

Announcements:

1. Next quiz will be due on Monday next week
2. Next HW will be due on Wednesday next week
3. Graded midterms are being scanned today;
available for pickup Wednesday from TAs

EECS 70A: Network Analysis

Lecture 7

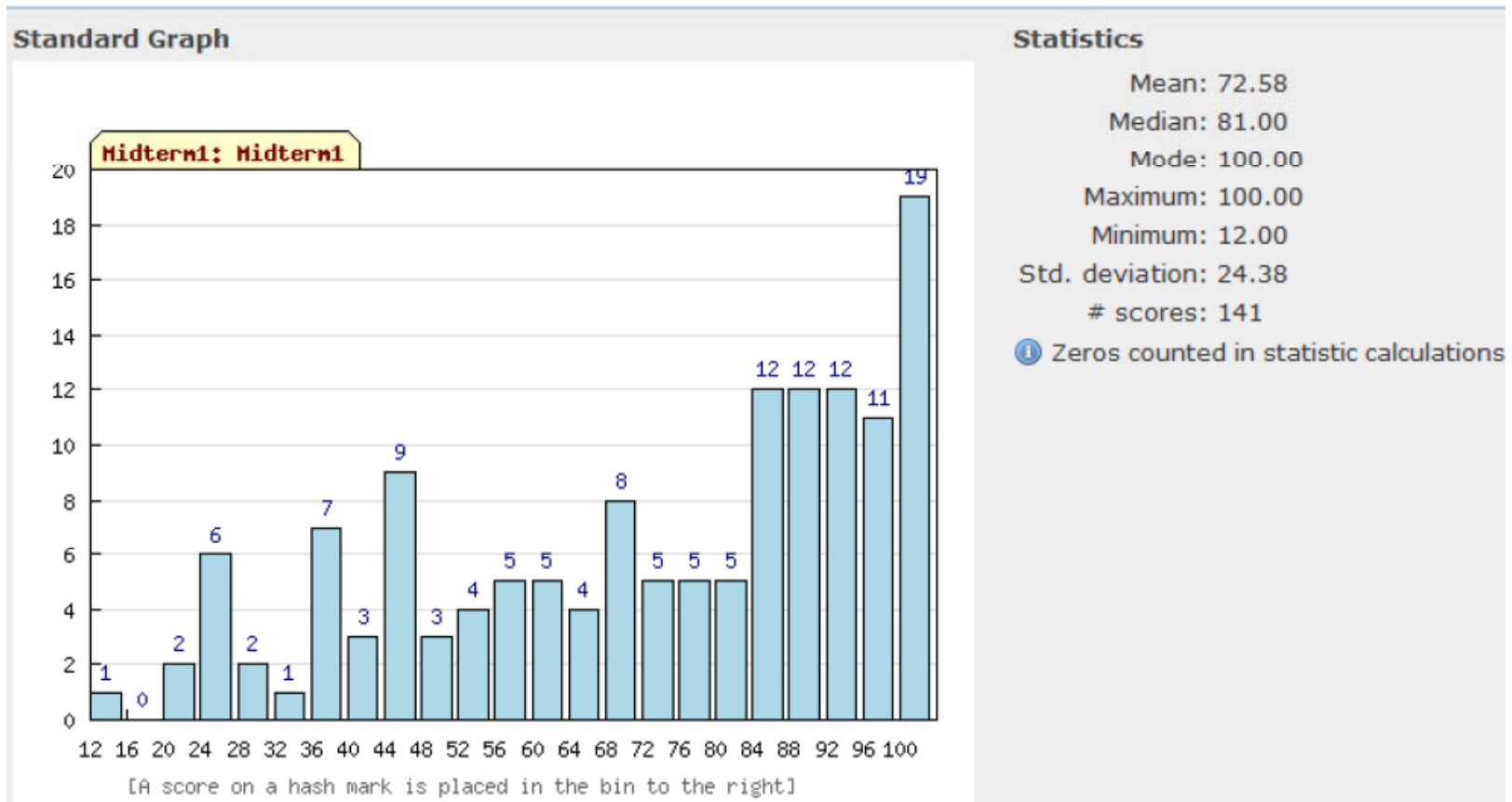
Today's Agenda

- TLTC Midterm Student Feedback Survey
- Midterm 1 results
- Review of Nodal Analysis
- Review of Mesh Analysis
- Example problems using both techniques
- Thevinin/Norton theorem

TLTC Midterm Feedback Survey

- The good:
 - Recorded lectures
 - online notes/tablet pc
- To improve:
 - Need more complex examples in class
- To drop:
 - Demos

Midterm results



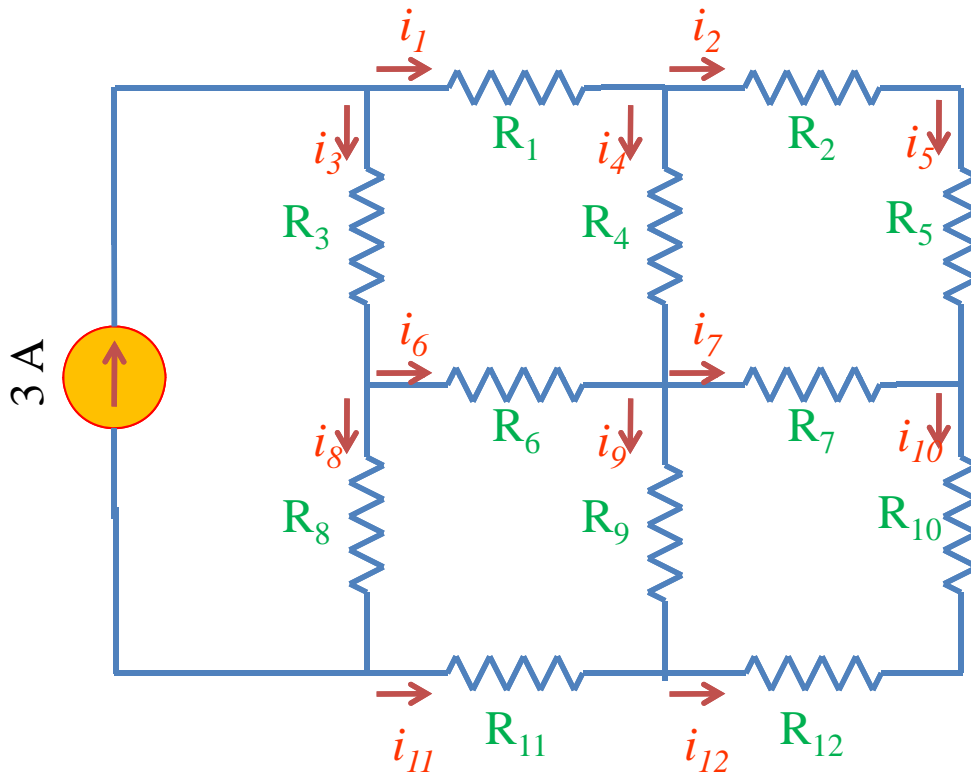
Detailed solutions posted online. Please make sure you understand them!

Nodal analysis summary

1. Define reference node
2. Label remaining nodes (e.g. V_1, V_2, V_3, \dots)
3. Apply KCL + Ohm's law
4. Solve for nodal voltages (e.g. using Kramer's rule)
5. Solve for currents

Nodal analysis example

1. Define a reference node.
2. Label remaining nodes.
3. Apply KCL + ohm.



Typical notation:

i_1 is current through R_1 . (Same as before)

V_1 is voltage of node 1 relative to reference node. (Different from before)

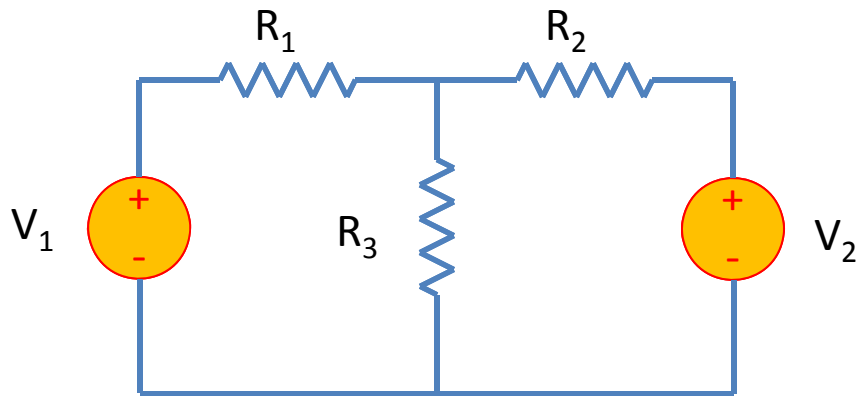
We will do this entire problem in class...

Using these techniques, you can attempt the "monster problem" as extra credit on HW3...

