

BEE 233 circuits lab orientation  
Fall 2015  
*Tuesday section AA only*

Lab instructor

Nicole Hamilton

<http://faculty.washington.edu/kd1uj>

# Lab instructors

Dr. Hung Cao was originally scheduled but is stuck in Canada. He may take over mid-quarter. We are your temporary replacements.

**Tuesdays**          Nicole Hamilton

**Thursdays**        Harry Aintablian, Ph.D.

Dr. Aintablian will post his own rubric and orientation instructions for his section. My instructions only apply to my section.

# Section AA lab hours

Tuesdays 3:30 pm to 5:30 pm  
Discovery 264

Attendance is not required. You are free to do the labs on your own during open lab hours *but you will miss out on the briefings and our help probably not do as well.*



## Nicole Hamilton

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Office hours: MW 3:30 pm to 5:30 pm  
Beardslee 276 conference room

### Education

BS & MS EE, Stanford, 1973.

MBA, Boston University, 1987.

### Background

Most of it as an entrepreneur selling a C shell I wrote for Windows.

Also worked at IBM, Microsoft and RealNetworks.

At Microsoft, I wrote the ranker and query language for the first release of what's now Bing.

This is my third time teaching the 233 lab.


Hamilton C shell 2012

hamiltonlabs.com/Cshell.htm

Seattle PI WST WSJ NY Times Krugman FedEx BofA W Wikipedia MightyText 371 Entrepreneurship IP Lookup WSJ DJIA Download

## Hamilton Laboratories

### Hamilton C shell 2012



Hamilton C shell

User guide

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#### The ultimate C shell for Windows

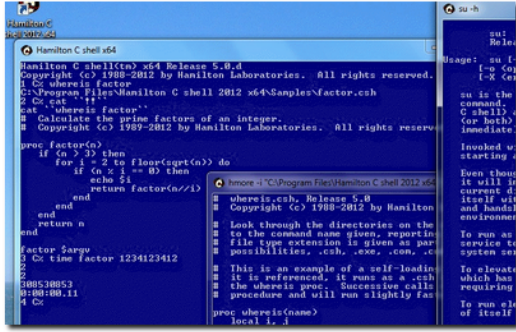
**Personal use license \$89** [Buy Now](#)

**Commercial license \$249** [Buy Now](#)

Hamilton C shell™ is a complete Unix shell environment for Windows, including all the important utilities, mv, cp, rm, more, grep, fgrep, head, tail, diff, sed, cron, tar and so on. There's even a real chown, a real su (super user) and a sudo alias to run a command elevated. And everything works under Windows 7 and 8.

**Everything in the original C shell, plus ...**

Hamilton C shell recreates everything in Bill Joy's brilliant Berkeley C shell, starting with a language that's prettier and more like C than anything based on the older Bourne shell syntax. We've also recreated all the original C shell's interactive features that made it so delightful, including history and command and filename completion.



64-bit Hamilton C shell 2012 on 64-bit Windows 7 Ultimate. Shown here are simple factor and whereis scripts and the on-line help for the su (super user) utility. The Hamilton more utility is the best more ever made.

If interested, feel free to download a free copy from <http://hamiltonlabs.com/HamiltonCshell2012/di/46gSQ9NZ/>

# The experiments

Lab 1: Intro to our lab instruments

Lab 2: Step response of RC circuits

Lab 3: Operational amplifiers

Lab 4: Integrators, differentiators and simple filters

Possible lab 5: TBD

Due at roughly two-week intervals.

# Objectives

1. Develop your basic skills using the instruments, taking and reporting measurements reliably.
2. Allow you to verify experimentally that these circuits behave the way the math predicts they will.

# Come prepared

All but the first lab require a significant amount of prelab work.



