Administrivia

- Waiting list
- Fixed grading scale error in lecture 1 and course policies handout
- HW 1 has been assigned. Due Wednesday, July 2nd 2003 @ 12:10 PM in lecture.
- Will be posted online by Friday, 06/27:
  - TA office hours/location
  - Webpage updates
    - Under newsgroup: getting a UNIX account and HOW-TO access the newsgroup
    - Location of computers (Windows and UNIX) in Cory Hall

Last Time...

- Intro. to Electrical Engineering
- Circuit variables: Voltage, Current, Power and Energy
- The Ideal Basic Circuit Element
- **Do you have questions on any of these concepts?**

This Time...

- Some Terminology (thanks to Sheila Ross' notes)
- Dependent Sources
- Ohm's Law
- Open circuits and short circuits
- Intro. to I-V graphs
- Kirchoff's Laws
- Analysis of a circuit with a dependent source

This Time (contd)...

- Series and Parallel Circuits

Some Terminology

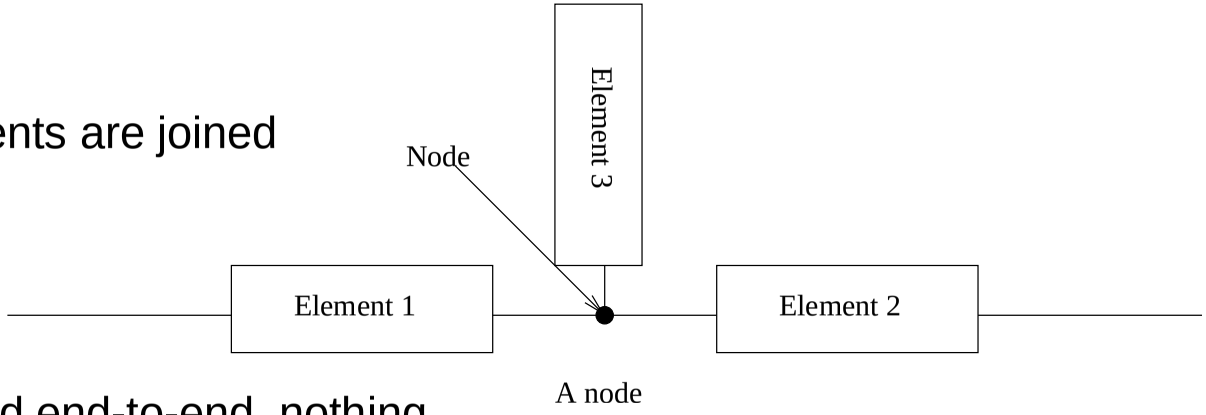
1. Active elements
2. Passive elements
3. Node
4. Branch

Some Terminology

- Active element - is an ideal basic circuit element
  that models a device capable of generating/amplifying electrical energy.
  - Example: voltage sources
- Passive element - is an ideal basic circuit element
  that models a device which cannot generate/amplify electrical energy.
  - Example: resistor

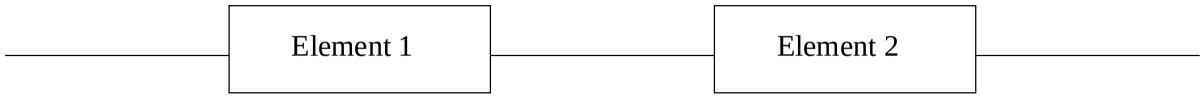
Some Terminology (thanks to Sheila's notes)

- Node - A place where elements are joined
  - Example:



A node

- Branch - elements connected end-to-end, nothing coming off in between
  - Example:



A single branch

Dependent Sources

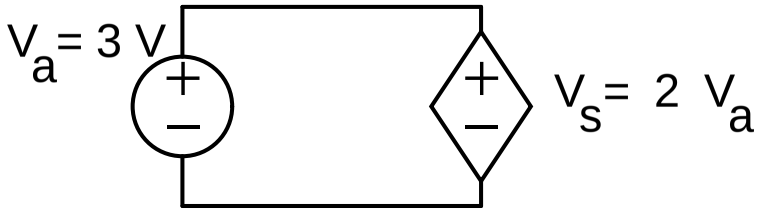
- Four types
  1. Voltage Controlled Voltage Source
  2. Voltage Controlled Current Source
  3. Current Controlled Voltage Source
  4. Current Controlled Current Source

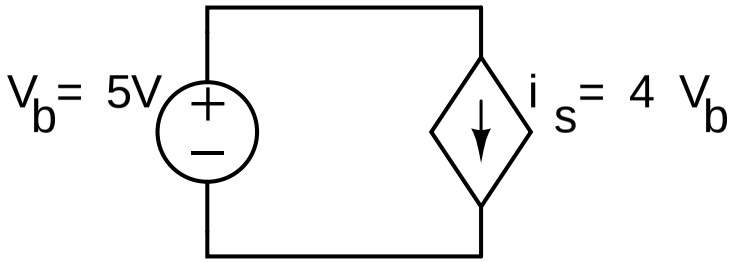
Dependent Sources

- Symbols:

Dependent Sources

- Examples: Are the circuits below valid?





