total be left on (with motor off) before the car will no longer start?

3. (D-62) A microcontroller consumes $I_{ss1} = 154\,\mu$A when active and I_{ss2} =0.5 μA in sleep mode (CPU turned off). It is programmed as a temperature logger and turns on once every 4 minutes for 4 s to take a measurement and then goes back to sleep. Calculate how long the circuit can be powered with a hearing aid battery with 79 J capacity at $V_{dd} = 2.4$ V (assume that the entire energy from the battery can be used).

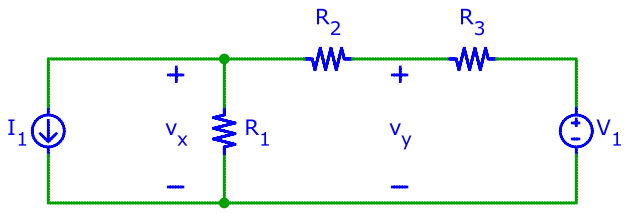
4. Redo practice problem 3.1 in Alexander and Sadiku, 5h Edition with component values replaced as follows: 2 Ω → 1.8 Ω, 6 Ω → 1.3 Ω, 7 Ω → 6.7 Ω.

5. Redo practice problem 4.3 in Alexander and Sadiku, 5h Edition with component values replaced as follows: 2 Ω → 6.6 Ω, 3 Ω → 9.4 Ω, 5 Ω → 1.5 Ω.

6. (D-21) Use Node Voltage Analysis to find voltages v_x and v_y for $I_1 = 3.9\,\mu$A, $V_1 = 4.8$ V, $R_1 = 6.8$ kΩ, $R_2 = 1.9$ kΩ, and $R_3 = 8.6$ kΩ.

   $v_x =$

   $v_y =$



7. (D-13) For evaluation, circuit (a') is temporarily connected to circuit (a) and the following measurements are taken with the ampère- and volt-meters shown in circuit (a') (for different values of R_L):

   i) $V = 4.9$ V $A = 9.5$ mA
   ii) $V = 9.2$ V $A = 3.8$ mA

a) Determine the values of V_T and R_T such that circuits (a) and (b) behave identically.

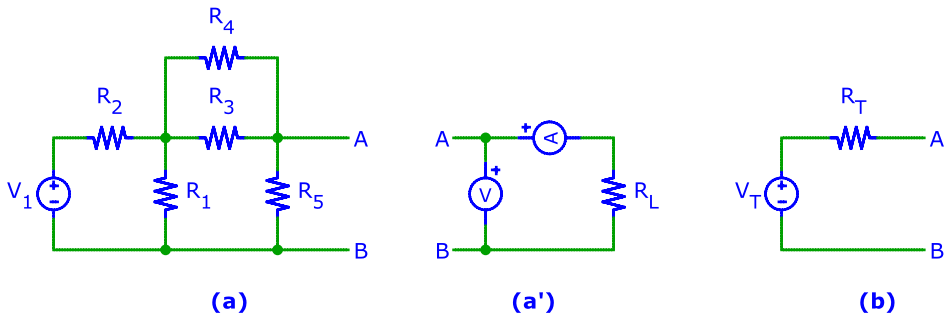
$V_T =$ ☐

$R_T =$ ☐

b) The apprentice is asked to verify the measurement, but inadvertently mixes up the volt- and ampère-meters. What readings does he get when redoing measurement (i) above? Use the values from part (a) for V_T and R_T.

$V =$ ☐

$A =$ ☐



8. Using just a 5 V voltage source (with zero output resistance) and two resistors R_1 and R_2 (value TBD) design a 3 V voltage source with 1 kΩ output resistance. Draw the circuit diagram and indicate all component values. Show your analysis.

9. Convert the decimal number 39 to binary and hexadecimal.

10. Convert hexadecimal ff0a to decimal.

11. Convert decimal 86304 to binary and count the number of (binary) digits. Suggestion: use Python.