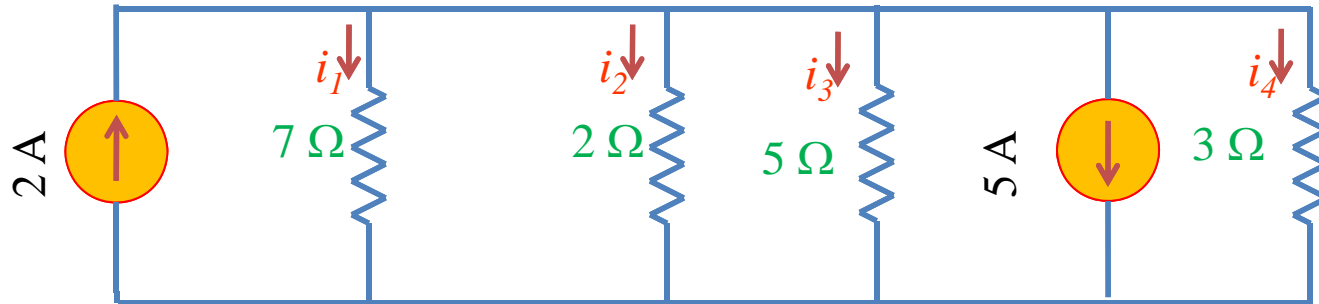
Mesh analysis summary

1. Assign mesh currents i_1, i_2, \dots, i_n
2. Apply KVL to each mesh
3. Solve for mesh currents (e.g. using Kramer's rule)
4. Then solve for voltages

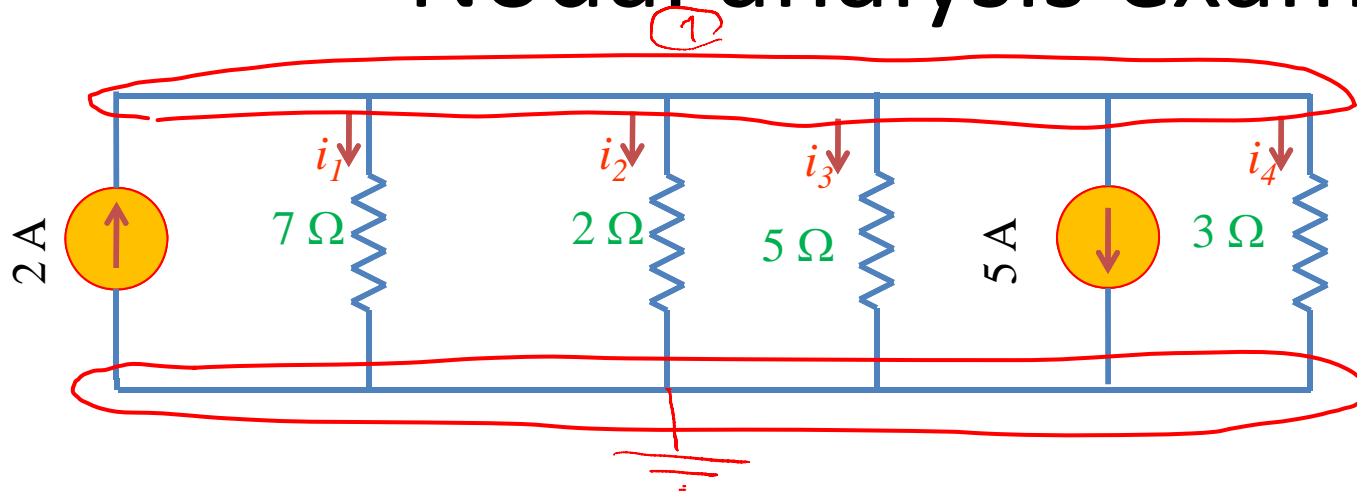
Assigning mesh currents



Nodal vs. mesh analysis?



Nodal analysis example



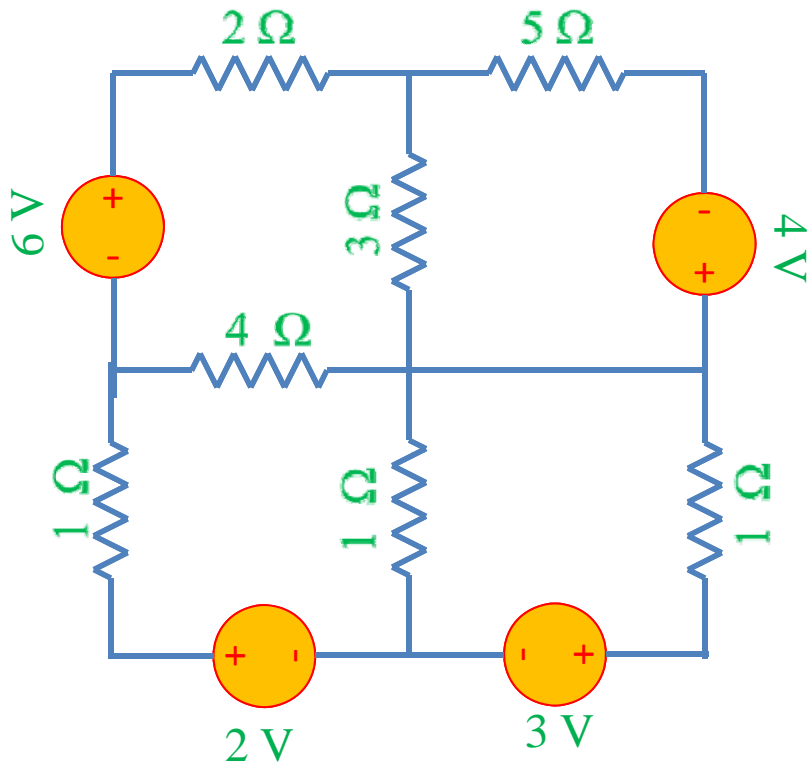
$$\text{KCL} : i_1 + i_2 + i_3 + i_4 + 5\text{A} - 2\text{A} = 0$$

$$\frac{V_1}{7} + \frac{V_1}{2} + \frac{V_1}{5} + \frac{V_1}{3} + 5 - 2 = 0$$

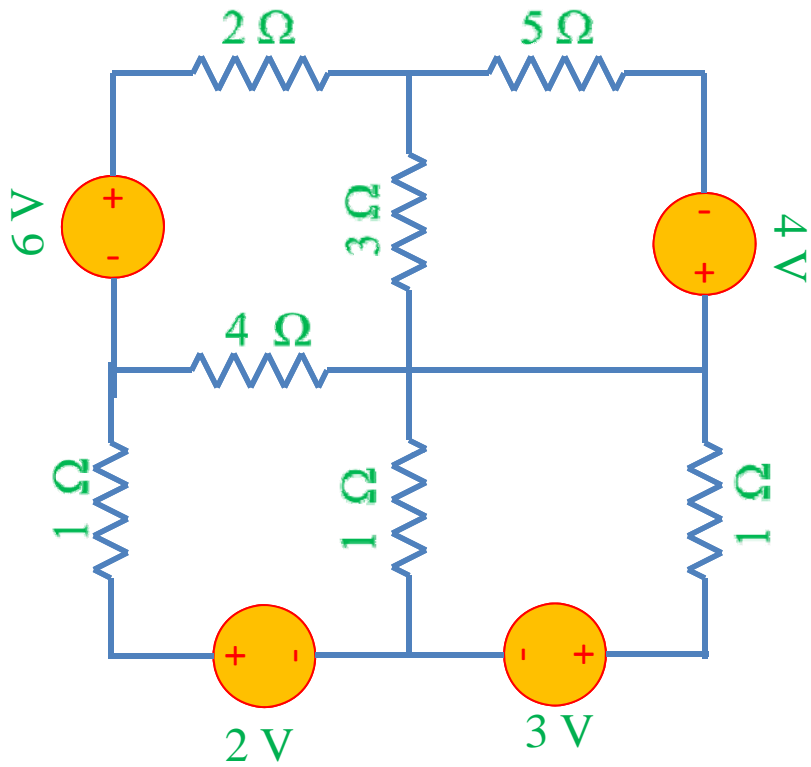
$$V_1 \left(\frac{1}{7} + \frac{1}{2} + \frac{1}{5} + \frac{1}{3} \right) = -3$$

