

Overview

Thursday, 6 August 2015
8:57 AM

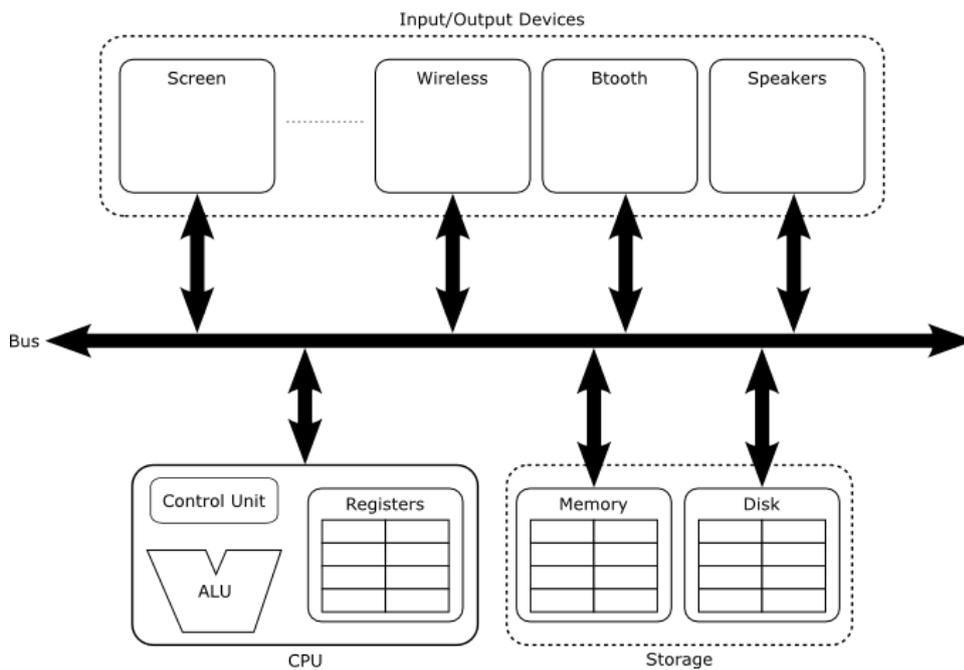
Arduino simulator: 123d.circuits.io

Lecture 1 Architecture

Wednesday, 8 July 2015
5:15 pm

Explain each element of the Von Neumann architecture.

CPU	Central processing unit, controls all communication between parts
Storage	Stores the results of calculations (data)
I/O	Sends and receives data from system



Types of memory

On board	Literally, on the circuit board Memory chips on the motherboard Can be volatile or non-volatile
Volatile memory	Only maintains its data when powered on RAM is volatile memory
Non-volatile memory	Computer memory that can retrieve stored data when power is cycled
ROM	Read only memory Non-volatile Can be read at high speed, but not changed by program instructions
RAM	Random access memory Any byte of memory can be accessed without touching preceding bytes Data stored as long as the computer is powered on

Lecture 2 Encoding

Friday, 31 July 2015
10:28 pm

Encoding

From base 2 to base 8	We are dividing by a power of the base Since, 2^3 is 8, we can remove the last 3 digits as the remainder
From base 2 to base 16	Same as above Since, 2^4 is 16, we can remove the last 4 digits as the remainder
From base 2 to base 10	Take the powers of 2, starting from 2^0
From base 10 to base 2	Successive divisions, taking the remainder backwards (most significant to least significant bit)
From base 8 to base 2	Expand to 3 bits
From base 16 to base 2	Expand to 4 bits

If you have n bits, you can encode 2^n numbers.
That is you can encode from zero to $(2^n)-1$.

How many bits do you need to encode number n in binary?
Take the ceiling of $\log_2(n)$.

For base 8, tack a 0 out the front
For base 16, tack a 0x out the front

Naturals are easy

Integers are encoded with sign and magnitude

Positive, 0

Negative, 1

What is the range of integers you can encode with n bits?
 $[(2^{n-1})-1, (2^{n-1})-1]$ -- $n-1$ because the first bit is reserved for sign

This is a problem for zero, as it has two codes

This is solved by the **2s complement**

If positive	Usual step for naturals
If negative	1. Encode the positive 2. Flip the bits 3. ADD ONE!

When going from 2sC to base 10:

1. Flip the bits
2. Add one
3. Remember the SIGN!!!

Range for n bits in 2s complement

[1000..... , 011111....]

$[-2^{(n-1)}, 2^{(n-1)}-1]$

Addition and subtraction in 2s complement IS AS NORMAL

Reals are a little different

They have 3 parts: sign, mantissa, and exponent

Method?

Shift the first non-zero number to the right of the decimal point (this becomes the mantissa)

Lab 02

Monday, 3 August 2015
10:24 am

Write a list with the three advantages and three disadvantages that you perceive in team work.

Advantages	Greater pool of knowledge Can achieve more than one person alone Can work to everyone's strengths and mitigate weaknesses
Disadvantages	There may be opposing views between members Not all members may be willing to work Requires good communication between members

Write a brief description of your experience with the situations described in the document given as resource. Describe also a situation in which a conflict appeared in a team in which you were a member and the strategy you should have followed to solve it.

Would you be able to describe what is the role of the following elements when designing an Arduino program?

Board	Hold all the Arduino components in place
Editor	Converts computer code to human readable code for editing Converts human readable code to computer code for use
Breadboard	Contains a set of tie points where you can place wires Each point is connected to a single rail All points on the same rail are connected to each other A component should NOT be connected to only one rail in case of shortcircuit Some components have a polarity and must be connected in correct direction
Pin	An electronic socket; can be configured for input or output

Microcontroller	Microprocessor equipped with memory and additional circuits to send and receive signals All components are integrated onto a single chip
Function	All Arduino programs must have at least two functions <i>Loop</i> and <i>setup</i>
Upload/Flash	Transferring compiled code to the Arduino from the PC