Advanced material processes and die design
DSL 732

Topic 3
uC programming
Instructor: Jay Dhariwal, Asst. Prof., IIT Delhi

8th August 2019

Announcements

- Assignment 1: Website Development deadline: 11th August (Please let us know your website through the google form so that we can evaluate.)
- Assignment 2: Project Proposal deadline: 21st August
- CRF Slots for makerspace orientation to be opened on Monday at 2 pm (as per Jugpreet) every week.
- No classes on Monday (Eid) and Thursday (15th August) next week. So, we only meet on Tuesday next week.
- Project development till minor test 1: One slide and one video of up to 1 minute on your project page of your website. Video editing with Kdenlive or Adobe Premier Pro or Quik mobile phone app or others. Date: 5th September. Slide Video Example
- Start developing your project on the project page of your website
- Arduinos and other electronics to be given to students.

Programming Basics

- Programming – instruction to perform task
- English or Hindi – grammar, similarly programming languages have syntax
- How would a calculator add two numbers?

Algorithm for adding two numbers

- Input number 1
- Input number 2
- Add number1 and number 2
- Print the result.
- Example
- https://www.onlinegdb.com/online_c_compiler
- http://learn.onlinegdb.com/c_program_to_add_two_numbers

Introduction to programming in C

- https://www.onlinegdb.com/online_c_compiler
- http://learn.onlinegdb.com/learn_c_programming
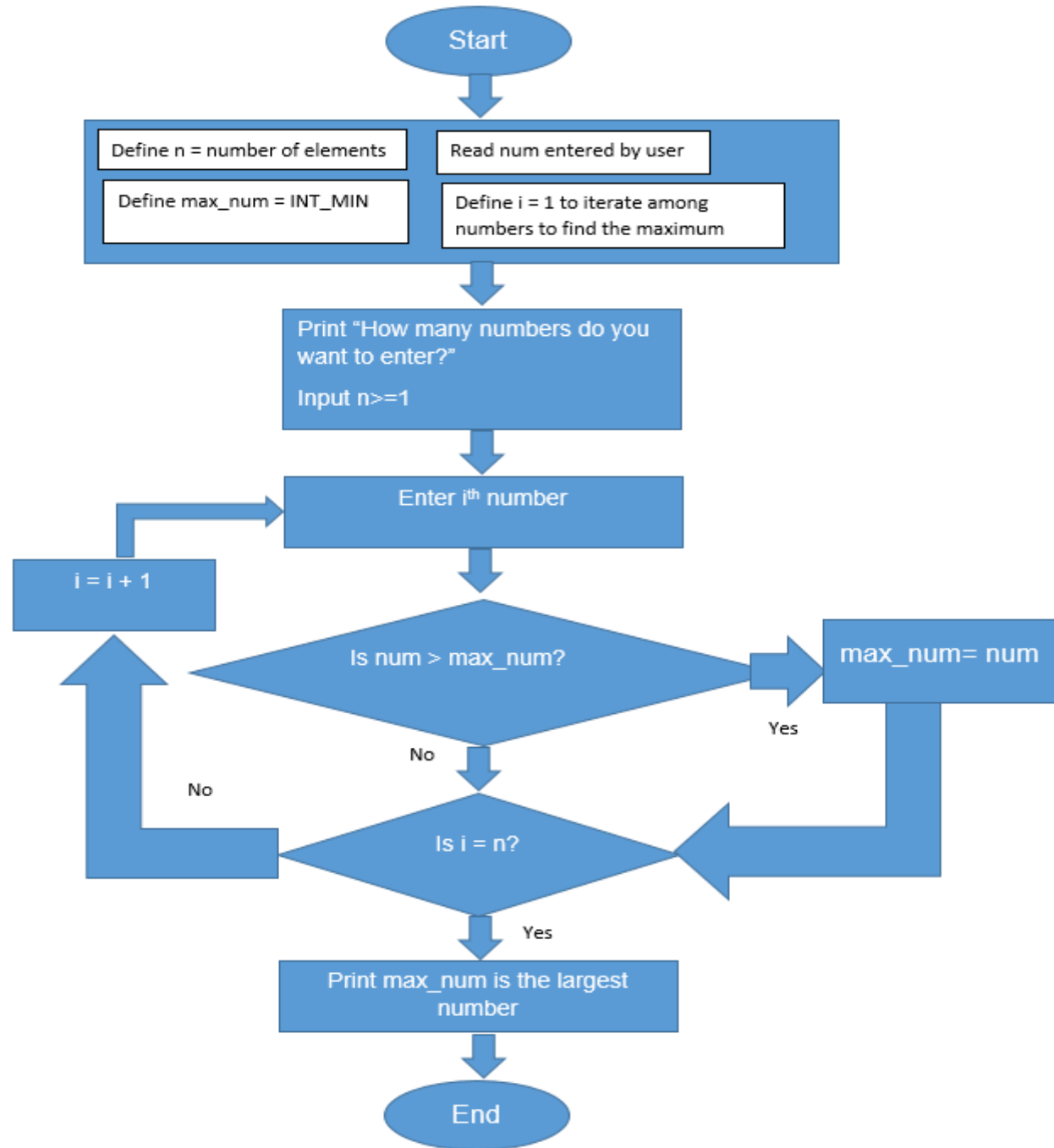- http://learn.onlinegdb.com/c_program_examples