# Your parts kit

## Qty Description

2 51  $\Omega$  resistor  
green/brown/black

5 1 K $\Omega$  resistor  
brown/black/red

4 5.1 K $\Omega$  resistor  
green/brown/red

6 10 K $\Omega$  resistor  
brown/black/orange

3 20 K $\Omega$  resistor  
red/black/orange

2 27 K $\Omega$  resistor  
red/violet/orange



## Qty Description

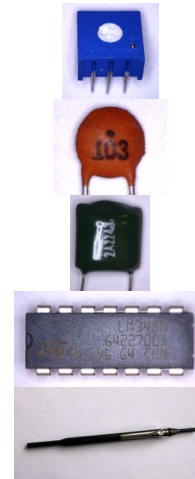
2 10 K $\Omega$  potentiometer

6 0.01  $\mu$ F ceramic capacitor

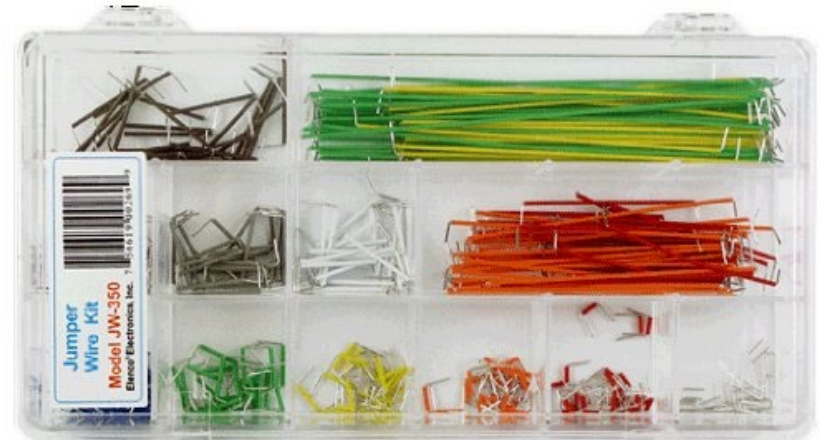
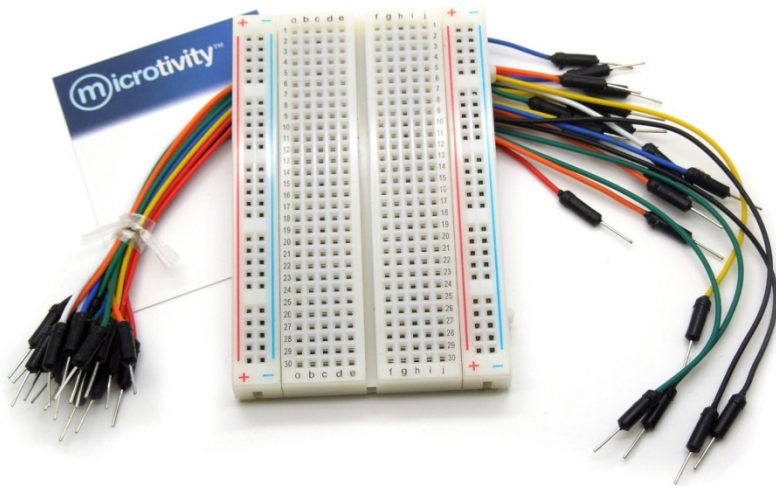
2 0.22  $\mu$ F polyester capacitor

