PHYC 306L
Contemporary Electronics

Fall 2016

Instructor: Francisco Elohim Becerra

WHAT IS THIS COURSE ABOUT?

Practical, hands-on experience with electrical circuits, electronics, and instrumentation

LabView: Data-flow programming with National Instruments popular software package

HOW THE COURSE WILL WORK

10 minute quiz at the start of each class. Quiz will test concepts from previous week.

45 minute lecture introducing material for the current lab; LabView instruction

Remaining time for lab work

GRADING:

50%: Weekly quiz scores
(2 dropped; no makeup quizzes)

25%: Lab work (from lab write-ups), analysis reports, notebook
(1 dropped, no makeups)

25%: Labview Project Assignments
(1 dropped, no makeups)

No exams

Electronics Projects

**** Lab work (from lab write-ups), analysis reports, notebook***

Labs are designed to be completed in one session

Students work in teams of 2: collaboration with everyone is encouraged

Teams change each week: List in lab with names/weeks

Report writing will be minimal. Keep a notebook.
Show your work to instructor as you progress through the project.

Some analysis will be required. Email analysis reports to instructor BEFORE class.

LabView Projects

**** Labview Project Assignments:***

Data-flow programming for implementing virtual instruments (VI)

Wide variety of freely available tutorials: videos, manuals, examples

Weekly projects

Due on Monday 11:30am. Come to my office anytime (or send me an email to meet) before deadline and demonstrate your working VI.

Work not reviewed by Monday at 11:30 am will not receive credit.

Hint: Do not wait until Monday at 11:30 am …

Work alone or discuss with classmates. Each student responsible for producing, demonstrating, and understanding the assigned VI

Where to get it?

UNM has a site license; see me for install procedure

Michael P. Hasselbeck –can provide support too
Office: P&A 157. Phone: 505-277-0590. Email: mph@**unm**.edu.

Installed on computers in Jr. Lab (PandA 133)

ECE student computer pods

Purchase from National Instruments: $20

I'm a physics major! Why are they making me take an

ECE course ???

I'm a physics major! Why are they making me take an *ECE course ???*

- This is not an ECE course
- Experimental Physics: It is essential!!!
- ECE and Physics overlap more than most other STEM disciplines
- Learn instrumentation and techniques that will be needed in 307L and 493L
- LabView is a marketable skill: academic, government, industrial research labs
- This course is a common component of undergrad curriculum at many other P&A departments

Short biography of the Instructor:

2003 BS, Physics (Guadalajara, Mexico)

2006 MS Physics (CINVESTAV, Mexico City, Mexico)

2009 PhD Physics (CINVESTAV and University of Maryland)

2010-2013 Postdoc (NIST, Gaithersburg, MD)

2013- Present Assistant Professor (UNM PandA)

Research program:

Experimental quantum optics

Experimental atomic physics

Data-flow programming: allows for **parallel execution** of code

Graphical: Easy to learn, Drag-and-drop icons

Vast library of **example code** available and **drivers**

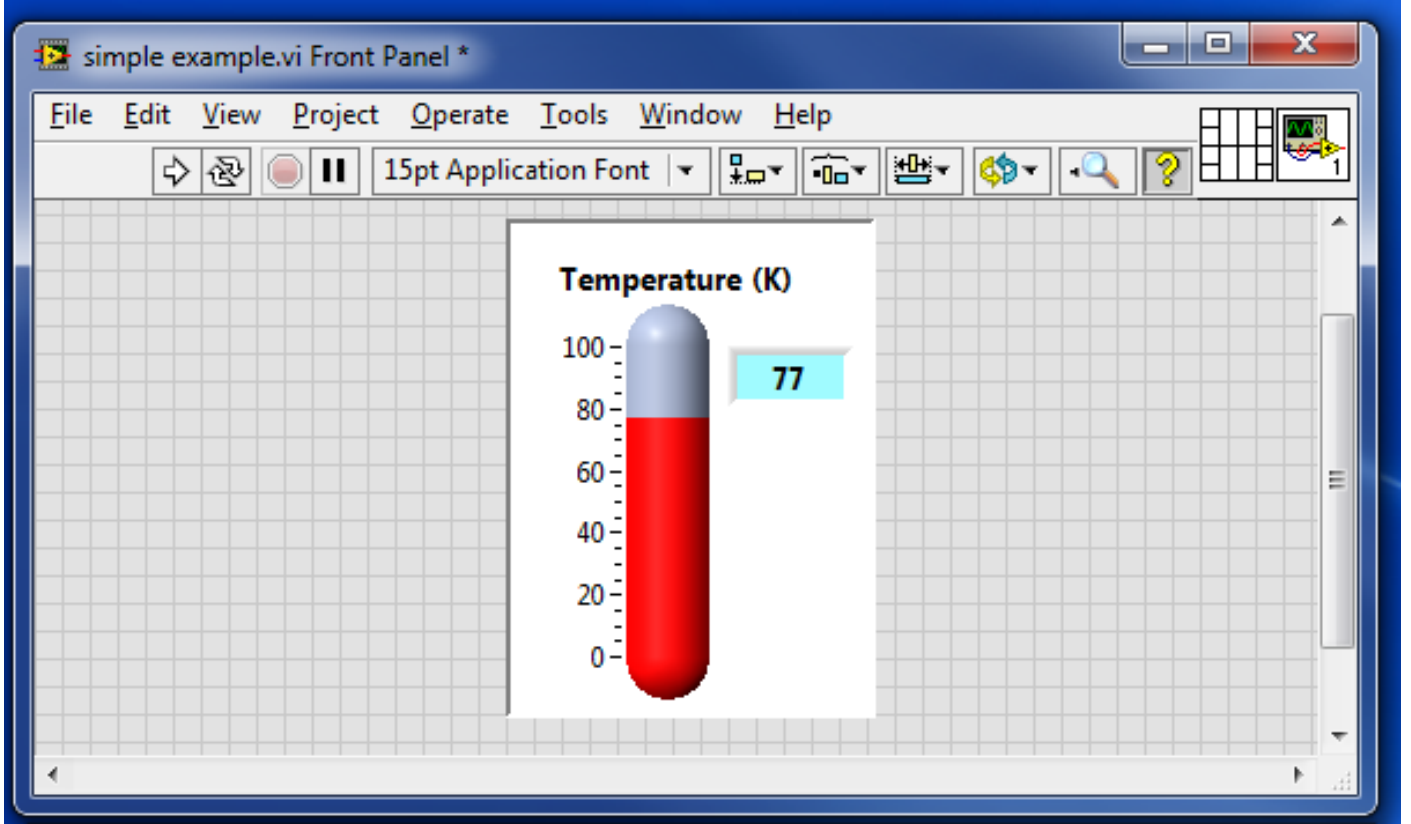
Readily **integrates** with NI hardware and many other devices