C programming examples

- char (http://learn.onlinegdb.com/c_program_check_entered_character_vowel_consonants)

- logical and arithmetic operators

(http://learn.onlinegdb.com/c_program_count_vowels_consonants_digits_special_characters_in_string)

- find maximum of a set of numbers (http://learn.onlinegdb.com/c_program_find_maximum_numbers_from_entered_numbers)

Flowchart

[Flowchart for Largest number](#)

Languages have different syntax but are largely similar. Learn one language and you can learn others quickly. Flowchart/Algorithm is the key.

Basic elements of programming language

- Programming Environment
- Data Types
- Variables
- Keywords
- Logical and Arithmetical Operators
- If else conditions
- Loops
- Numbers, Characters and Arrays
- Functions
- Input and Output Operations
- Comments
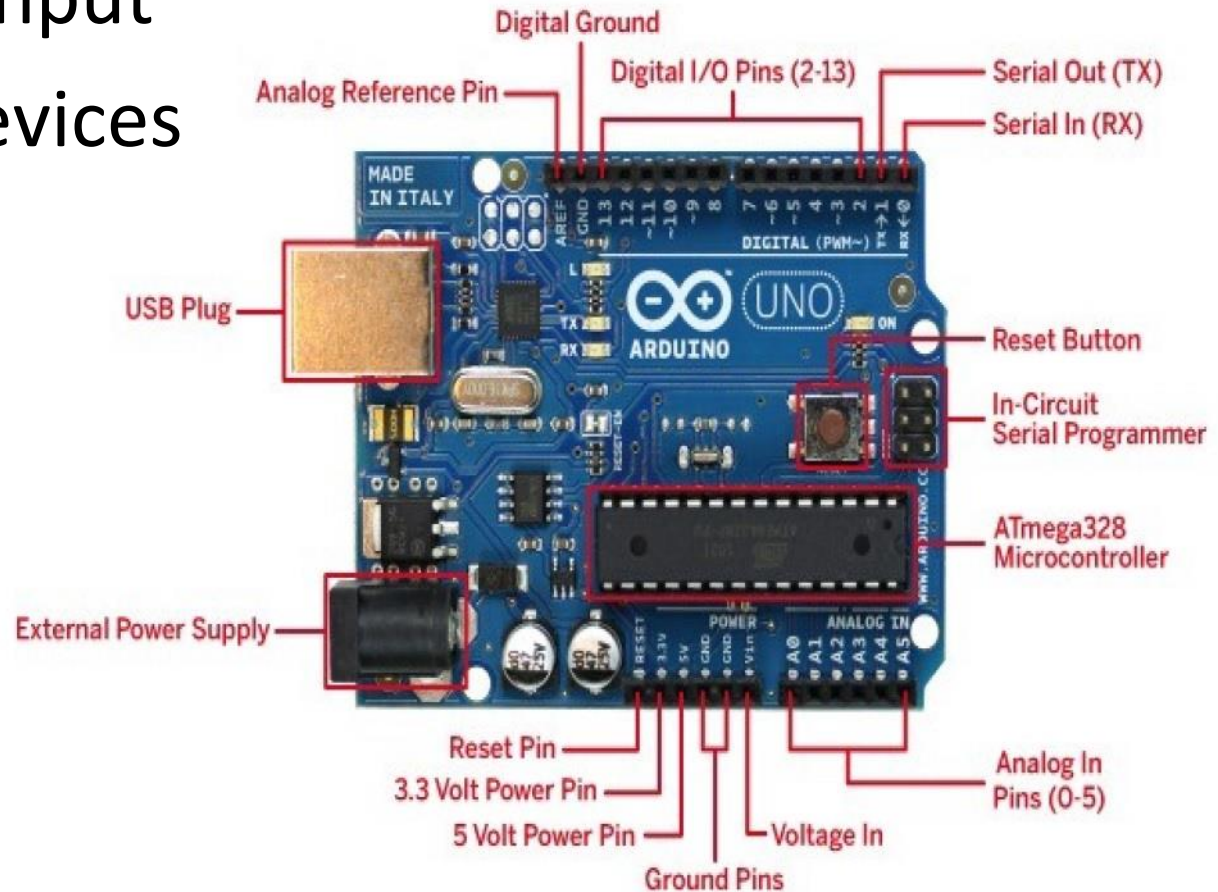- Indentation
- Bottom up debugging

