

**ASSIGNMENT #6 – Effect of Statistical Variation of Component Parameters**

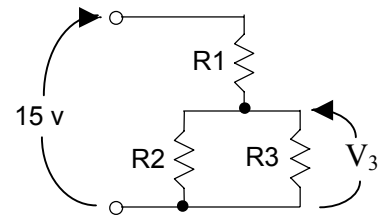
**DUE:** At the beginning of your recitation section, November 7-9, 2006

**NOTE:** This assignment is to be performed in the same group of 2 or 3 that you worked with on Assignment #5.

This project explores the effects of various models of component parameter variation on the predicted behavior of a simple electrical circuit. Part of the challenge for your group is to determine an appropriate simulation method for solving this project; you may use Excel, MATLAB, a computer program or other methods of your choosing.

**PROBLEM STATEMENT**

- 1) Assume that all resistors in the circuit shown to the right are specified as  $\pm 5\%$  tolerance. Calculate worst-case values (minimum and maximum) for the equivalent network resistance,  $R_{EQ}$ , and for the indicated voltage,  $V_3$  (voltage across  $R_3$ ). What is the percent variation for  $R_{EQ}$  and  $V_3$ ?



Each of the remaining parts of this problem considers a different probability distribution for the variation in the resistor values in this circuit.

- 2) Assume that all resistors are selected randomly from manufactured populations that are distributed uniformly between 5% below and 5% above the specified nominal values.
- 3) Assume that all resistors are selected randomly from manufactured populations that are distributed normally, with  $\pm 3\sigma$  corresponding to  $\pm 5\%$  of the specified nominal value.
- 4) Assume that all resistors are selected randomly from manufactured populations as described in step 3, except that the population has been “binned” to remove all resistors within  $\pm 1\%$  of the specified nominal value.

**Resistor Values:**

R1	3 k $\Omega$
R2	6 k $\Omega$
R3	2 k $\Omega$

Prepare one report for your group. At the top of the first page, list all of your names and your lab section. For part 1, show your equations/calculations. For each of parts 2 – 4, do the following:

- Describe your simulation method(s) and/or algorithms in sufficient detail to demonstrate the reasonableness of your approach. How did you determine an appropriate sample size (number of simulations) for each part?
- Include a table listing only the first 10 simulated random values for R1, R2, and R3, along with the corresponding computed values of  $R_{EQ}$  and  $V_3$ .
- Include a table listing the average, minimum, maximum, and standard deviation of the simulated values for the R1, R2, R3,  $R_{EQ}$  and  $V_3$ .
- Plot probability distribution functions (histograms) for R1, R2, R3,  $R_{EQ}$  and  $V_3$ . Choose ranges for the x and y axes such that the plots clearly demonstrate the effects of the different probability distributions.