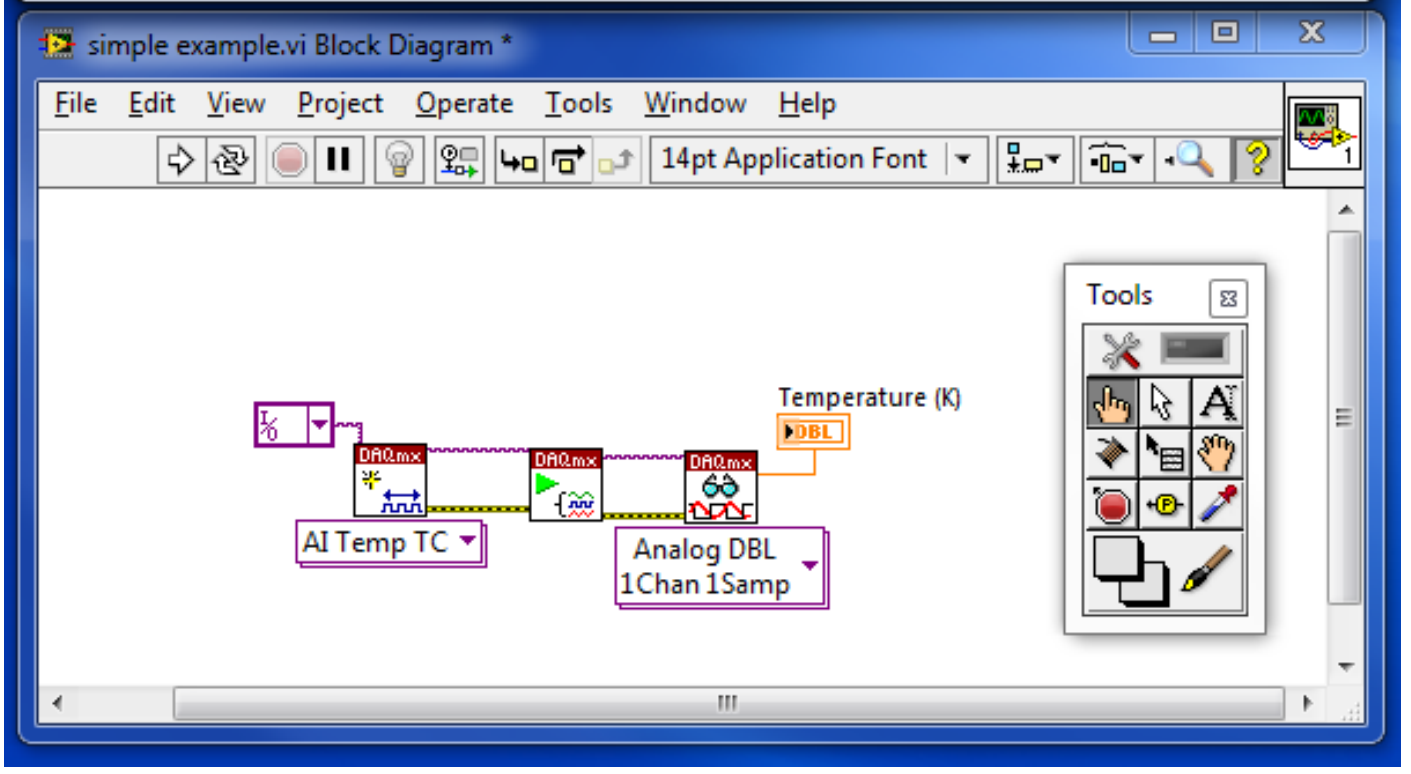
All popular data **buses** supported (GPIB, PCI, ethernet, USB, wireless...)