$$V_1 = -2.5\text{V}$$

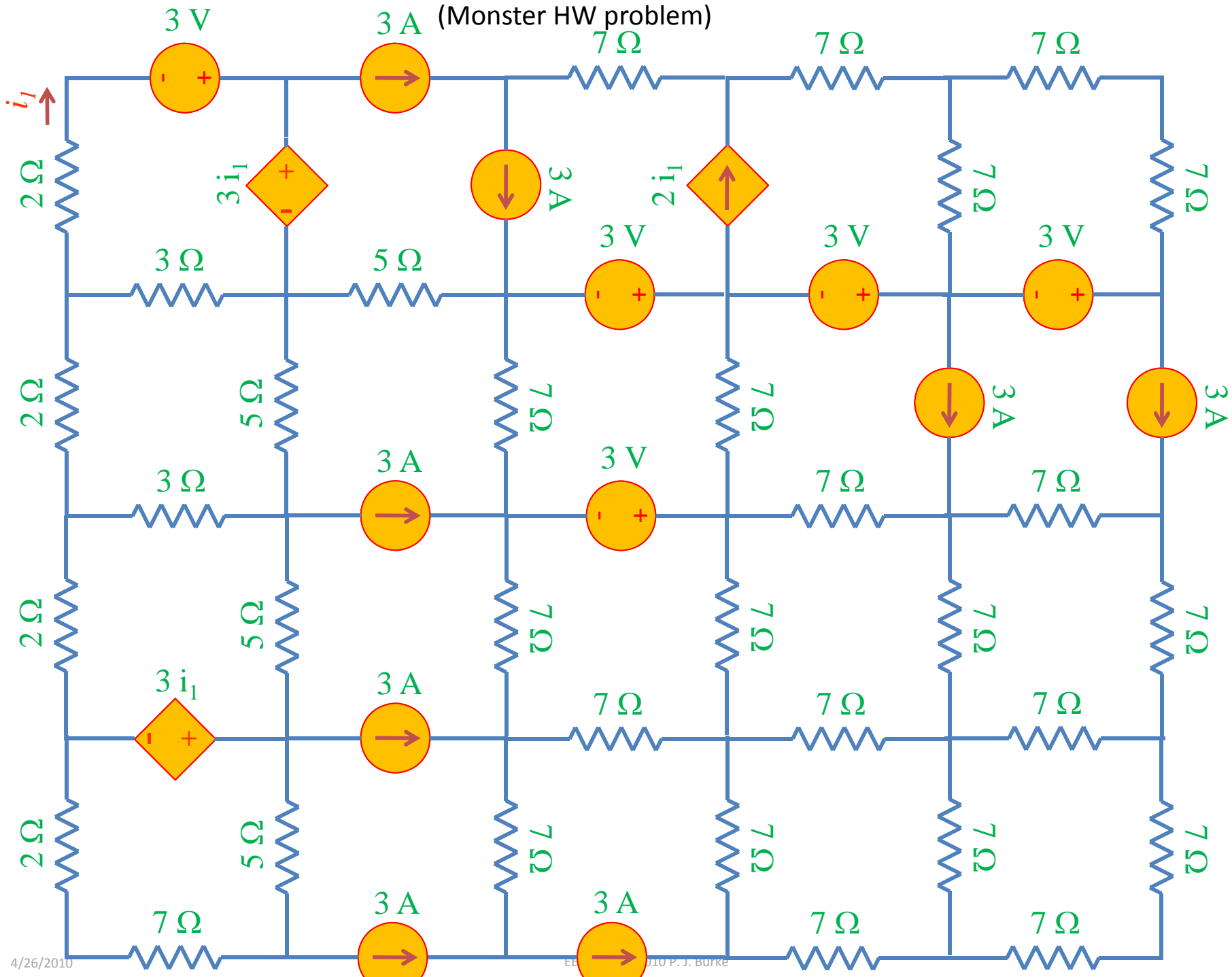
Nodal vs. Mesh Analysis

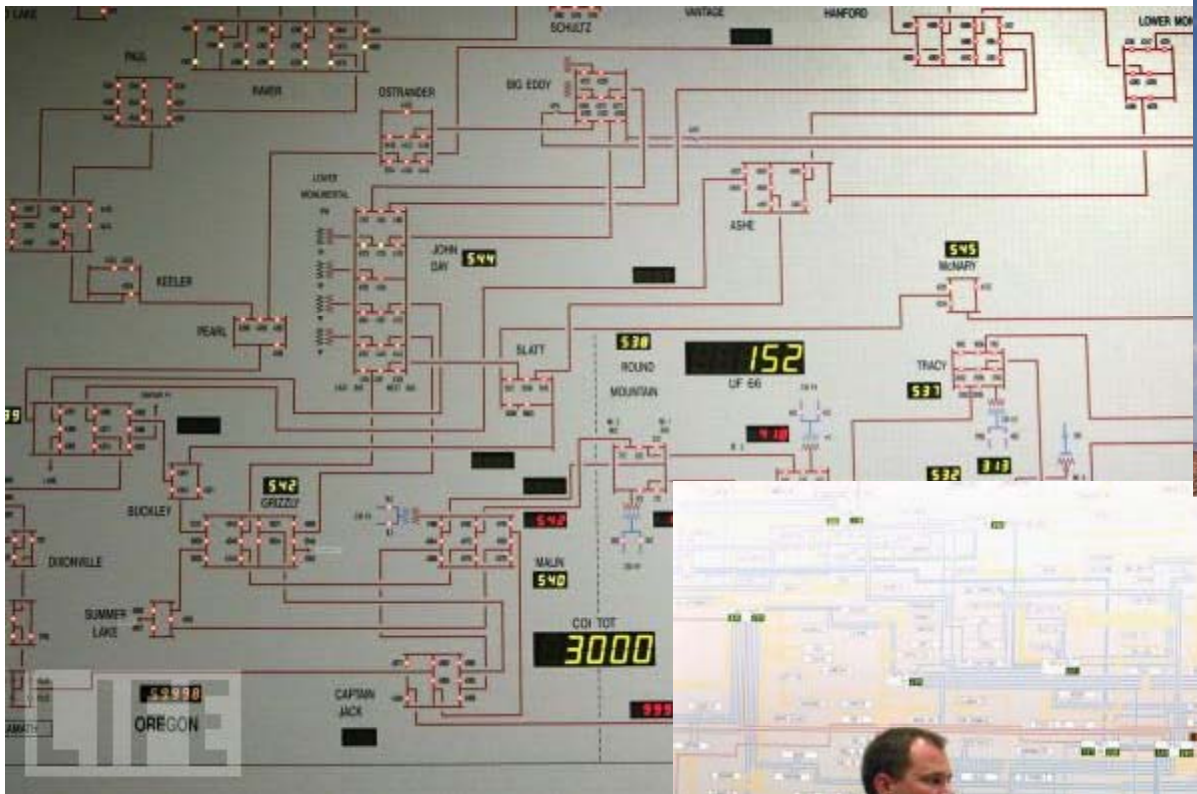


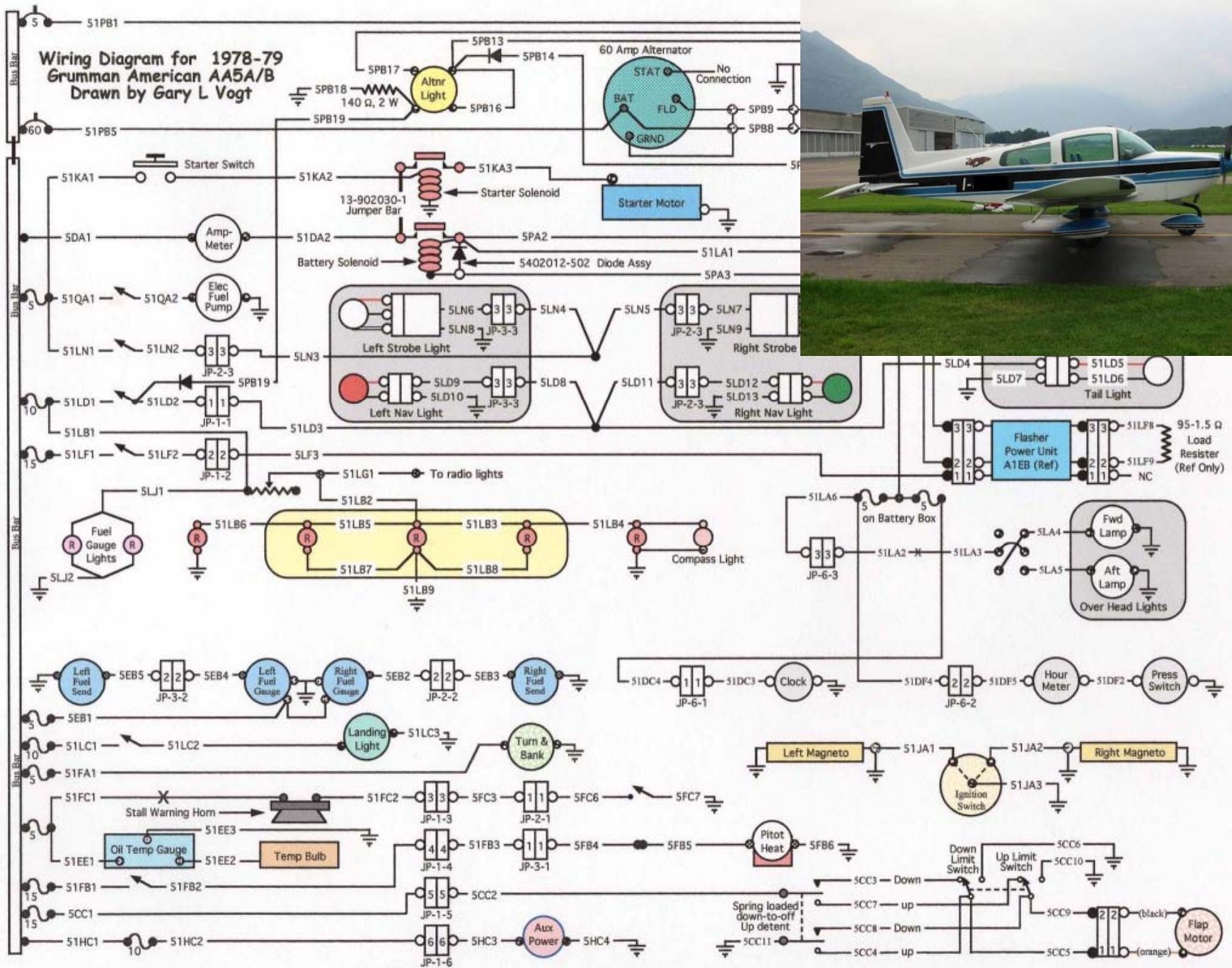
