# ELEN 50L: Project 1 Deliverables

- Hard copy calculations showing how you derived the equations to solve the circuit, Rth, and Vth. This also includes the matrices.
- Hard copies using MATLAB Publish in Word Document format showing the run-time results.
    - Your MATLAB solution will show the calculation results and run-time results for the items outlined below, except for:
        - **Problem 1**: Explain the conditions for which P9 is maximal
        - **Problem 2**: Perform an analysis and show that the P9 plot is maximal at the conditions identified in Problem 1
        - **Problem 3**: Explain how R9_best is selected
        - **Problem 4**: Perform an analysis and show that the P9_meas plot is maximal at the conditions identified in Problem 1
        - **Problem 4**: Explain how R9_best_measured is selected
- Hard copy of the Excel file containing your measured data.
    - Your MATLAB solution will show this imported at run-time and the subsequent calculations and plots.
- E-mail a compressed soft copy of your Project #1 file set which includes:
    - Excel file containing measurements
    - Matlab .m script file and support functions (makedatatip and importfile) to your TA for reference.
        - Used to validate your calculations and lab experiment
- Neatness will be a factor in grading the final project reports

## Measurements

- Pick 9 resistors between 500 and 2000 ohms and measure them. Record their values. Assign them identifiers R1, R2, R3, R4, R5, R6, R7, R8, R10. The decade box will be used as the variable resistor for R9.
- Assemble the circuit in Fig. 1 in your project using the chosen resistors in Step 1 and measure the following:
    a. Voltage source, Vg
    b. $V_{th}$ and $R_{th}$, and calculate $P9_{max}$
    c. While varying the decade box (R9), measure V1, V2, V3, V9, V10. The R9 range of values can be found in the **Excel template** which is provided to you. You must use the Excel template to record your measured values as noted in this step. Do not put the values from step a & b into the Excel file or it will cause problems when importing the Excel sheet into MATLAB.

## MATLAB – 2 Parts

- Simulation = Part 1 – using the **ideal (nominal)** resistor values (from the resistor color bands), and the **ideal** source voltage (12V)
    - Compute Rth, Vth, and the maximal power through R9 using Vth and Rth.
    - Solve the circuit in Fig. 1 as noted in the project.
    - Compute and plot: $P_9$(R9), $P_{10}$(R9), the ratio $P_9$(R9)/ $P_{10}$(R9), and η(R9), where $\eta = \frac{P9+P10}{Pg}$. The R9 axis is plotted on a semilog scale. You can use "semilogx()" in MATLAB.
    - From the above plots choose one R9 value that maximizes the efficiency η(R9), while also satisfying the condition $0.7 \le P9/P10 \le 1.3$

- Lab Measurements = Part 2 – using your **measured** resistor values and voltages
    - Compute and plot the measured $P_9$(R9), $P_{10}$(R9), the ratio $P_9$(R9)/ $P_{10}$(R9), and η(R9), where $\eta = \frac{P9+P10}{Pg}$

- From the above measured value plots choose one R9 value that maximizes the efficiency $\eta(R9)$, while also satisfying the condition $0.7 \leq P9/P10 \leq 1.3$

- Find the % difference between the following theoretical and experimental quantities: $V_{th}$, $R_{th}$, and your best estimate for the $R_9$ point.