Executables can be generated: Use on computers without LabVIEW

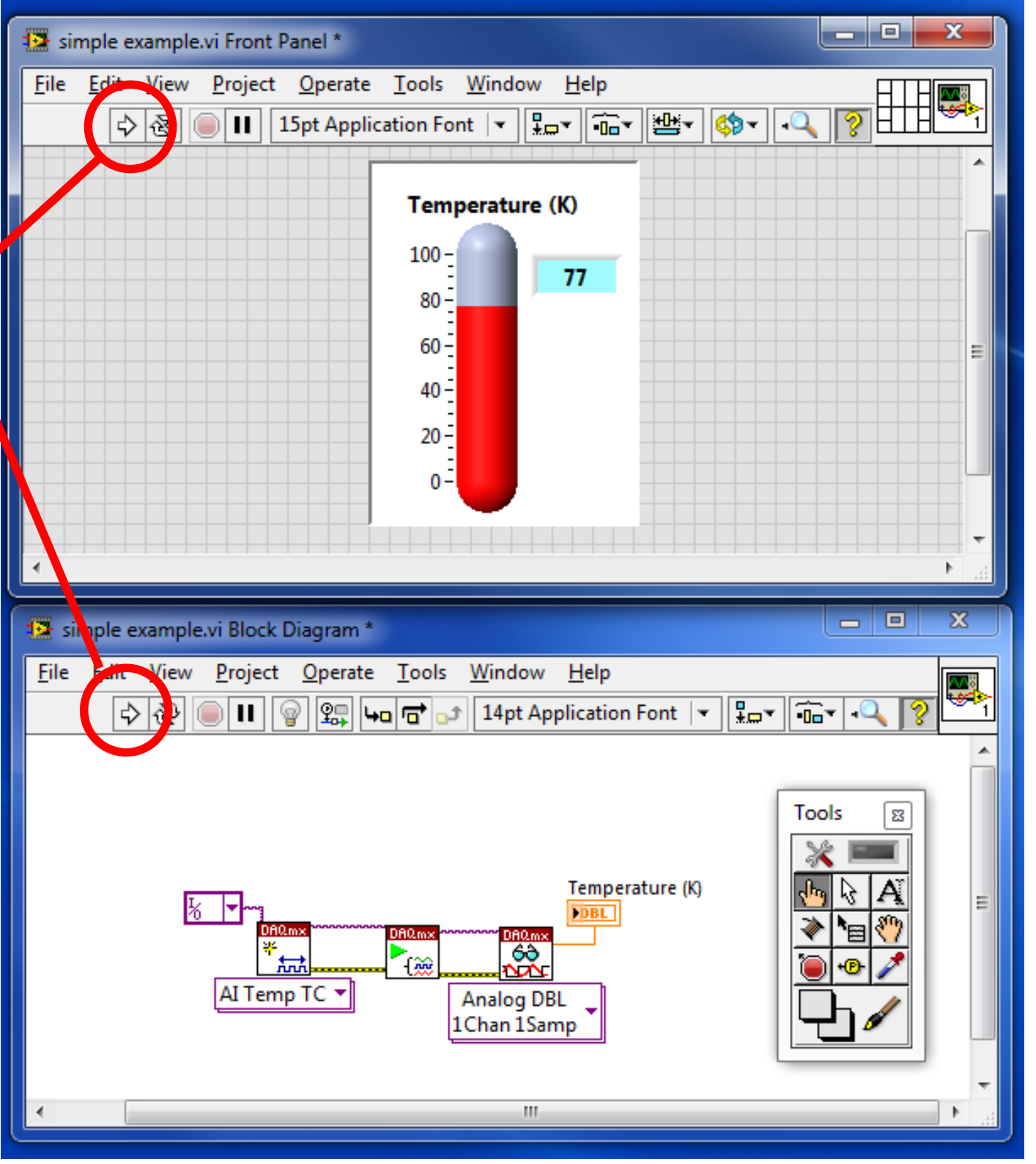
FRONT PANEL

BLOCK DIAGRAM



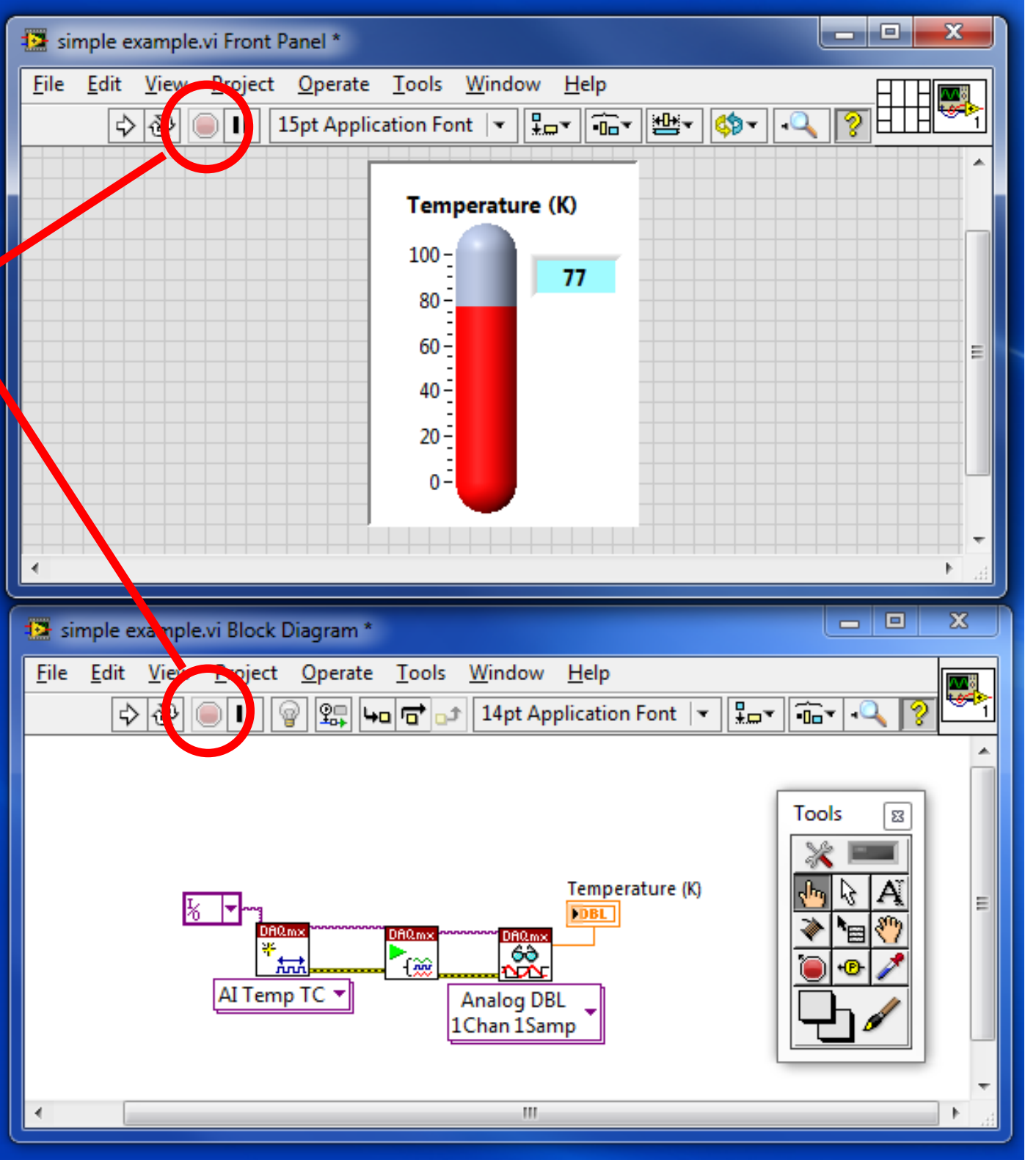


Run the VI

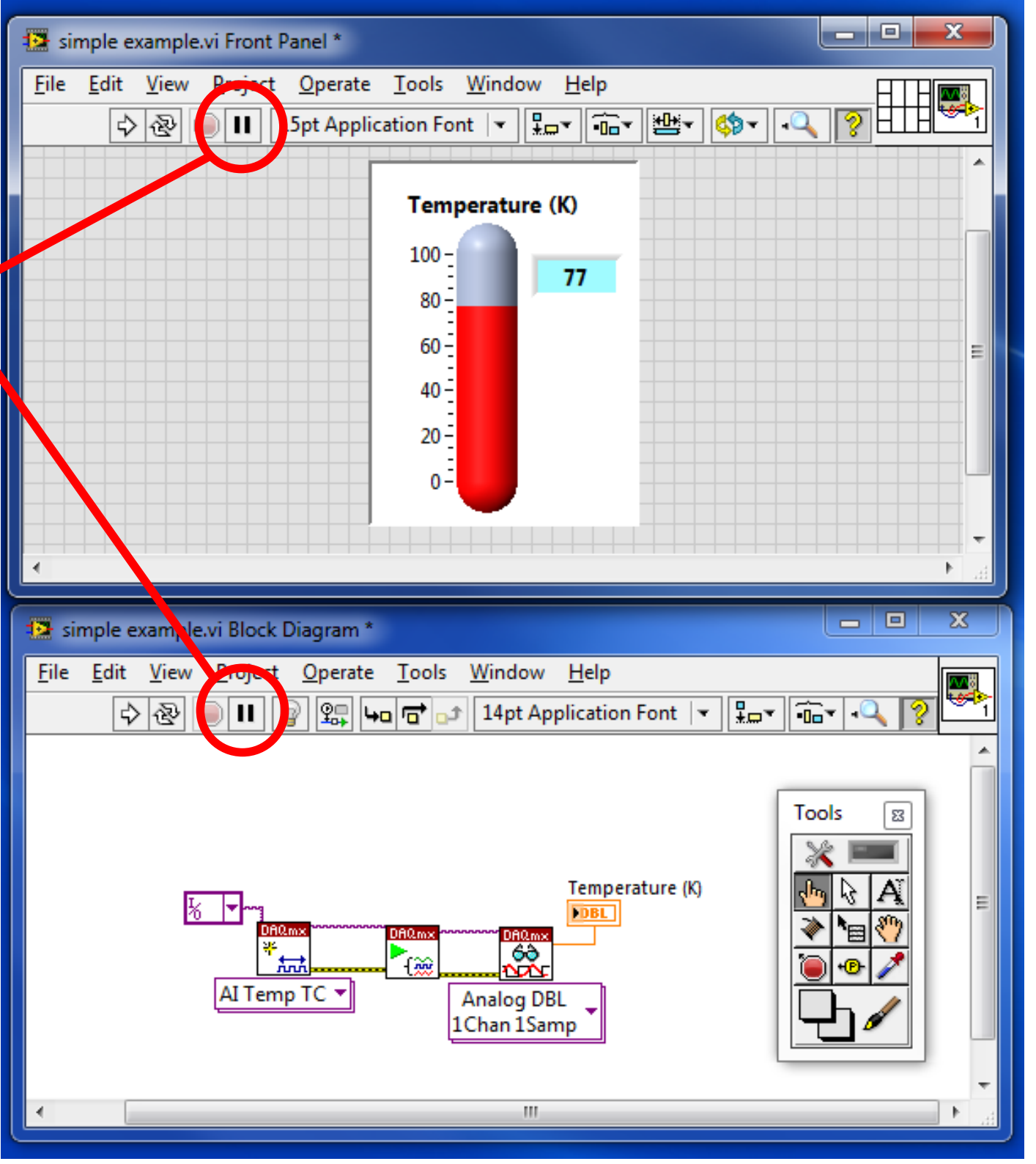

simple example.vi Front Panel *
File Edit View Project Operate Tools Window Help
15pt Application Font
Temperature (K)
100
80
60
40
20
0
77
simple example.vi Block Diagram *
File Edit View Project Operate Tools Window Help
14pt Application Font
Tools
Temperature (K)
DBL
DAQmx
DAQmx
DAQmx
AI Temp TC
Analog DBL
1Chan 1Samp

Abort the VI*

* Use this only when all else fails



Pause the VI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DAQmx
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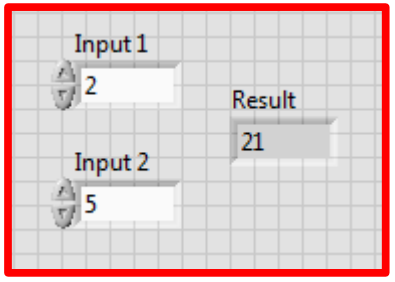
1Chan 1Samp
Tools

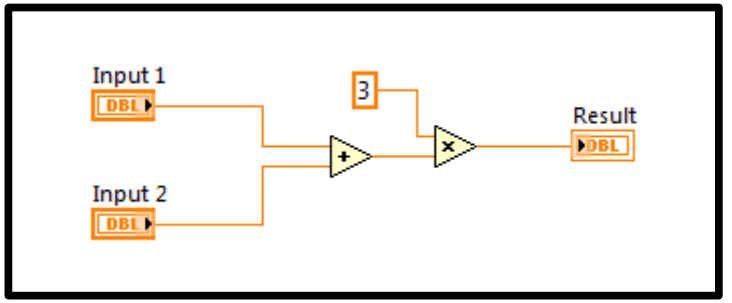
Data-flow programming on the Block Diagram

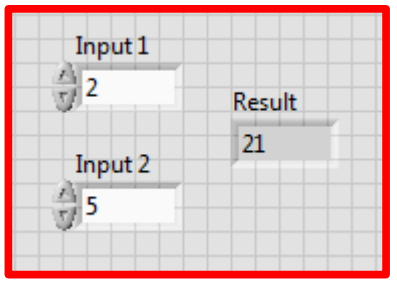