Nodal vs. Mesh Analysis

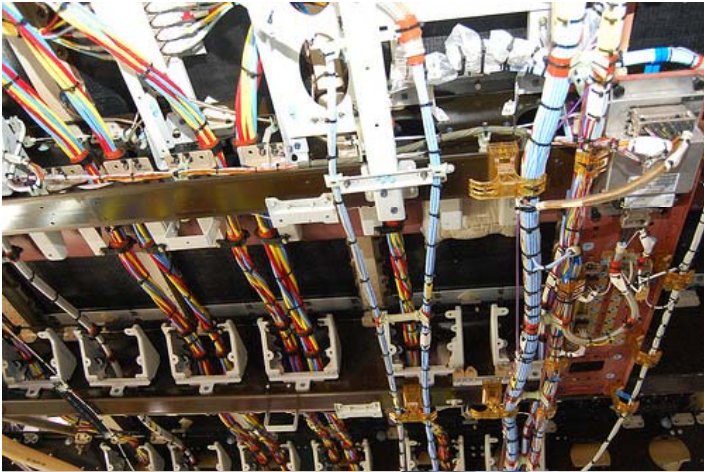


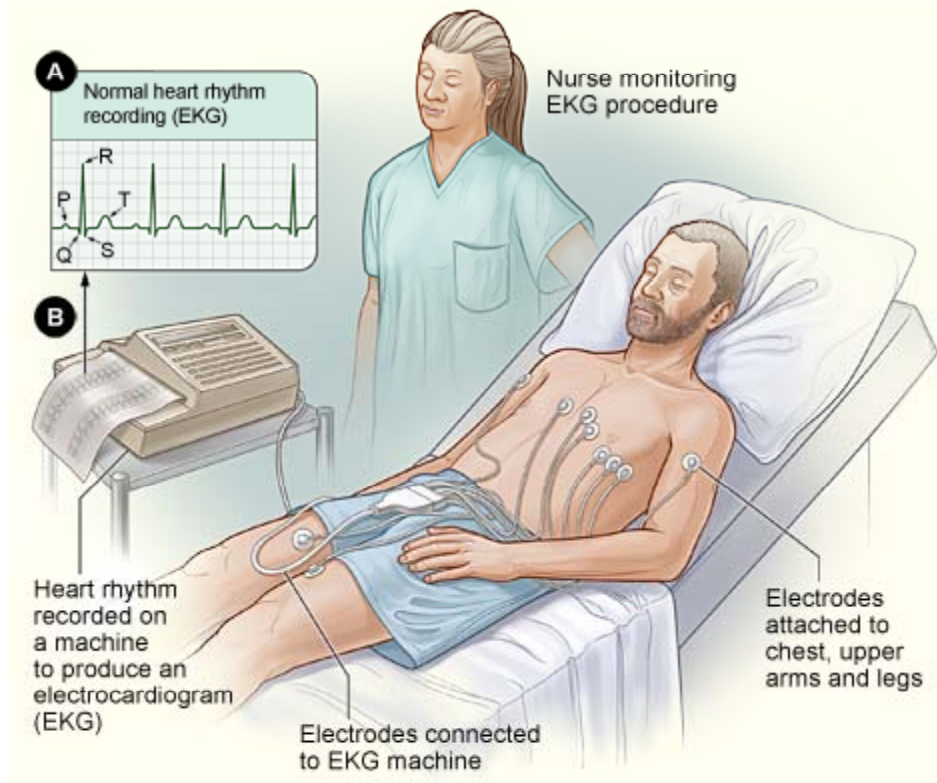
3 A (Monster HW problem)