5 LM 348 quad op amp

1 Trimmer tool

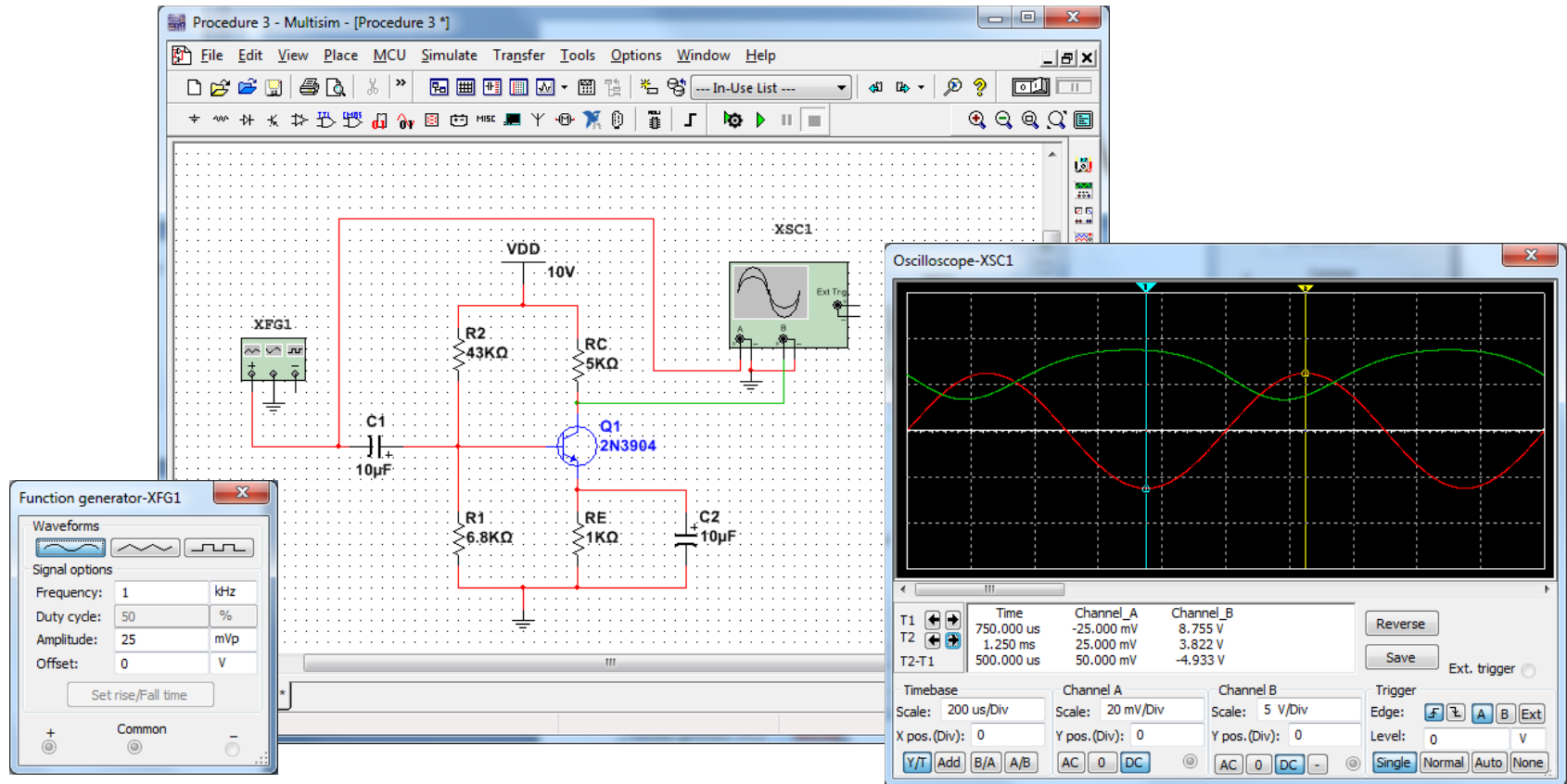


# You will need breadboards and wires



You may want several breadboards so you don't have to tear down one circuit to build the next.

# Multisim is on all the lab machines



You'll find it helpful to simulate the circuits you're testing. A [student license](#) is \$40 and probably worth the money.

# Teams of 2

- No exceptions unless we have an odd number.
- It is up to you to select your partner.
- Both partners are expected to contribute equally to each lab.
- My grading will assume you've done that, meaning you'll both get the same grade.
- Each team should submit *only one* copy of each report but with both names on it.
- To turn off the complaint from canvas, submit an otherwise blank sheet that gives your teammate's name.

# Reports

1. Reports may be typed or handwritten neatly *in ink* and submitted in PDF format or on paper.
2. I will not accept cellphone photographs of your work. If you submit a scan, it must have been made on an actual scanner.
3. I already have a copy of the assignment, so I do not need you to copy-and-paste it into your report.
4. I also do not need title pages with colorful backgrounds, boxes identifying who did what, a list of the standard lab instruments at each bench or anything else not called for in the assignment.
5. I am far more concerned about the quality of your work than I am about due dates and will usually accept late submissions without penalty.