Dependent Sources

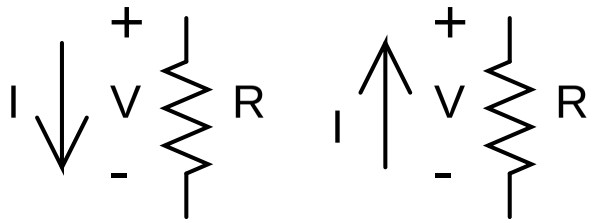
- Solution:

Ohm's Law

- Resistance is the capacity of materials to impede the flow of current
- What causes resistance?
  - Answer:
- Unit of resistance: Ohm. Named after Georg Simon Ohm
- Symbol: Ω
- Another unit: Conductance, reciprocal of resistance.
- Symbol: Siemens (S), mho (ohm spelled backward, $\mho$)

Ohm's Law

- Resistor symbol and IV relationship



  - V = voltage (in volts)
  - I = current (in amps)
  - R = resistance (in Ωs)

Ohm's Law

- Power at the terminals of a resistor:

Open circuits and short circuits

- Open circuit
  - Symbol:
  - Mathematical model: R $\rightarrow \infty$
  - Current through an open circuit is ____
    whereas the voltage across it is ____
- Short circuit
  - Symbol:
  - Mathematical model: R = 0
  - Current through a short circuit is ____
    whereas the voltage across it is ____

Intro. to I-V graphs

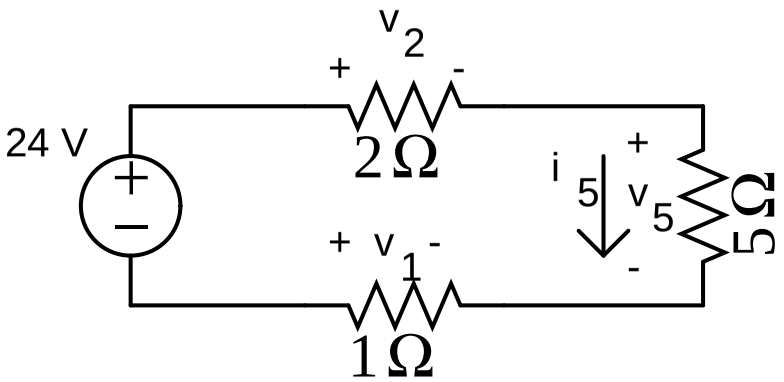
- I-V graphs: graphical method to solve circuits
- A circuit is solved when the voltage across and the current through every element has been determined
- I-V graph for a 5 Ω resistor:

Intro. to I-V graphs

- Solution:

Kirchoff's Laws

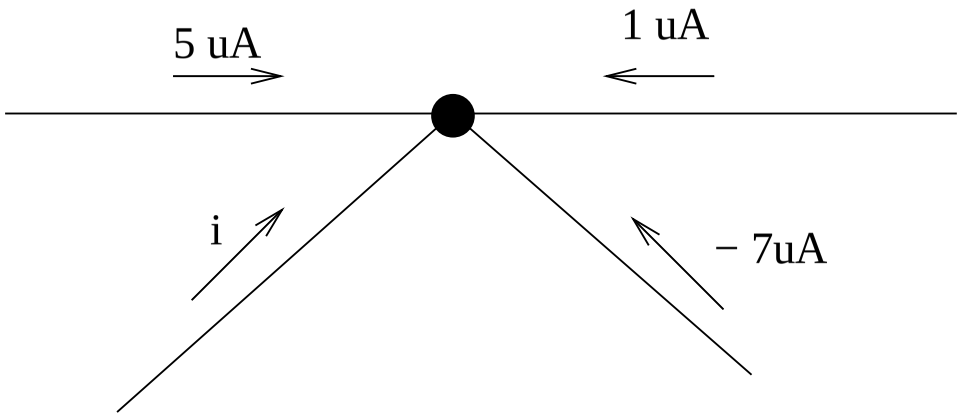
- Recap: we now understand how to work with voltage sources, current sources and resistors.
- Not enough to solve circuits. For example, solve the circuit below (drill exercise 2.2, p. 37):



Kirchoff's Laws

- Before we can solve the circuit, we need Kirchoff's laws.
- Kirchoff's Current Law (KCL) statement:
  - **The algebraic sum of all the currents at any node in a circuit equals zero**
  - Hence to apply KCL, just assign an algebraic sign (+ or -) to every current at the node. That is:
    1. If currents leaving the node are positive, then currents entering are negative
    2. If currents leaving the node are negative, then currents entering are positive
- Let us look at a simple example