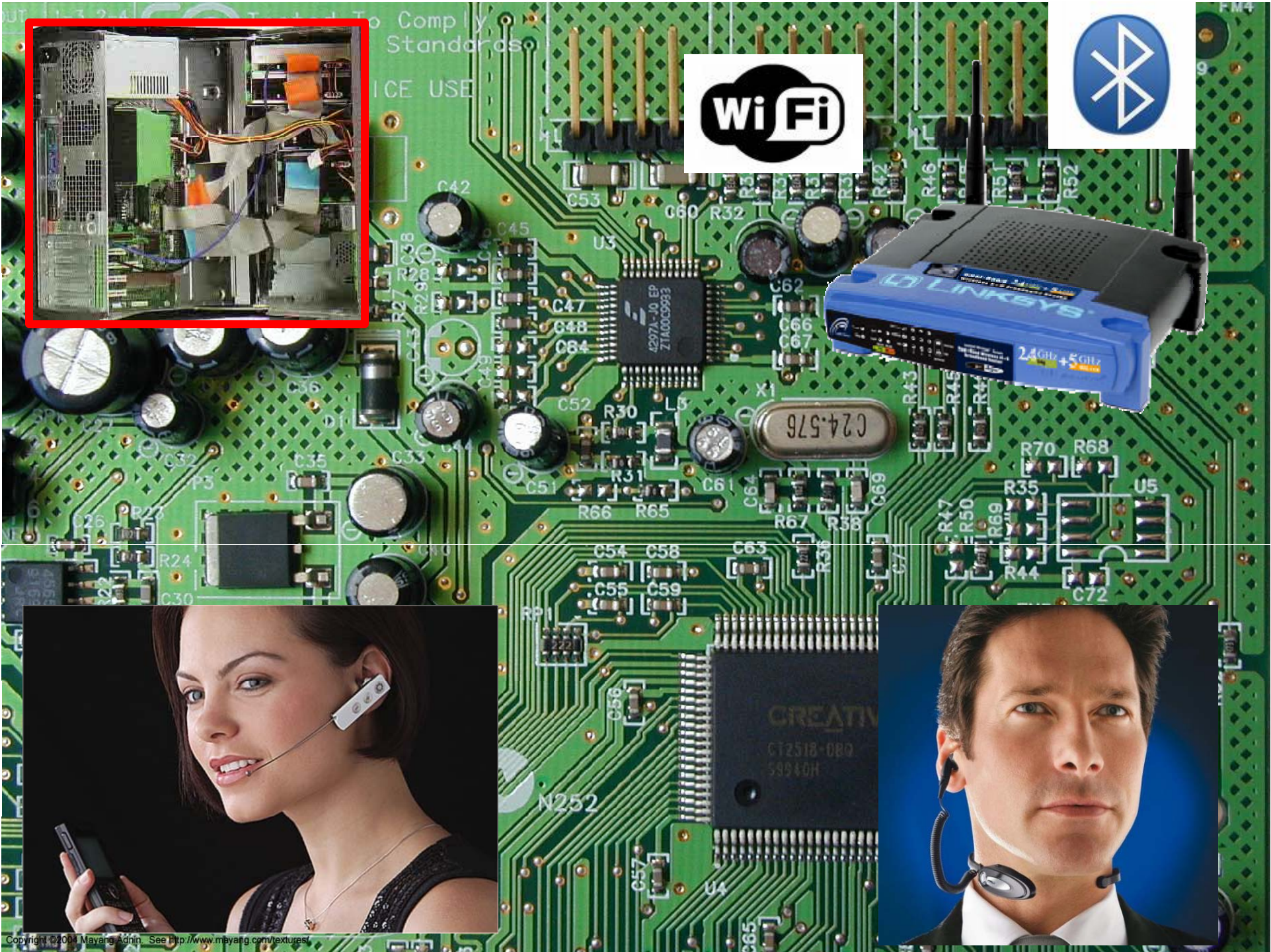










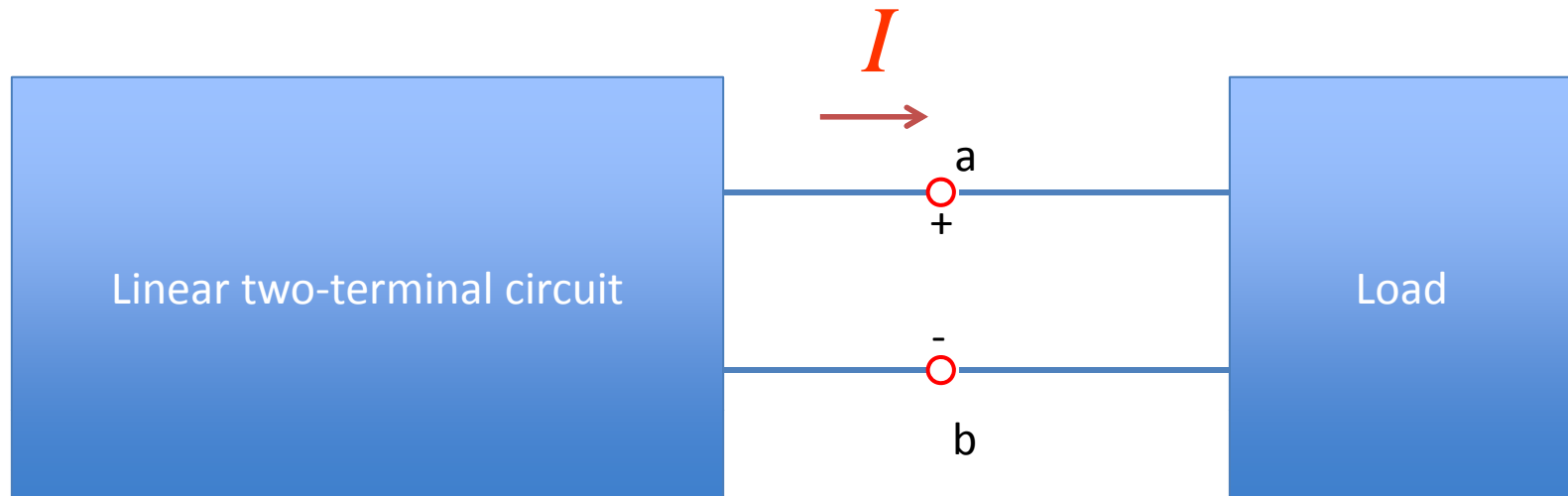


Compartmentalization: Need for simplicity

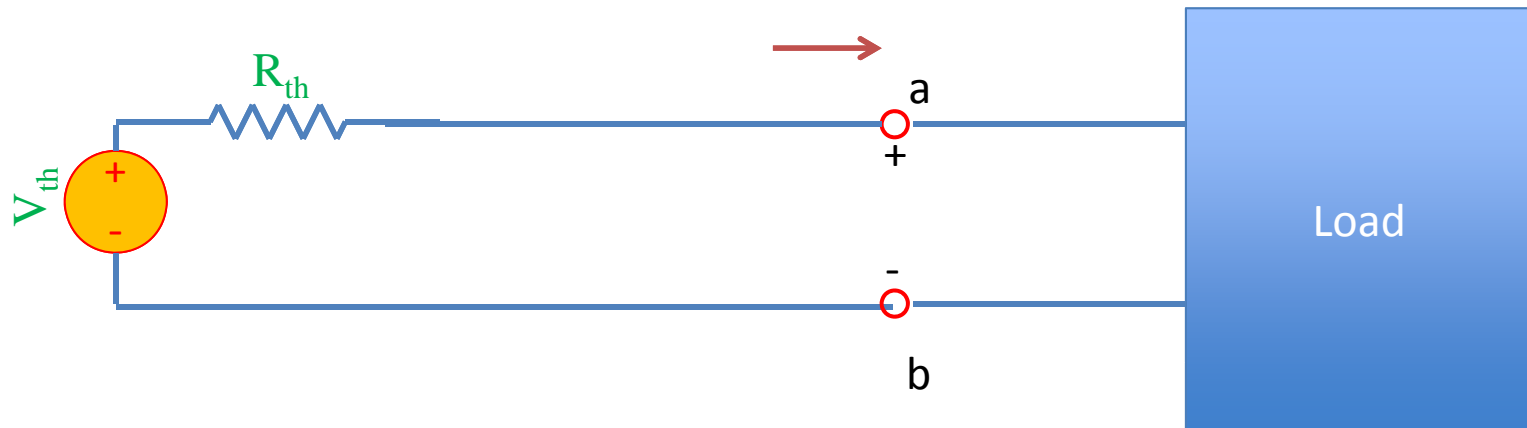


Power brick image.
And ask class to show their own...
Demo: Computer?

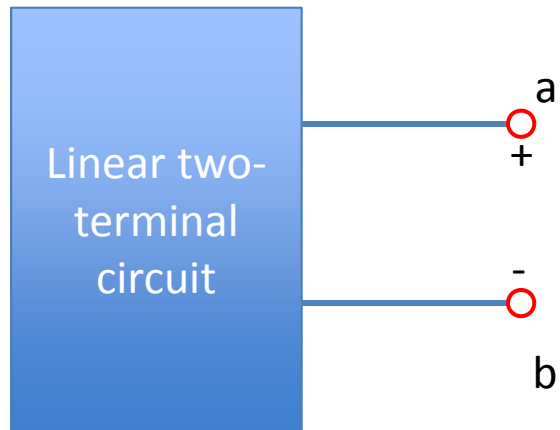
Thevenin's Theorem



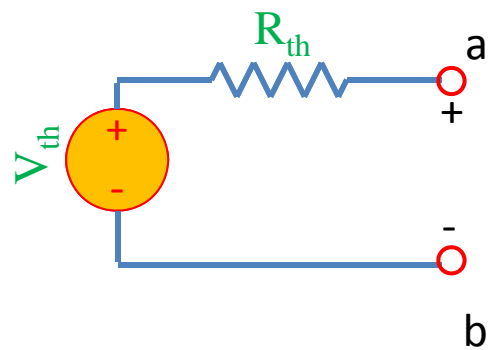
Equivalent to:



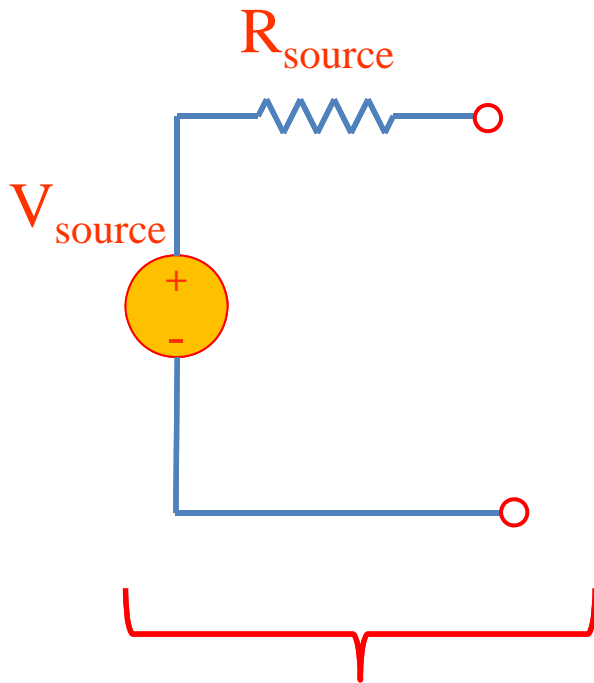
Finding V_{th} , R_{th}



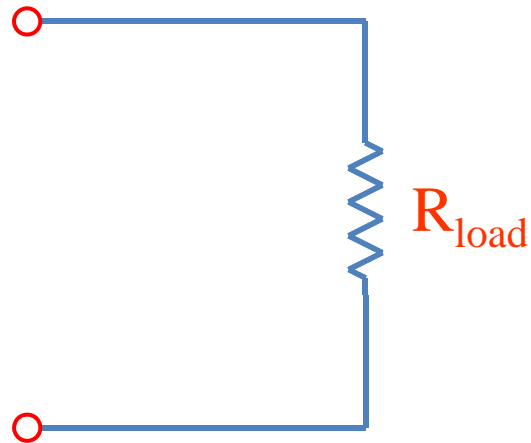
Equivalent to:



Source/load



Thevenin Thm:
Any circuit can be
represented by this
equivalent circuit.



$$V_{load} = \frac{R_{load}}{R_{load} + R_{source}} V_{source}$$

Derivation:

Case 1:

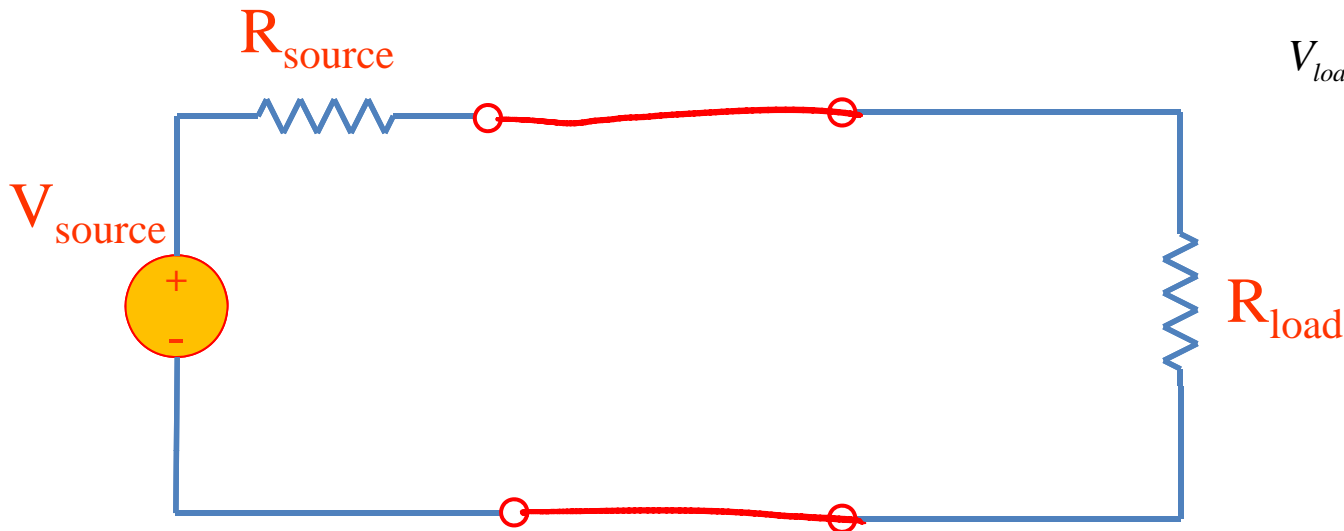
$$R_{load} \gg R_{source}$$

Case 2:

$$R_{source} \gg R_{load}$$

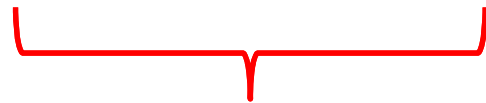
We say R_{load} "loads down" the source.

Source/load



$$V_{load} = \frac{R_{load}}{R_{load} + R_{source}} V_{source}$$

Derivation:



Thevenin Thm:
Any circuit can be represented by this equivalent circuit.

Case 1:

$$R_{load} \gg R_{source}$$

$$\Rightarrow V_{load} \approx V_{source}$$

Case 2:

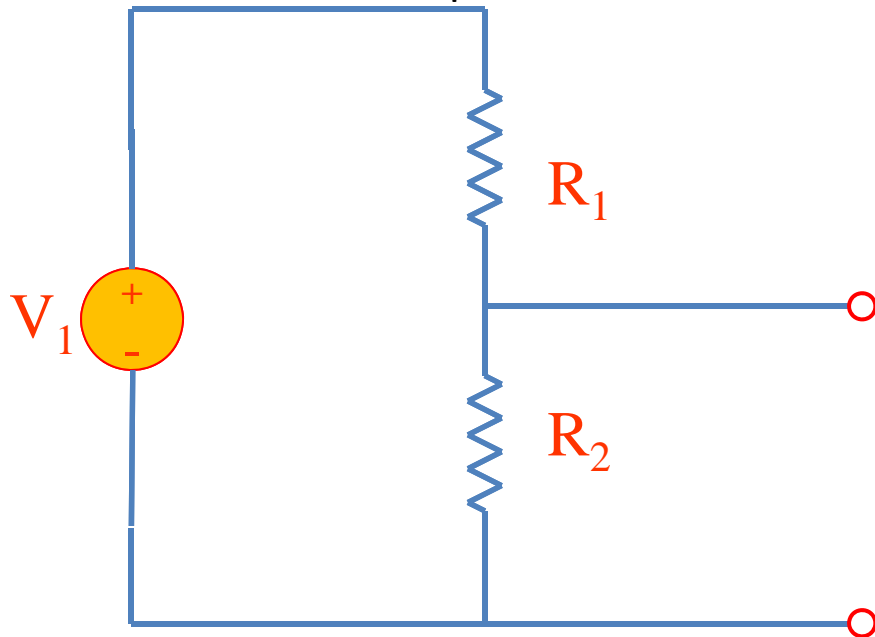
$$R_{source} \gg R_{load}$$

$$V_{load} \rightarrow 0$$
$$\approx \frac{R_{load}}{R_{source}} V_{source}$$

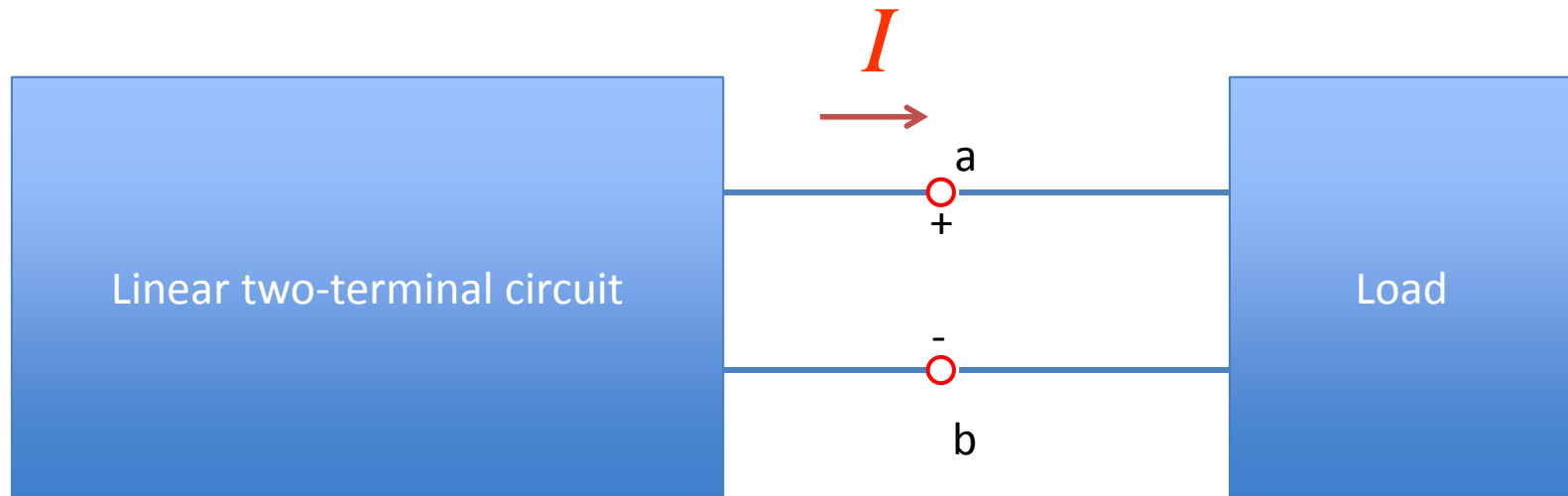
We say R_{load} "loads down" the source.

Example

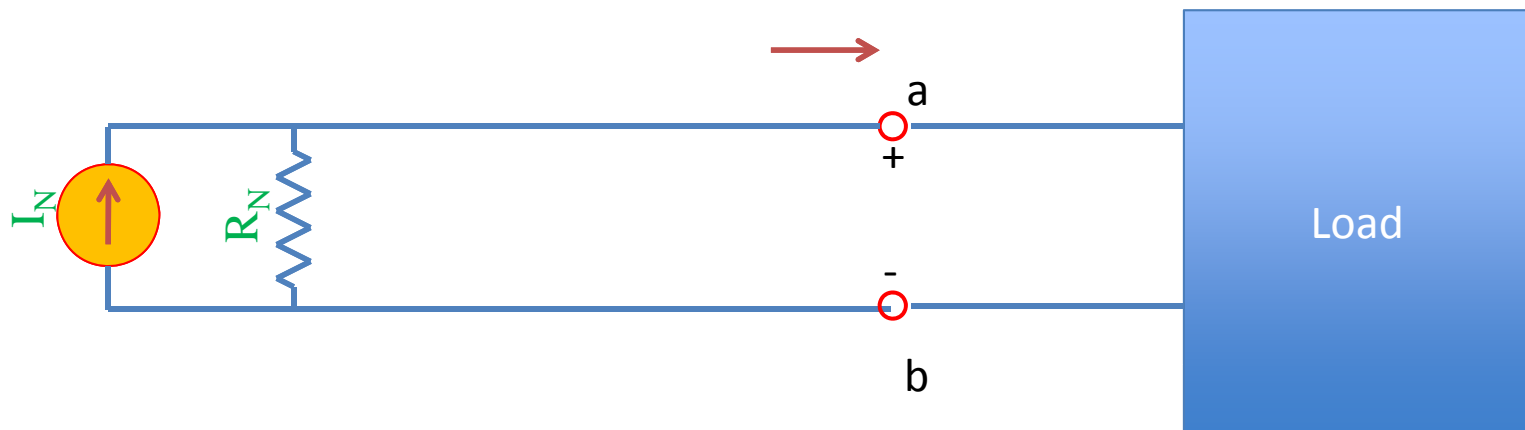
Find Thevenin equivalent circuit:



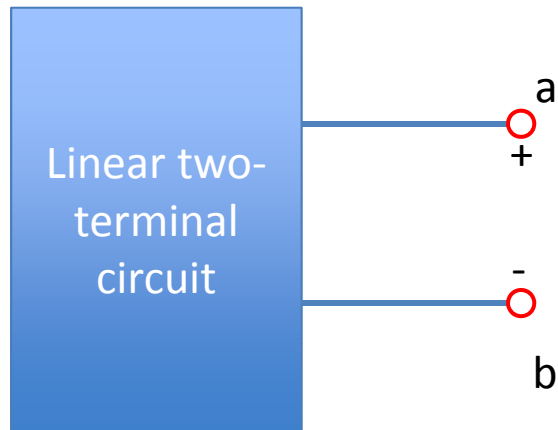
Norton's Theorem



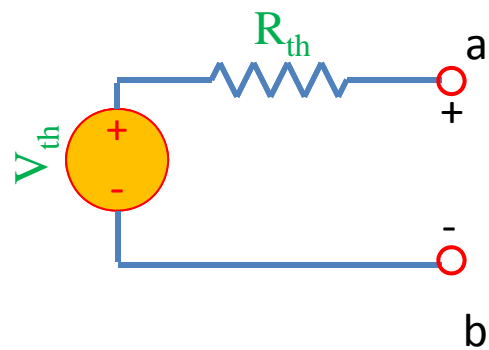
Equivalent to:



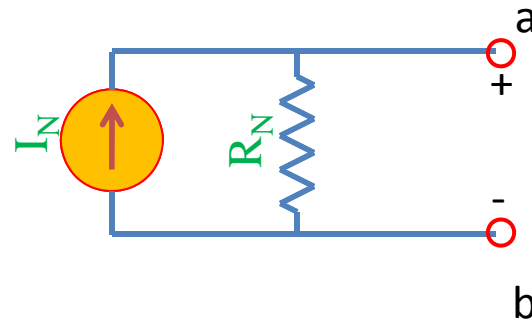
Finding V_{th} , R_{th}



Equivalent to:

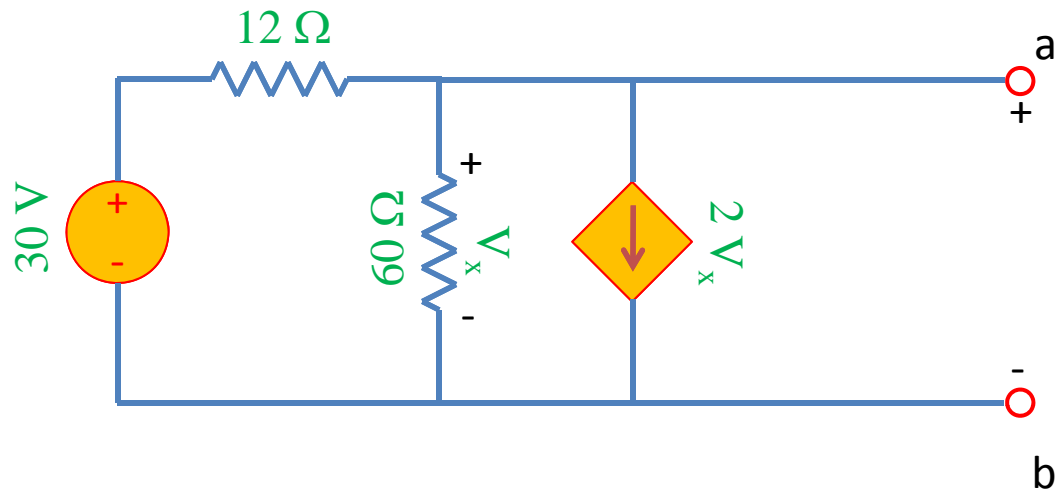


Equivalent to:

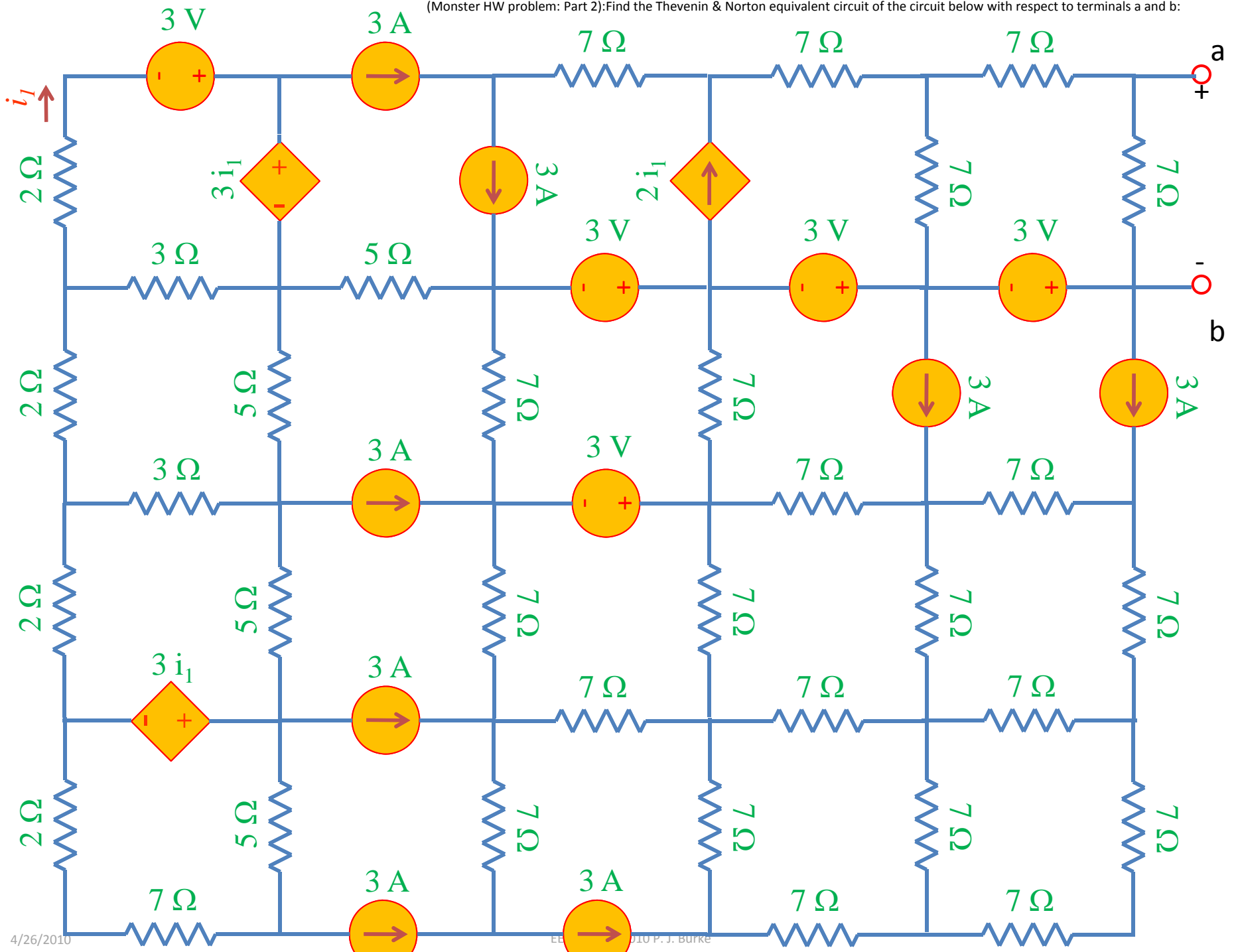


Example

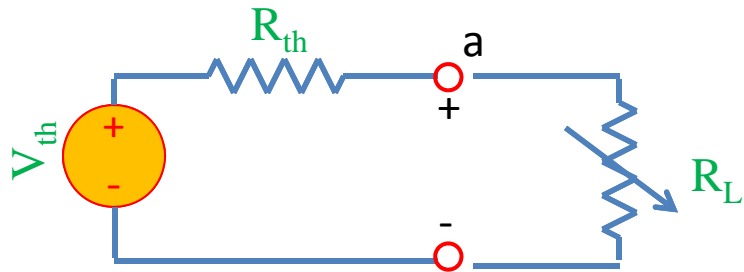
Find the Thevenin & Norton equivalent circuit of the circuit below with respect to terminals a and b:



(Monster HW problem: Part 2): Find the Thevenin & Norton equivalent circuit of the circuit below with respect to terminals a and b:



Power

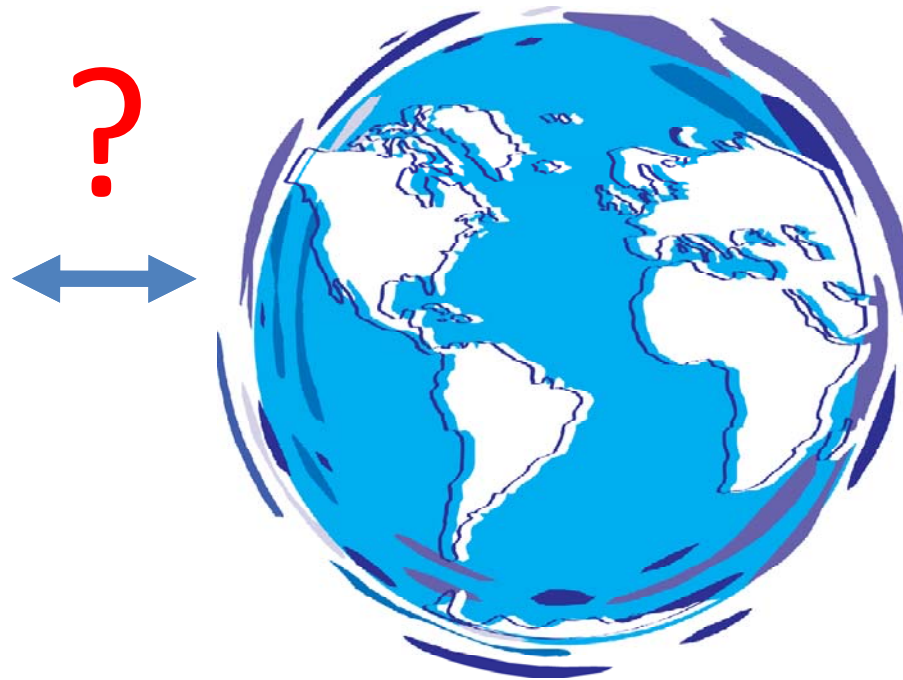


Arrow means R_L variable (e.g. by a knob)

Power delivered to load = ?

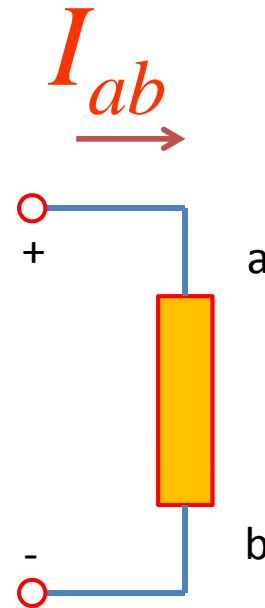
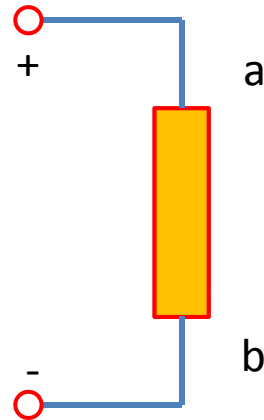
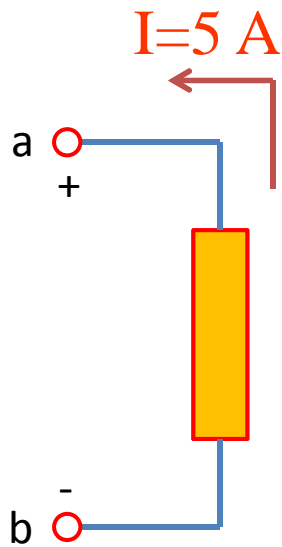
Questions?

Ground?

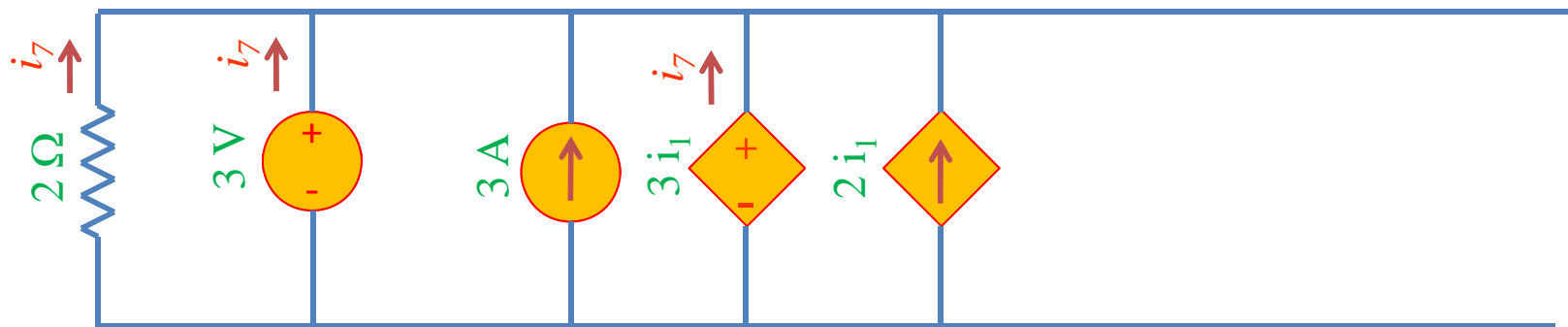
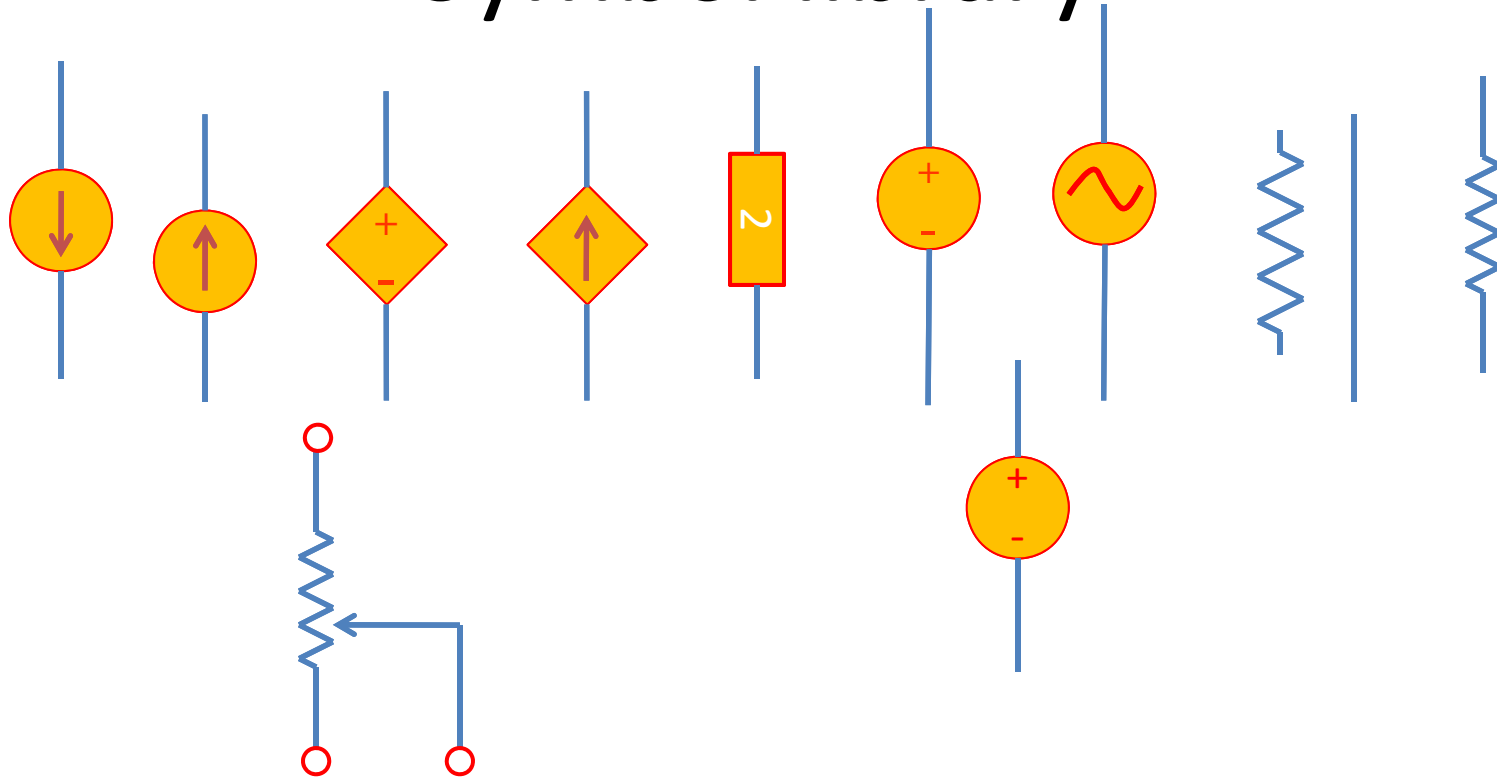


Ground
Reference
Earth

Symbol library



Symbol library



Symbol & circuit library