Code does not execute left-to-right

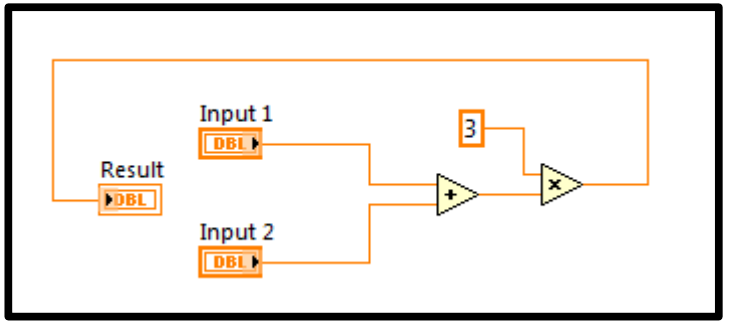
Nodes execute depending on availability of data at input terminals

These two VIs are operationally identical:









Setting up Block Diagram to flow left-to-right can help visualize logical flow

Description of Tools Palette

View -> Tools Palette

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View -> Tools Palette

Operate Value

Interact with working VI
primarily from Front Panel

Description of Tools Palette

View -> Tools Palette

Position/Size/Select

Used on both Front Panel and Block Diagram

Opens pop-up menus with right-click

Description of Tools Palette

View -> Tools Palette

Edit Text

Works like a word-processor cursor

Description of Tools Palette

View -> Tools Palette

Connect Wire

Connects icons and objects on the Block Diagram

Handy keyboard shortcuts

CTRL-Z: Undo the last operation (has extended memory)

