CS150 Lab Lecture 4: Using Test Equipment

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Test Equipment

- HP E3630A Triple-Output Power Supply
- Fluke 8010A Digital Multimeter
- HP 8112A Pulse Generator
- HP 54645D 100 MHz Mixed Signal Oscilloscope

Overview

- Test Equipment Introduction
- Lab Hints

Past Labs

- Load circuits onto Xilinx and everything works
- What if there are problems?
- Time for debugging/test equipment!

HP E3630A

- Power Supply
- 3 output voltages
- +6V, +20V, –20V

Press ‘meter’ buttons for voltages
Set Tracking Ratio to right
Use knobs to set voltage
Use leads with COM
And the correct voltage
HP E3630A
- Don’t directly connect COM to voltage
- Large current will flow
- $P = I^2R$ means resistors and wires will fry
- As a safety feature, current is limited

Measuring Current
- Press mA button
- Connect black lead to Common
- Connect red lead to ma (0-2000 ma) or 10A (0-10A)
- Connect in series to measure current

Fluke 8010A Digital Multimeter
- Measures AC/DC Voltage, Current, and Resistance
- More accurate than the power supply display

Measuring Voltage
- Press V button
- Connect Common to ground, and V/kΩ/S to voltage to measure
- Connect probes in parallel

Measuring Resistance
- Press kΩ/S button
- Connect black lead to Common
- Connect red lead to V/kΩ/S
- Device must be removed from circuit before measurement

Adjust Measurement Scale
- Adjust the scale based on the range of values you expect
**HP 8112A Pulse Generator**
- Generate single or period square waveforms
- Can vary voltages, periods, duty cycles, pulse widths, and slew rates

**Changing Values**
- Set Mode to Norm
- CTRL to nothing
- Use PER for period
- DTY is duty cycle
- WID is pulse width
- HIL set high voltage
- LOL sets low voltage

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**Adjusting Values**
- Use Vernier to change value of each digit
- Range changes magnitude
- Make sure disable is off
- Use shown probe
- Has two leads

**Oscilloscopes**
- Can show analog signals and digital signals from Xilinx pins
- Valuable Resource
- Useful on project
- Use soft menus to navigate

**Analog Inputs**
- Two analog inputs
- Volts/Div knobs sets Y axis
- Auto-scale (white button) does a lot of work for you
- Can get exact measurements for voltage, time, etc
- Use buttons, then follow menus

**Triggering**
- Triggering determines when to catch and display signals
- Trigger menus for manual adjustment
- Bad Triggering
- Good Triggering

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Digital Inputs
- 16 inputs
- Input knob selects pin
- Main method of seeing
- Xilinx signals
- Careful when attaching pins
- Don’t bend pins

Lab 4
- Measure Power Supply Voltage
- Observe Pulse Generator with Scope
- Both basic operations described earlier

Digital Triggering
- Pattern matching
- Check signal for High, Low, Positive Edge, Negative Edge, or don’t care
- For project, useful to label pins so easier to identify

Rest of Lab
- Download two ROM circuits
- First circuit repeatedly outputs 3 16 bit outputs
- Use trigger and storage to capture information
- 1 output is known, so it can be used as a reference to determine exact contents of other two outputs

Save/Recall
- Store sweeps of data
- **Single** gets one sweep
- **Run/Stop** freezes current output
- **Auto-store** stores on triggers

Rest of Lab
- Second circuit used to measure propagation delay
- Logic analyzer used to measure worst-case delay
- Use triggers to mark when worst case transition occurs
- Delay can be measured off analyzer