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Dec 16 – 20, 2019

What is Programming?



Computer Systems



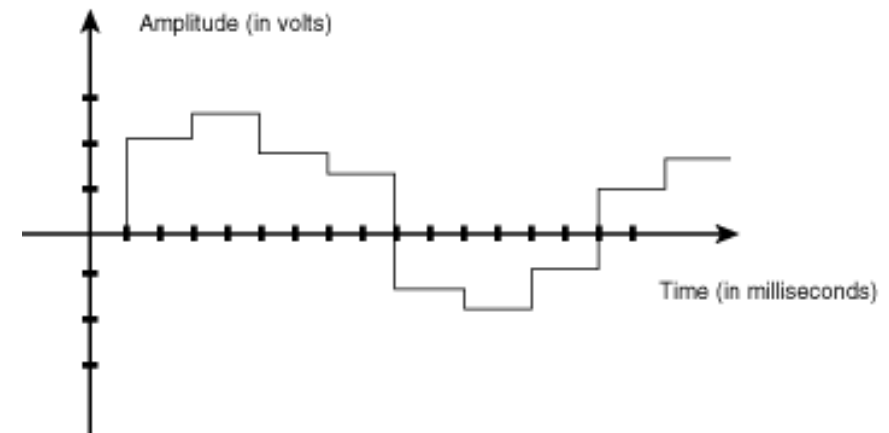
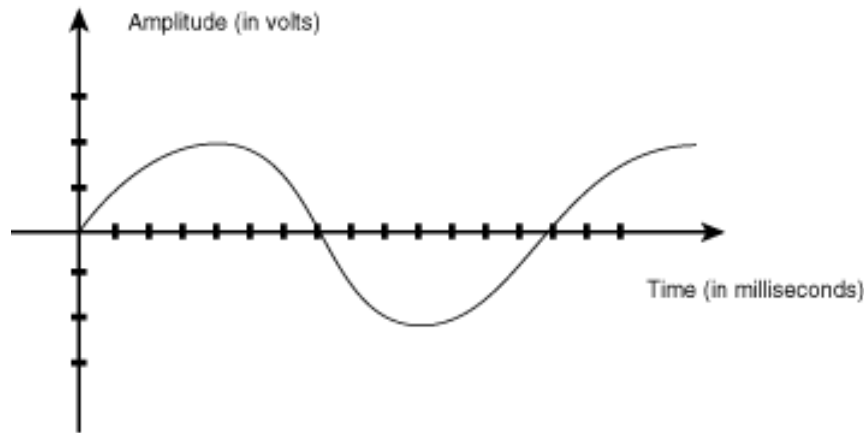
Google TV™



A computer is a machine.

The Advent of the Digital Age

- Analog vs. digital?



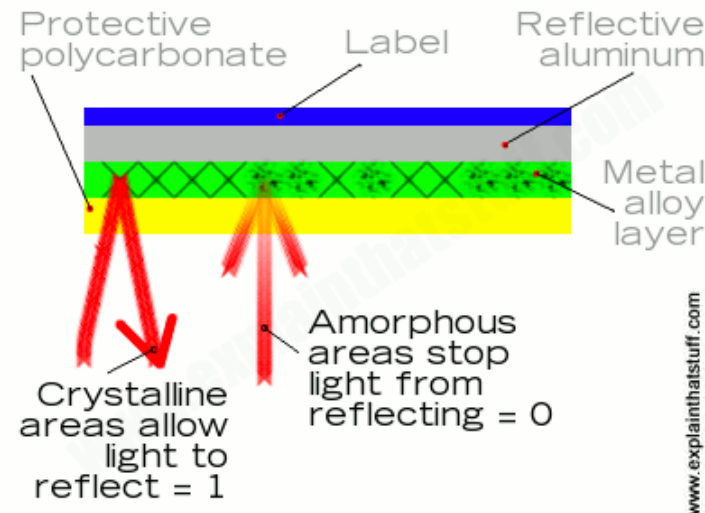
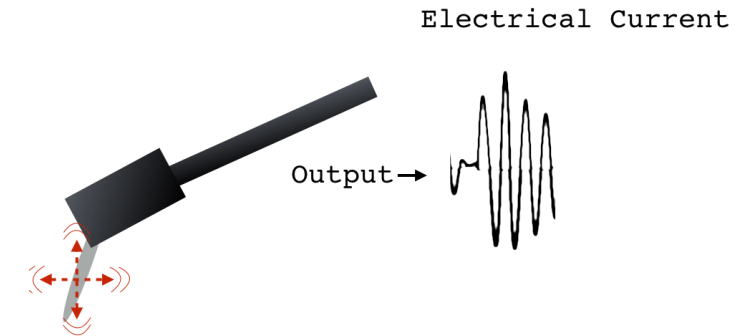
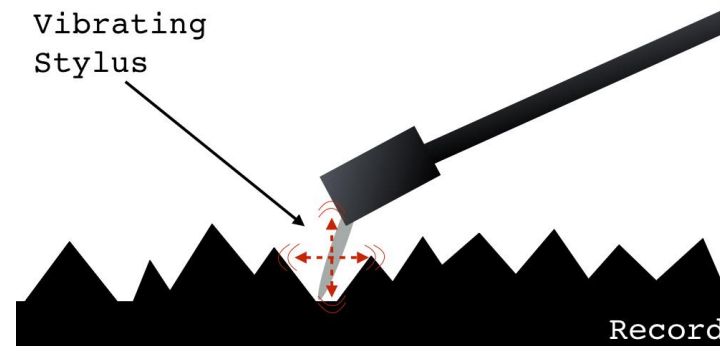
- Compact Disc (CD)