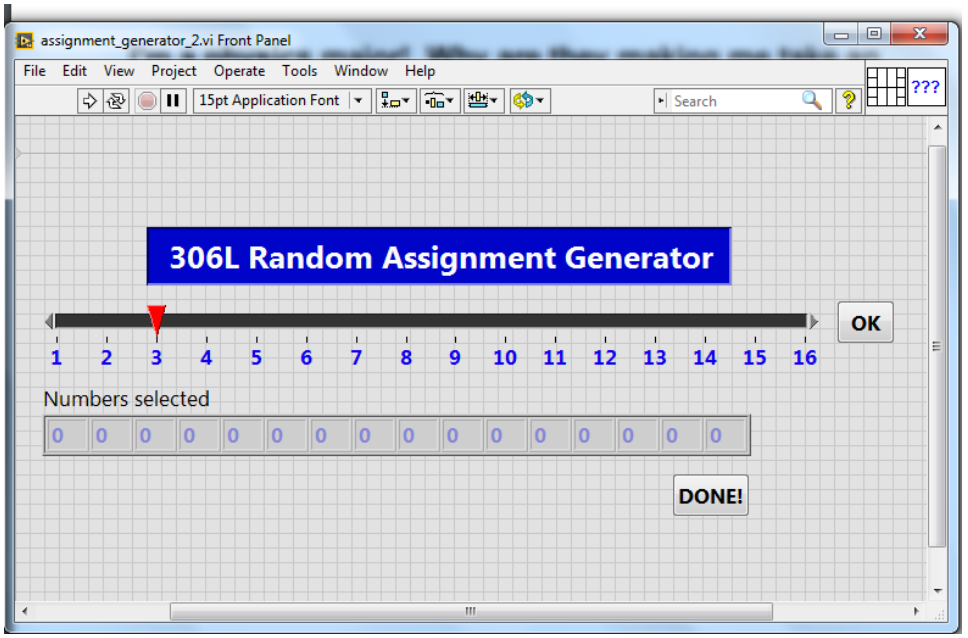
CTRL-E: Toggle between Front Panel and Block Diagram

CTRL-B: Remove broken wires

CTRL-H: Enable context help (hover over components to get specific help)

Fist LabView Assignment

Make a program that…..



Lab work

ELECTRICAL SAFETY

Electrical energy comes from:

* Power supplies, wall outlets
* Batteries, capacitors, inductors

Can cause:

Shock, burns, fires, explosions

It is known that ac voltage levels of around 50V can be lethal in certain conditions

Lab work

ELECTRICAL SAFETY Capacitor danger

Same essential physics as a carpet shock

Dangerous even when circuits are de-energized

All capacitors have a maximum voltage rating

Be especially careful with electrolytic capacitors: Polarity (+/-) is marked on device.

306L Lab Rules

Never work on circuits without someone else in the lab

Don't attempt the work if you are excessively tired

Double-check circuits before applying power

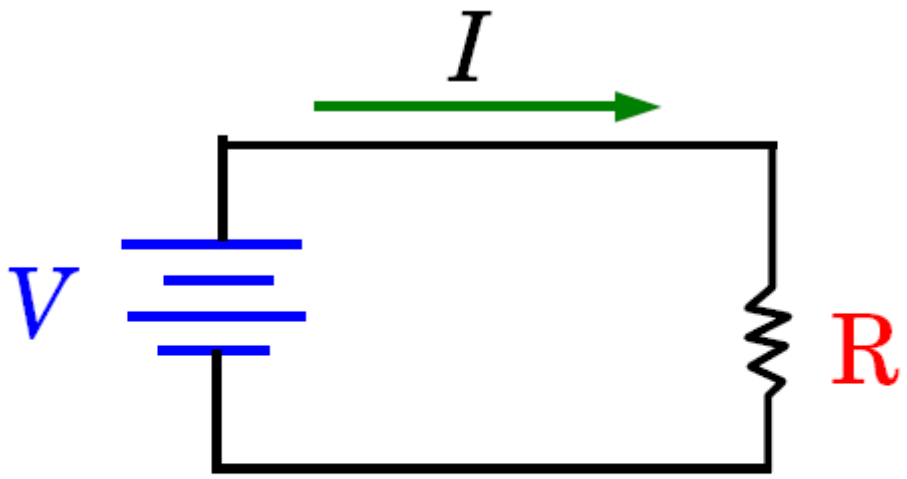
No food or drink allowed (we are guests here)

Know where the safety exits are

Know where the fire extinguishers are

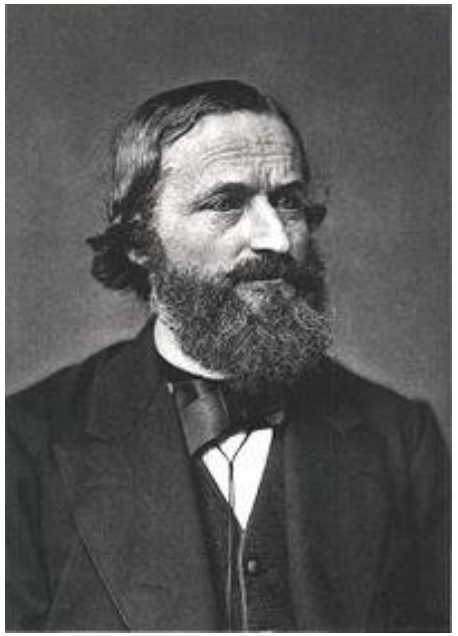
If in doubt, please ask!