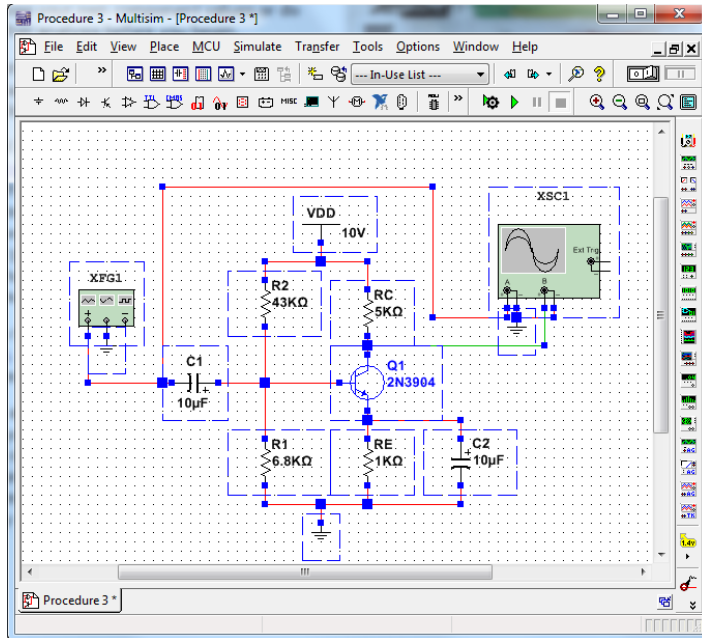
# Schematics

Your reports must include a schematic for each circuit being discussed.

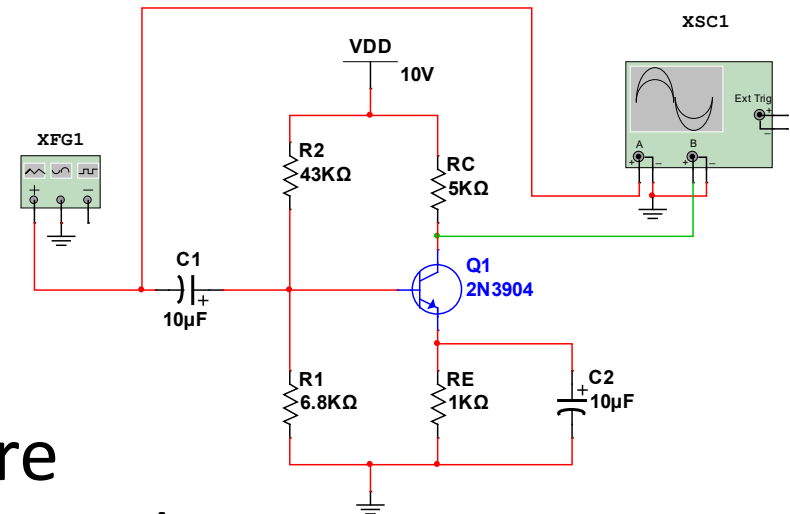
If you add a wire, I need a new schematic.

I'll accept handwritten but the easy way to do a schematic is with Multisim.

# To copy a schematic from Multisim



Select and copy all (Ctrl-A, Ctrl-C) in Multisim.



“Paste Special” as “Picture (Enhanced Metafile)” in Word.