Electrical Safety and handling

- http://academy.cba.mit.edu/classes/output_devices/index.html (1:30 - 4:00 minutes)
- Take utmost care of the electronics that we have provided. Shouldn't be exposed to water. Keep in Ziploc bags. Delicate stuff.

Introduction to uC

- uC vs uP, Arduino = single board uC, IDE, easy to work with input
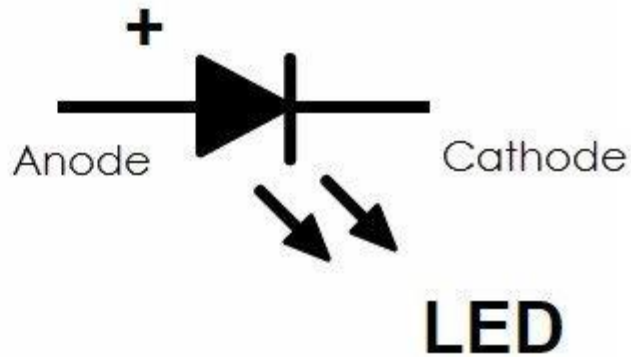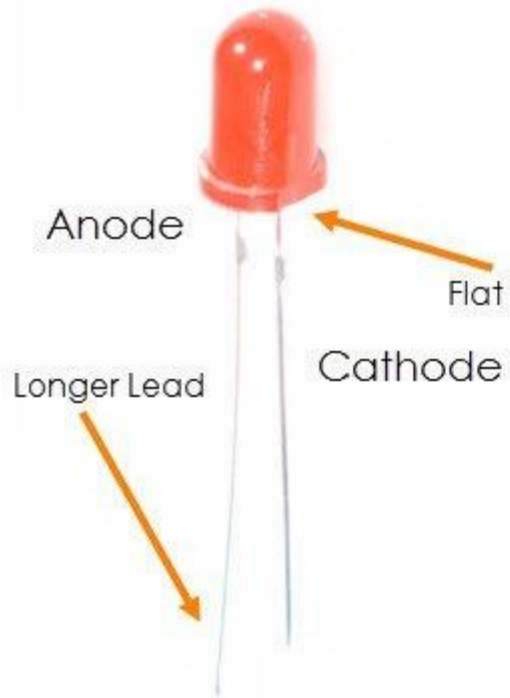 and output devices

Arduino installation

- Download ([Arduino kit pdf](#) for instructions) from https://www.arduino.cc/en/main/software
- Lesson 0 of Elegoo Arduino Kit
- Open Arduino IDE (Check if the port is detected)
- Blink sketch with pin 13
- Blink sketch initialize pin 13
- Lesson 2 of Elegoo Arduino Kit
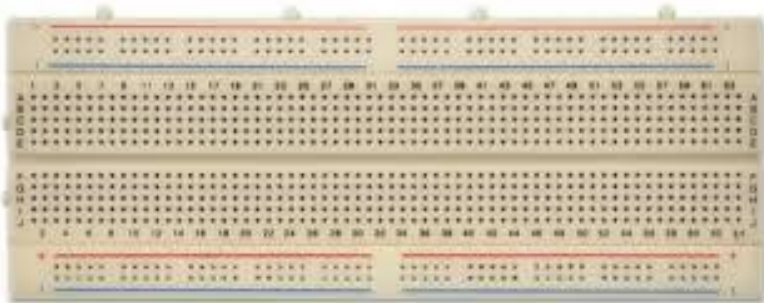
LED is a diode