Ohm's Law



Georg Ohm (1789--1854)

$$I = V/R$$



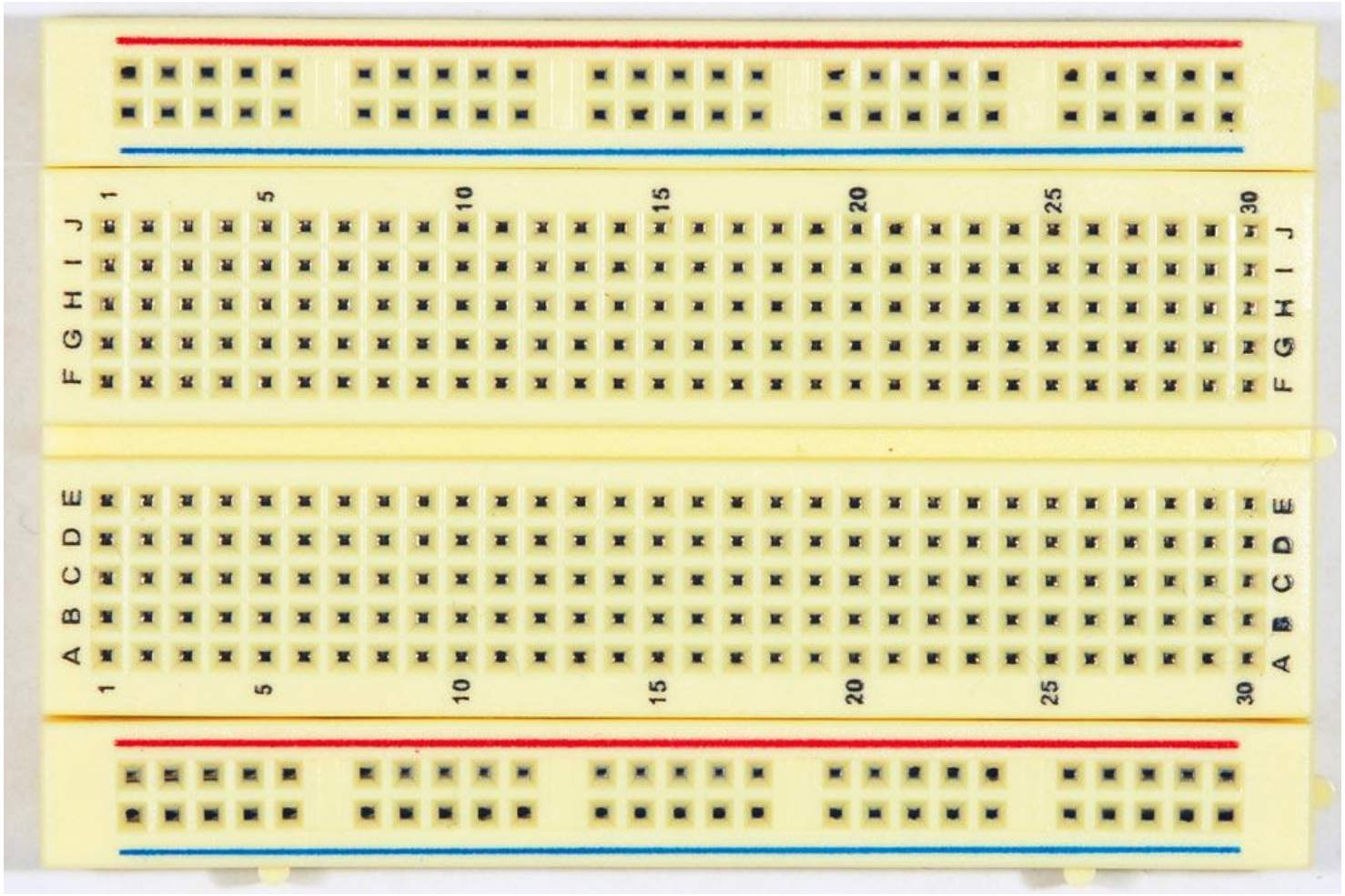
Gustav Kirchoff (1824—1887)

Kirchoff's Laws (1845)

Kirchoff's Current Law:
Sum of currents at a node is zero

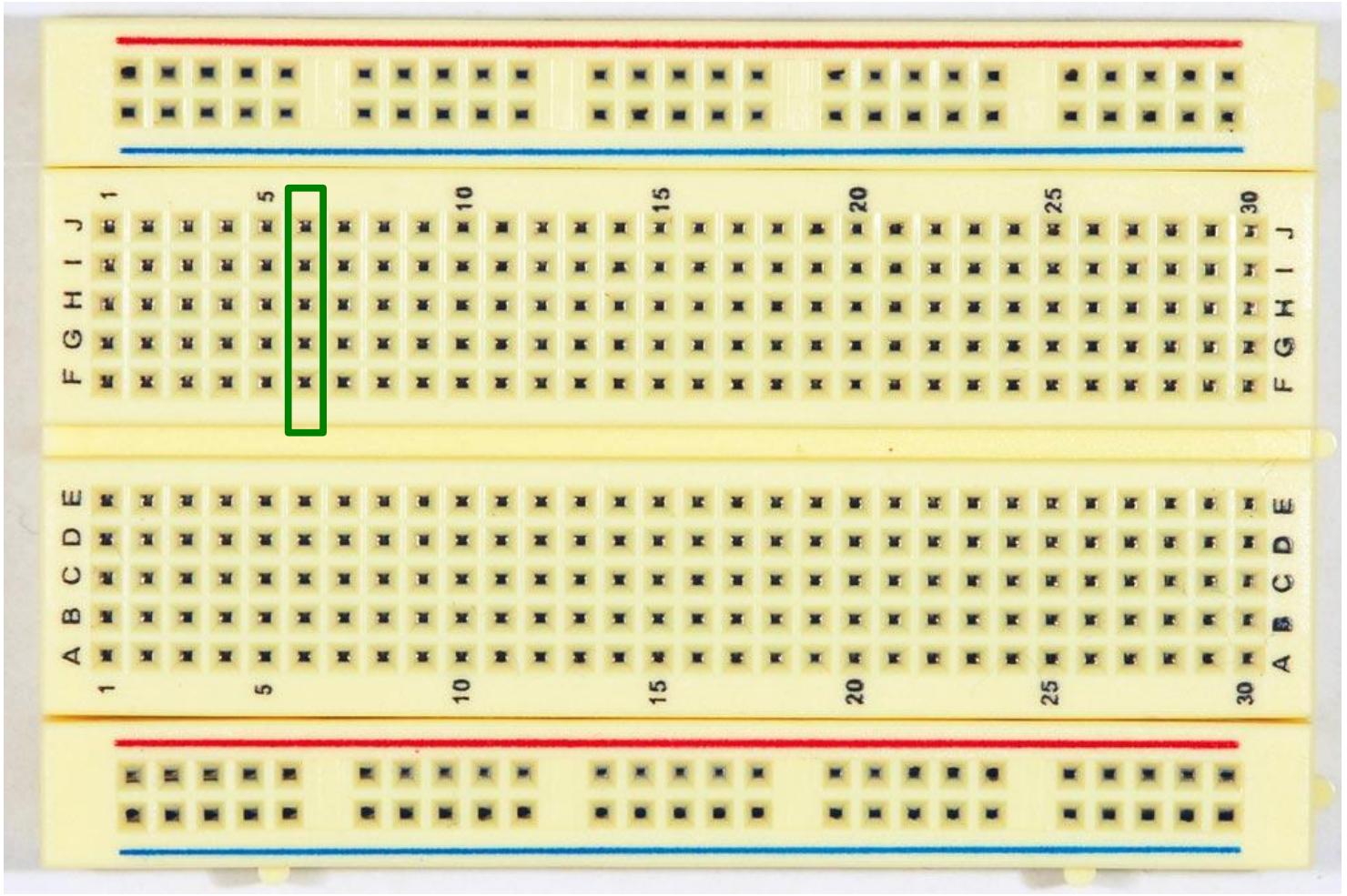
Kirchoff's Voltage Law:
Sum of potential drops around a closed loop is zero.