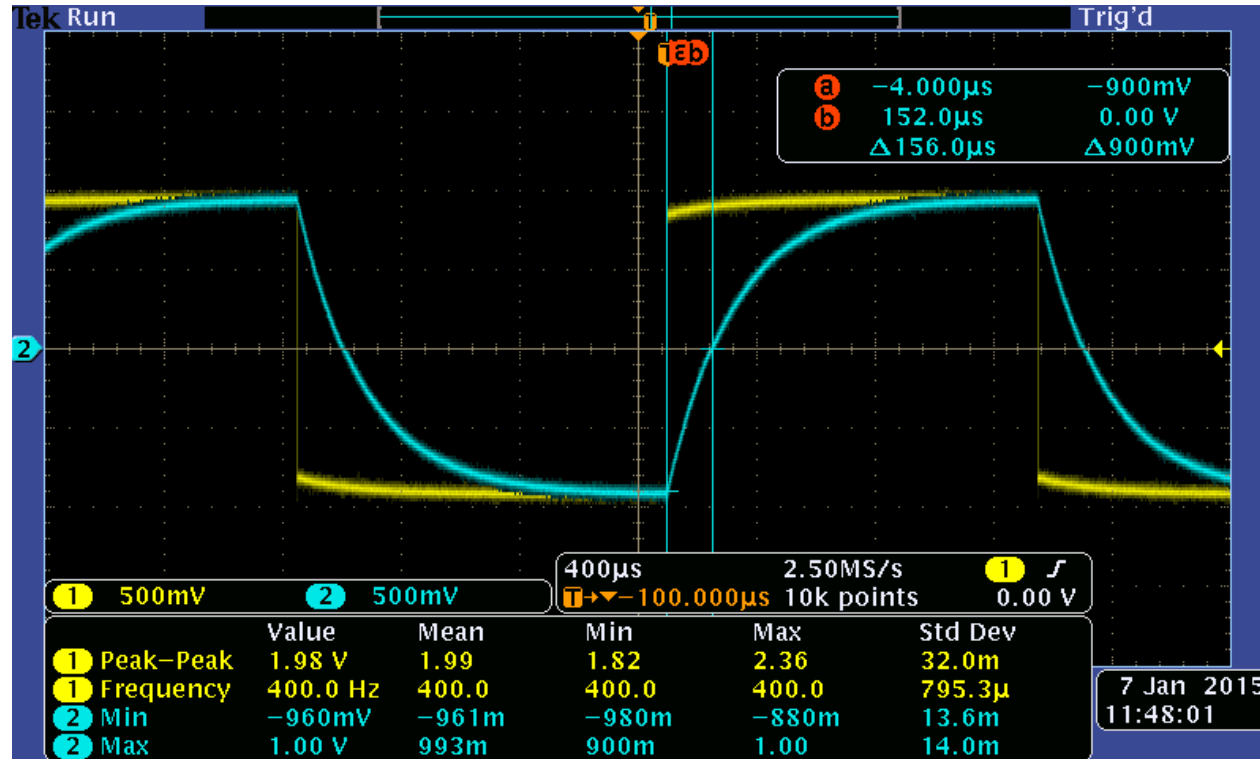
# Measurements

You'll be expected to show that you know how to use the instruments.

1. Set the output impedance of the function generator.
2. Use the oscilloscope to fine tune the function generator output.
3. Capture a useful screenshot on the oscilloscope.



# Screenshots



Make them **BIG**, input on channel 1, output on channel 2.  
Add useful on-screen measurements.

For more: *“Using the lab instruments”*

# Grading

1. I tend to count up the number of “things” a given lab is asking for and assign each a roughly equal value.
2. I never deduct points simply because your measured results didn't perfectly match the expected.
3. I am *extremely* picky. I give a lot of 40s and 50s to people who've never seen them before.
4. Each lab is only worth a small percentage of your grade, I do this to everyone and it all gets curved.

# All the work must be your own

1. Copying answers from another student or off the internet will get a zero, even if you're clear about where you got them.
2. If you omit the attribution, submit work that's not your own or try to deceive me with fabricated results, you will, in addition, find yourself reported for academic misconduct.
3. I'm good at spotting misconduct and very good at reporting it.
4. ***I do not give warnings. I report everything.***

# Lab 1

Intro to our lab instruments

# Lab 1 objectives

- Familiarize you with using our laboratory instruments, the multimeter, power supplies, the function generator and the oscilloscope.
- Ensure that when you're asked, e.g., on a future lab,  
*set  $V_{in} = 1.0 V_{pp}$  square wave at 1.0 KHz with a 0.5 V DC offset and take a screenshot of  $V_{out}$  with suitable on-screen measurements,*  
that you will know what that means and you can do it.
- It is perfectly okay if this is your first time using the lab instruments and you need help.

# Lab 1 assignment

1. Use the DMM to measure some resistors and power supply outputs.
2. Figure out how the current limit and series mode features on the multi-output power supply work.
3. Determine the function generator's output impedance.
4. Generate some waveforms and capture some screenshots.