LED is a diode which makes the current flow only in one direction
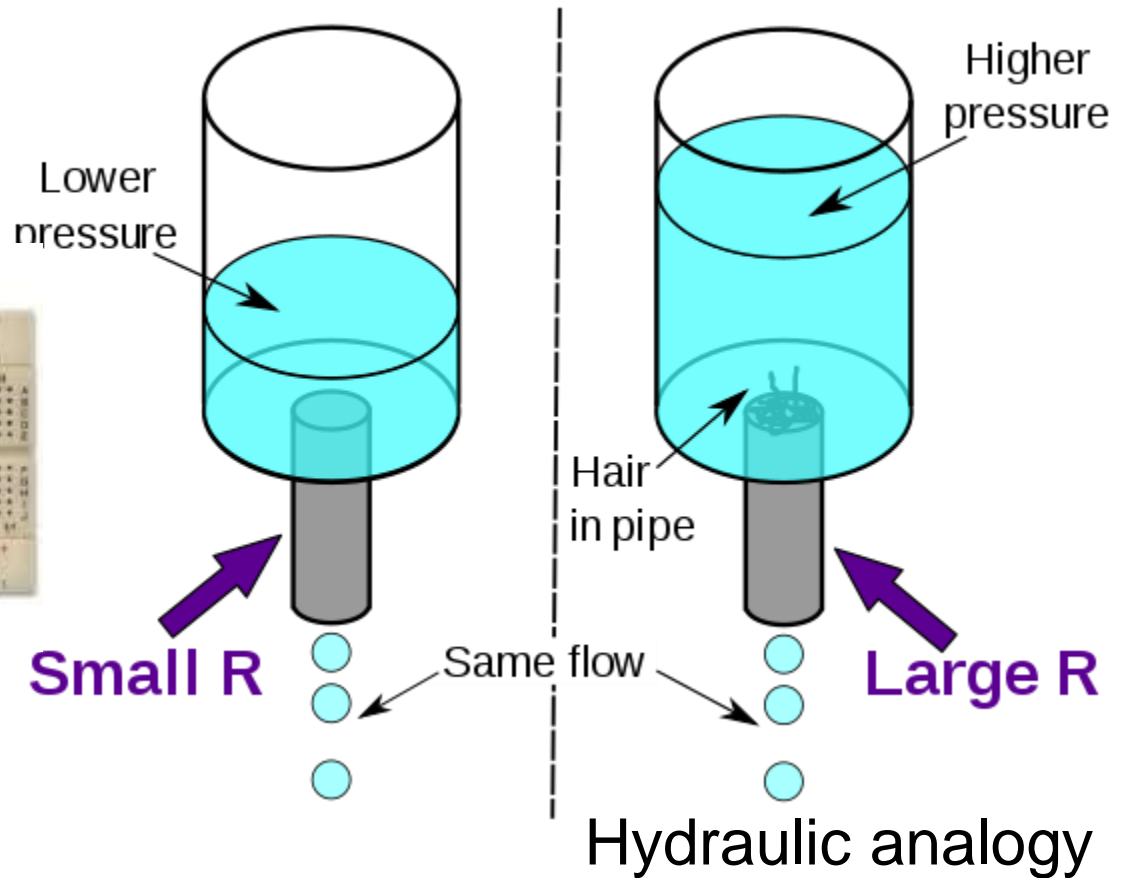
Blinking LEDs

- Blink sketch (pin 13) with own LEDs and resistors (Lesson 3 of Elegoo Arduino Kit)

- Breadboard

Ohm's Law, V=IR

Lower pressure

Higher pressure

Hair in pipe

Small R

Same flow

Large R

Hydraulic analogy

Thermal analogy, Q = dT/R
I = V/R

Source: Google Image,
Diode circuit

Kirchoff's Voltage Law

Blinking LEDs

- Blink sketch (pin 12) with own LEDs and [resistors](#)