Kirchoff's Laws

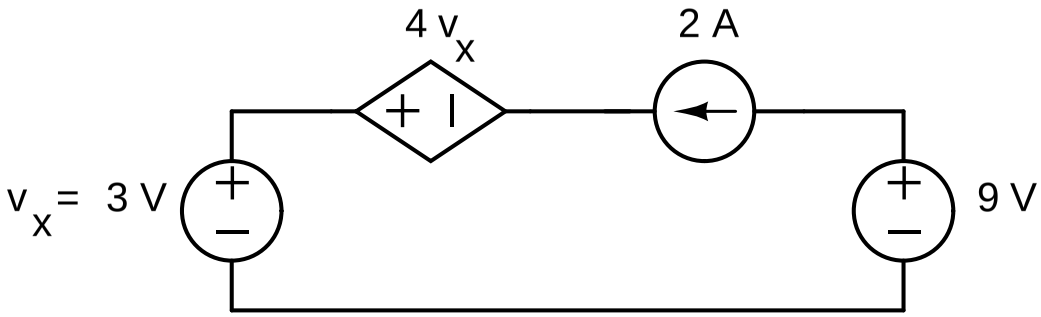


- Find i
- Solution:

Kirchoff's Laws

- Kirchoff's Voltage Law (KVL) statement:
  - **The algebraic sum of all the voltages around any loop equals zero.**
  - To apply KVL:
    1. Assign an algebraic sign to every voltage in the loop
    2. Trace a closed path around the loop, and sum each voltage as you "hit the sign".
- Lets look at a simple example.

Kirchoff's Laws

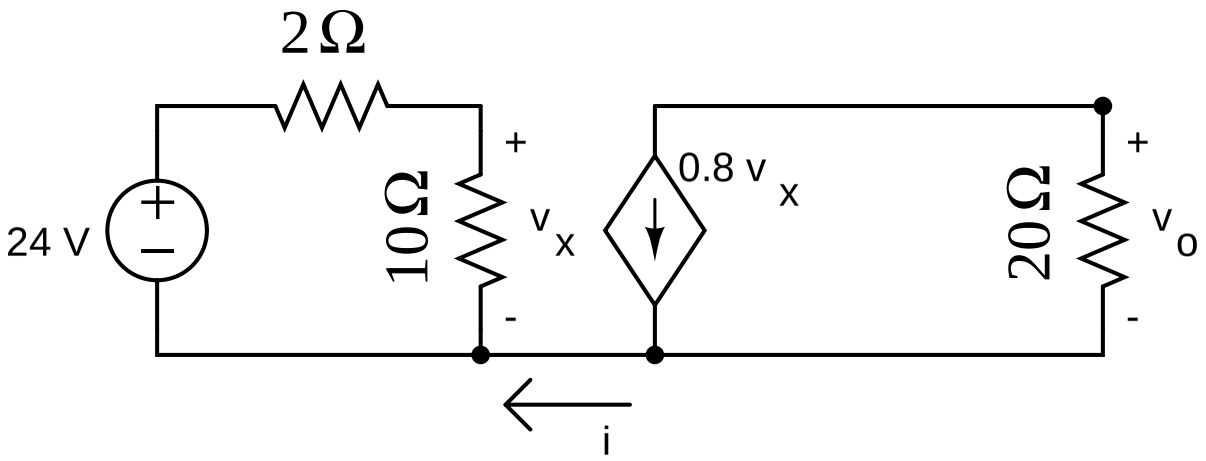


- Find the voltage drop across the current source.
- Solution:

Kirchoff's Laws

- Now we can attack drill problem 2.2.
- Solution :

Analysis of a circuit with a dependent source



- Lets put it all together and find v_0 and i in the circuit above.

Analysis of a circuit with a dependent source

- Solution

Before we go on...

- How do you become good with circuits?
  - Answer:

Series and Parallel Circuits

- Series circuits
  - Definition: When just two elements are connected at a single node, they are said to be series.
  - **Series-connected circuit elements have the same current through them**
  - Concept of series-equivalent resistance:

Series and parallel Circuits

- Parallel circuits
  - When two elements are connected at a single node pair, they are said to be in parallel
  - **Parallel-connected circuit elements have the the same voltage across them**
  - Concept of parallel-equivalent resistance:

Summary

- We added more tools to our circuit analysis toolbox:
  - Dependent sources
  - Resistors
  - KVL, KCL
  - Series and Parallel circuits

In Conclusion...

- Make sure you:
  - get the reader
  - get a keycard
  - activite your UNIX and Windows account.
  - take a look at the homework
  - practice them circuits!
- Next time: More circuit analysis tools
- Reading: Sections 4.1 - 4.8
- Labs 1 and 2 should help you understand KCL, KVL etc better
- Questions?