- 44.1 KHz, 16-bit, 2-channel

- MP3

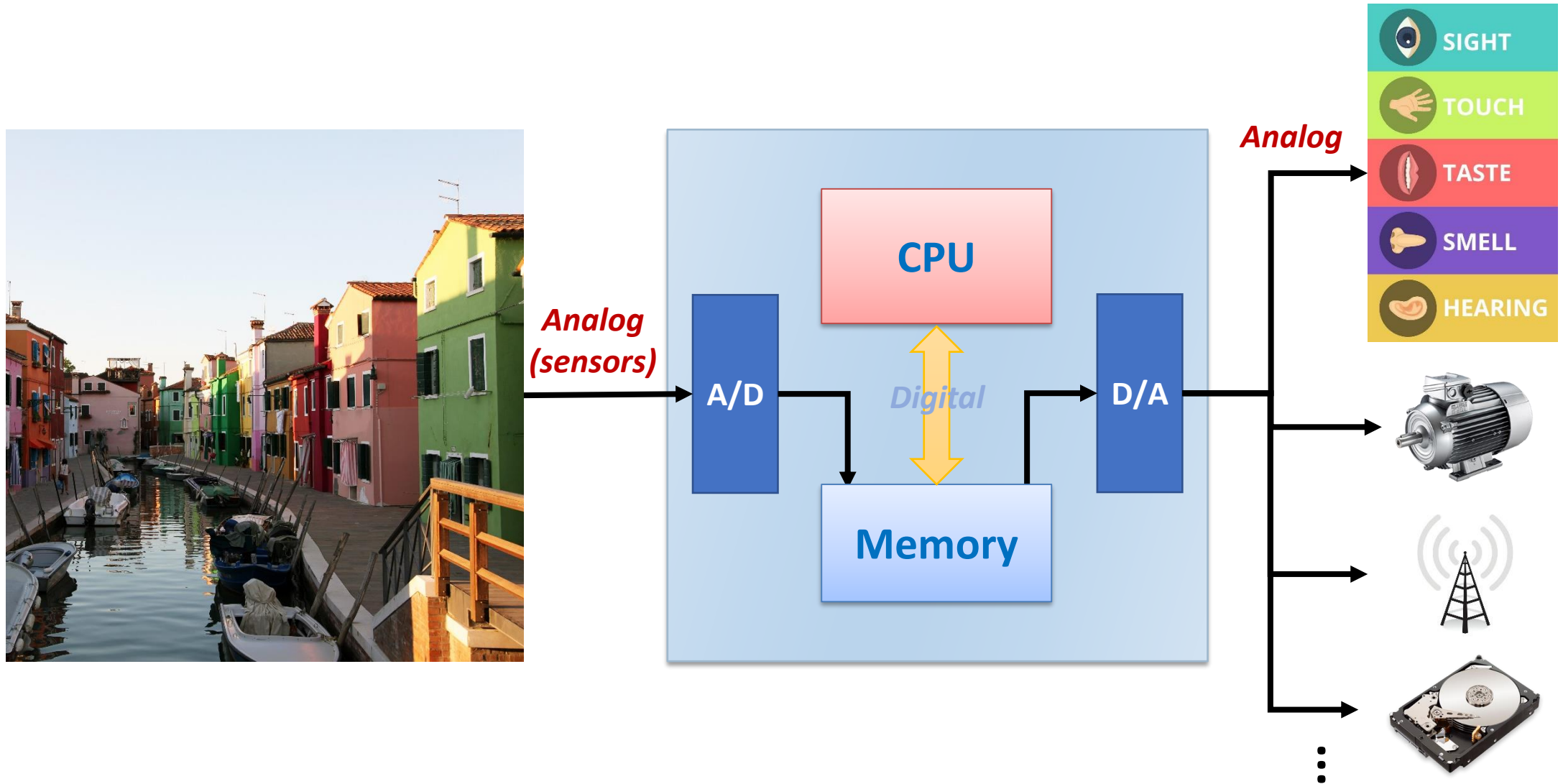
- A digital audio encoding with lossy data compression