- Blink sketch (pin 12) with own LEDs and [resistors](#) and pin 13. (Sequentially on and off vs. Both on and Both off.) [Arduino code](#)
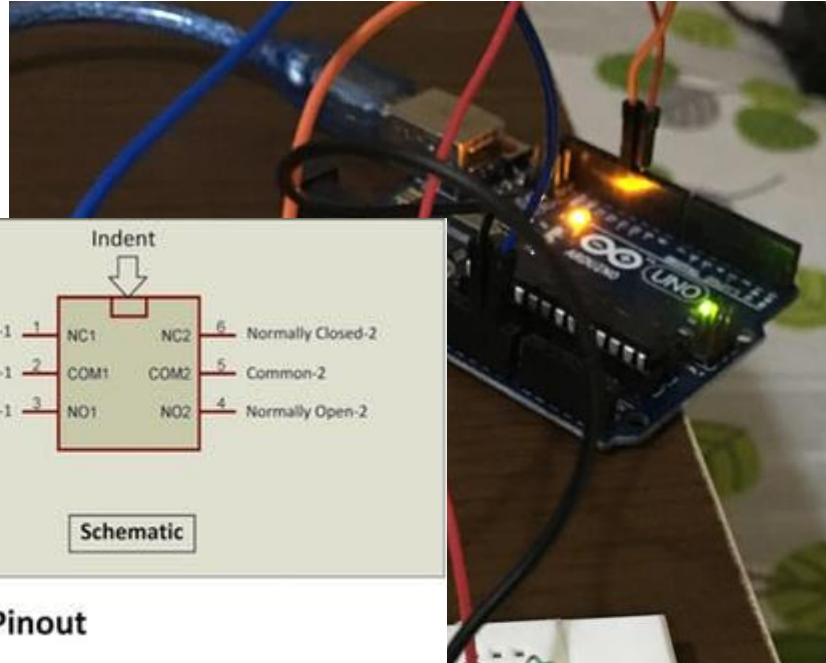
Announcements

- 29th Aug – no class on Thursday. On 29th Aug, from 4-5 pm if you have questions please let me know. 5-6 pm talk from Prof Pradeep Yammiyavar.

- Project development till minor test 1: One slide and one video of up to 1 minute on your project page. Video editing with Kdenlive or Adobe Premier Pro or Quik mobile phone app or others. Start developing your project on the project page of your website. Slide Video Date: 5th September.

- Assignment 1: Website Development deadline: 11th August (Please let us know your website through the google form so that we can evaluate.)

- Assignment 2: Project Proposal deadline: 18th August

- CRF Slots for makerspace orientation to be opened on Monday at 2 pm (as per Jugpreet) every week.

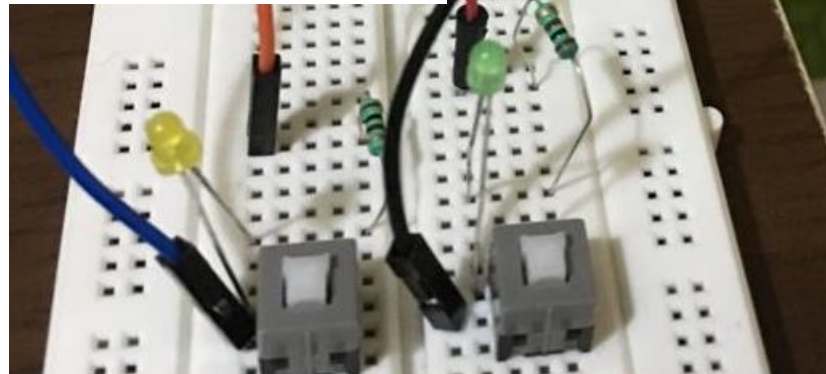- Arduinos and other electronics to be given to students.

Buttons

- Push buttons and LEDs

- [DPDT](#)

6 Pin Push Switch (Mini DPDT Push Switch) Pinout

- [Arduino code](#)

Push buttons (Input Pullup) – Lesson 5

- By default, input pullup pin is High, when push button pressed, it gets to Low. [Video](#)

Assignment 3

- In groups of **two**, write your first name by switching 9 LEDs on/off and push buttons such that:

1) With press of one push button, the letters of the name blink every 1000 ms

2) With press of another push button, all LEDs blink ON and then OFF with a delay of 1000 ms five times.

3) Extra credit: Also, print the letter typed on the Serial Monitor

 Note: Each group should have only one person from Elec/CS/PhD.

Hello Akhil   Hi Jay

Arduino features

- if then else

- function

- for loop

- serial communication with serial monitor

- Other examples

Suggestions for personal purchase

- Buy a digital multimeter
- Few components such as LEDs, resistors, basic sensors and actuators
- Arduino Kits
- Soldering Iron kit
- Amazon, element14
- Red fort – Lajpat Rai Market = Shop no. 595, 614, 625, etc.