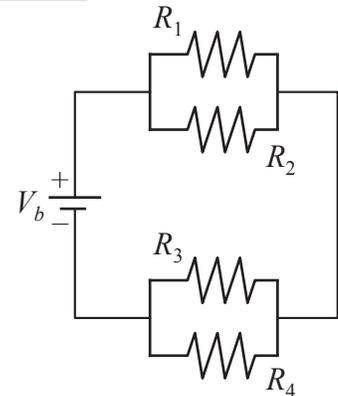


Use the Engineering Format for problem 1 of this assignment. Use the Direct Solution Format for problems 2 through 4. Use a word processor to include the photo from problem 3 and the source code for problem 4. The word processing document has a (small) header with your name, date, course, and the assignment number. Do not just print the source code on an otherwise unlabeled sheet of paper. Print the word-processor file and include it with any other sheets of paper you submit as part of your assignment. Do not email the document to your instructor. Thanks.

1. An ideal voltage source of 12 volts is attached to a set of four resistors with  $R_1=270\Omega$ ,  $R_2=470\Omega$ ,  $R_3=330\Omega$  and  $R_4=10k\Omega$  as shown below.

- (a) Find the equivalent resistance of the circuit diagram.  
 (b) Draw the equivalent circuit diagram (using standard symbols for the voltage source and the resistor).  
 (c) Compute the current leaving the power source.

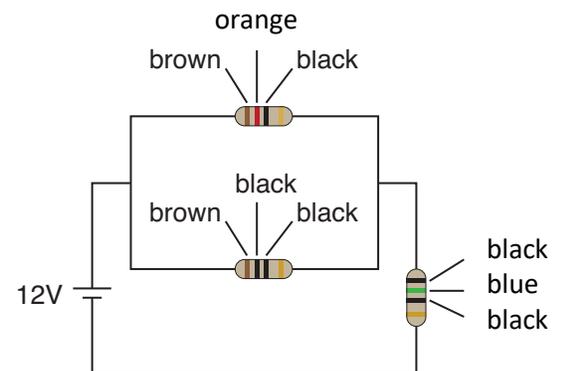
Answer = 24mA



2. To the right is a circuit with a battery and three resistors.

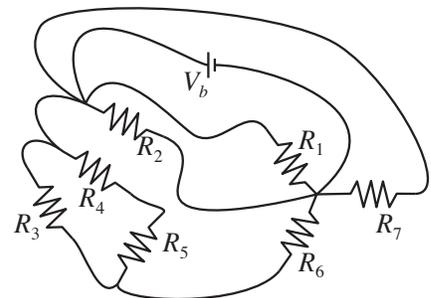
- (a) Redraw the circuit with symbolic labels  $R_1$ ,  $R_2$  and  $R_3$  for the three resistors and  $V_b$  for the battery. Obtain the *algebraic* formulas for the equivalent resistance of the circuit, the current through the black-blue-black resistor, and the power dissipated by the brown-black-black resistor. These formulas should be algebraic expressions involving  $R_1$ ,  $R_2$ ,  $R_3$  and  $V_b$ , and *not* the numerical values of these quantities.

- (b) Determine the resistance of each resistor based on the color codes.  
 (c) Evaluate the formulas for the equivalent resistance of the circuit.  
 (d) What is the current flowing through the black-blue-black resistor?  
 (e) What is the power dissipated by the brown-black-black resistor?



3. Consider the circuit shown to the right.

- (a) Redraw the circuit so that the resistors are oriented parallel to either the horizontal or vertical axes.  
 (b) Obtain the equivalent resistance of the circuit if the resistor values are  $R_1 = R_2 = R_5 = 10\text{ k}\Omega$ , and  $R_3 = R_4 = R_6 = R_7 = 330\Omega$ .  
 (c) Build the circuit on your breadboard and measure the overall resistance. What value do you obtain?



Use your cell phone or a digital camera to take a picture of the circuit on your breadboard. Include the picture in the word processor file that you print as part of your solution.

- (d) How much power is dissipated by  $R_6$  if  $V_b = 5V$ ? How much power is dissipated by  $R_6$  if  $V_b = 12V$ ?

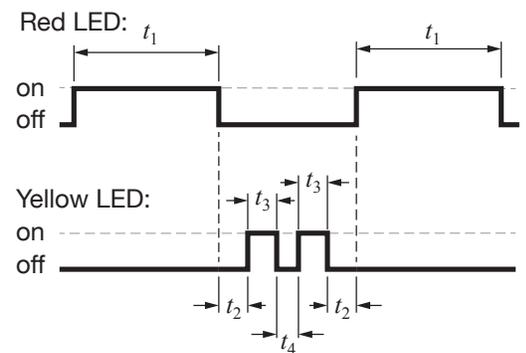
### Problem 4 is not part of Homework Assignment 3

Problem 4 was included when the assignment was designed. However, during the class #4 for Section 001 (Recktenwald's section), we did not get far enough into Arduino programming to cover the blink sketch. Problem 4 will be moved to Homework assignment 3. Working on this problem (if you have the time) will help you prepare for the coming lectures and will help you complete the next assignment.

4. Your kit comes with red and yellow LEDs. Build a circuit on your breadboard that can independently turn on one yellow LED and one red LED. Note that there is more than one way to build this circuit but be sure that each LED circuit includes a current-limiting resistor to protect the LED.

Write a program that causes the LEDs to be turned on and off in the pattern depicted in the diagram to the right. In your program, use  $t_1 = 1.2$  s,  $t_2 = 0.4$  s,  $t_3 = 0.3$  s, and  $t_4 = 0.15$  s.

Print out the program listing and have your Arduino running this program at the start of class on the due date. Keep your homework at your desk and open to your program listing. The instructor will check the function of your blinking LED program and circuit, make a note on your paper, and collect your homework at that point.



Appearance:



Gray indicates no light is on