HOW TO USE THE BREADBOARD



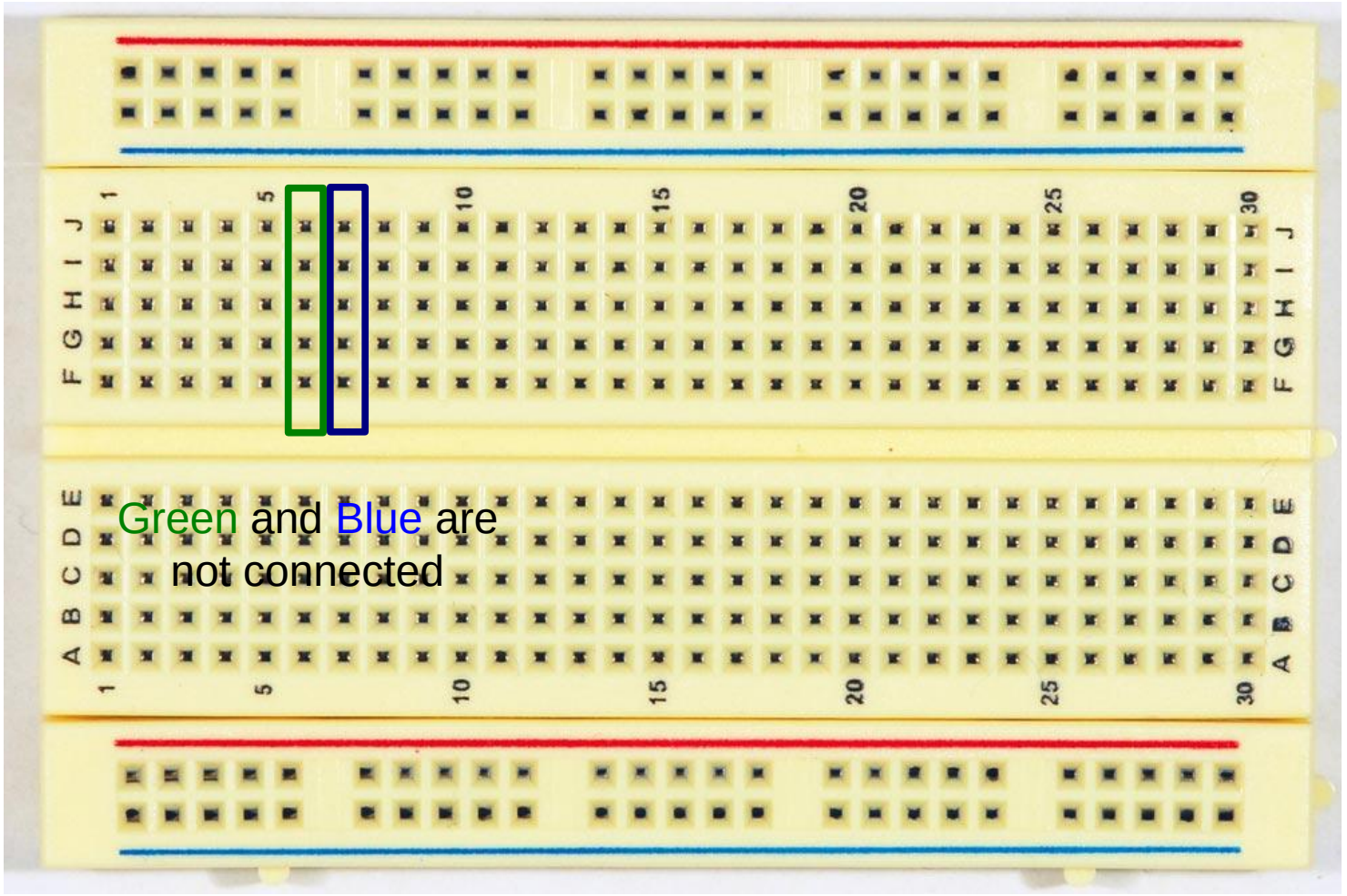
HOW TO USE THE BREADBOARD

Columns of 5 holes are connected



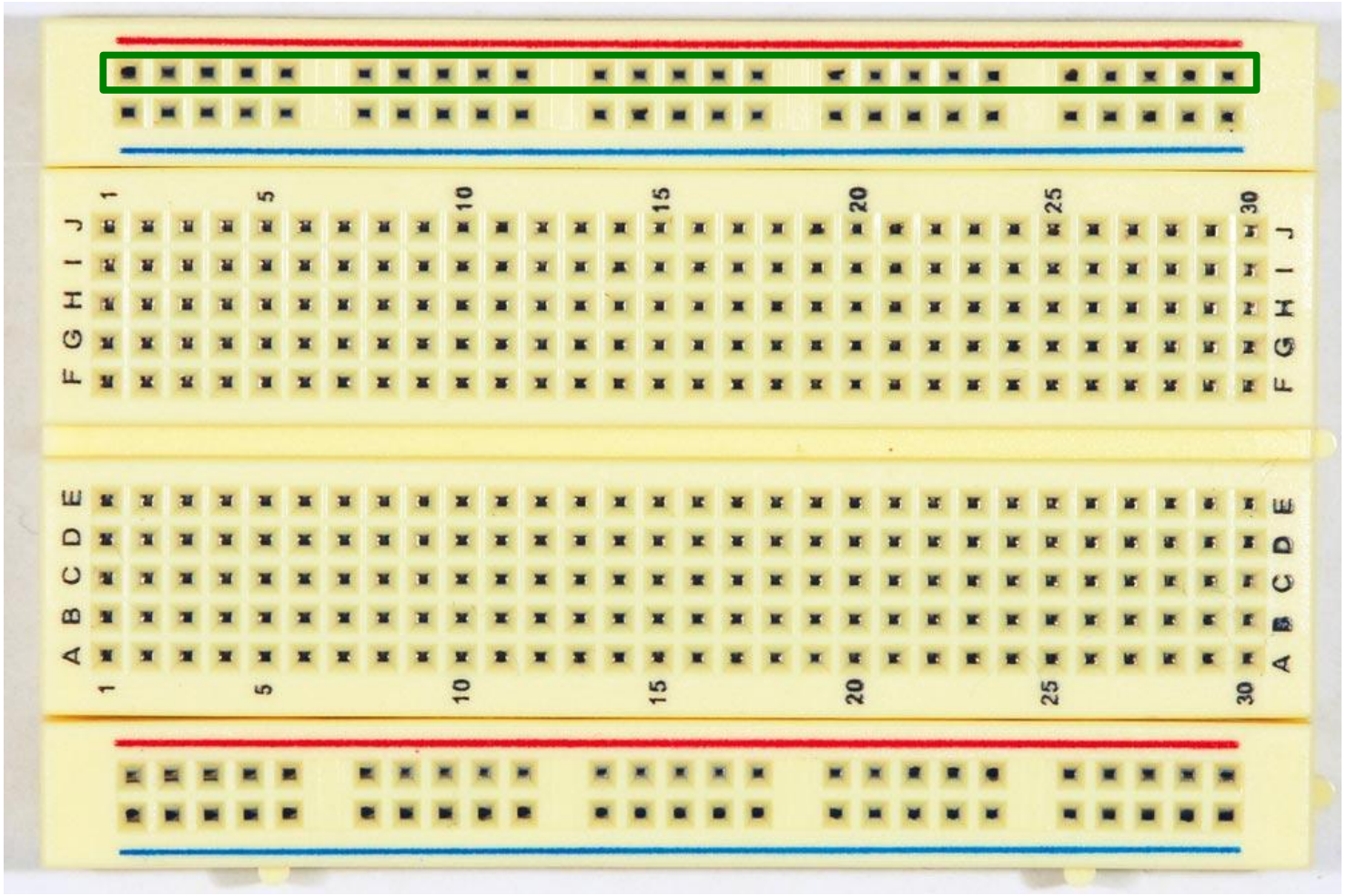
HOW TO USE THE BREADBOARD

Columns are all isolated from each other



HOW TO USE THE BREADBOARD

Rows adjacent to colored lines are all connected



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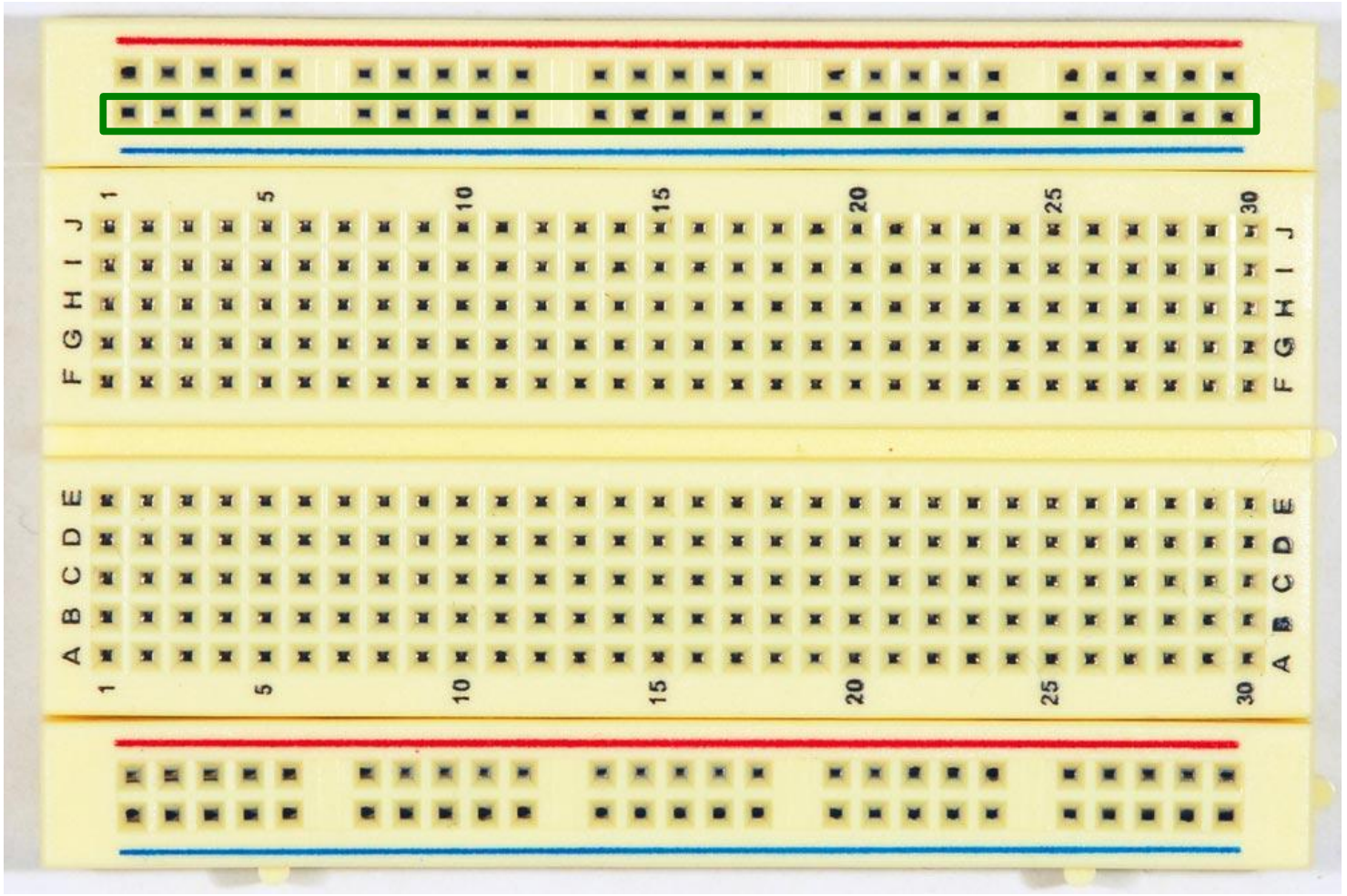

Go to website and open “Lab1” instructions