LP Record vs. Compact Disc



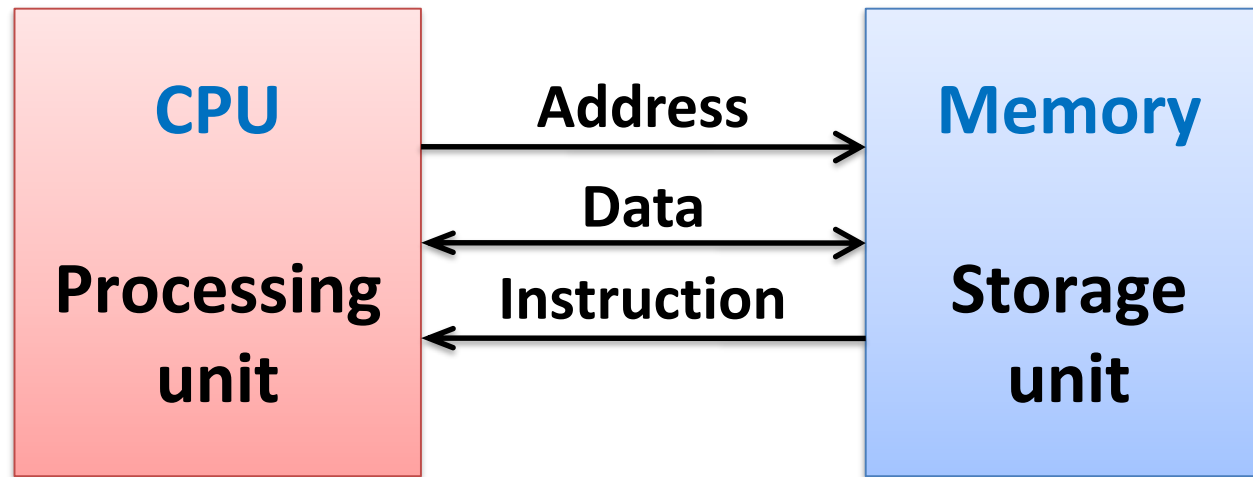
Source: <http://www.soundsetal.com/blog-how-do-vinyl-records-work/>
<http://www.explainthatstuff.com/cdplayers.html>

Digital Computer



Von Neumann Architecture

- By John von Neumann, 1945



Data movement
Arithmetic & logical ops
Control transfer

Byte addressable array
Code + data (user program, OS)
Stack to support procedures

Program? \approx Recipe!



준비시간 :10분, 조리시간 :10분

재료

라면 1개, 스프 1봉지, 오징어 1/4마리, 호박 1/4개, 양파 1/2개, 양배추 1장, 당근 1/4개, 물 3컵(600cc)

Ingredients
 \approx Data

만드는 법

- 1.오징어는 껍질을 벗기고 깨끗하게 씻어 칼집으로 모양을 낸다.
- 2.호박, 양파, 양배추는 모두 채썬다.
- 3.냄비에 물 3컵을 붓고 끓인다.
- 4.물이 끓으면 스프를 넣고 오징어와 야채를 넣어 충분히 맛이 우러나도록 5분 정도 끓여준다.
- 5.끓으면 면을 넣어 익힌다.

Directions \approx Instructions

CODE

단계 17: 농부3

5

전체단계



▶ 실행

소개



도와주세요! 밭을 모두 평평하게 만들 수 있게 프로그램을 수정해 주세요.

블록

작업 영역: 1 / 8 블록

동작
함수
논리
반복
계산
변수

실행하면

치우기1번

앞으로 이동

왼쪽으로 회전 ↶ ▼

오른쪽으로 회전 ↷ ▼

만약 흙더미가 ▼ 있으면
do

반복 7 번
실행

Code.org

CODE

단계 17: 농부3

5

전체단계



▶ 실행

소개



도와주세요! 밭을 모두 평평하게 만들 수 있게 프로그램을 수정해 주세요.

블럭

작업 영역: 8 / 8 블럭

동작
함수
논리
반복
계산
변수

실행하면

반복 7 번

실행

앞으로 이동

만약 흙더미가 있으면

do 치우기1번

왼쪽으로 회전 90

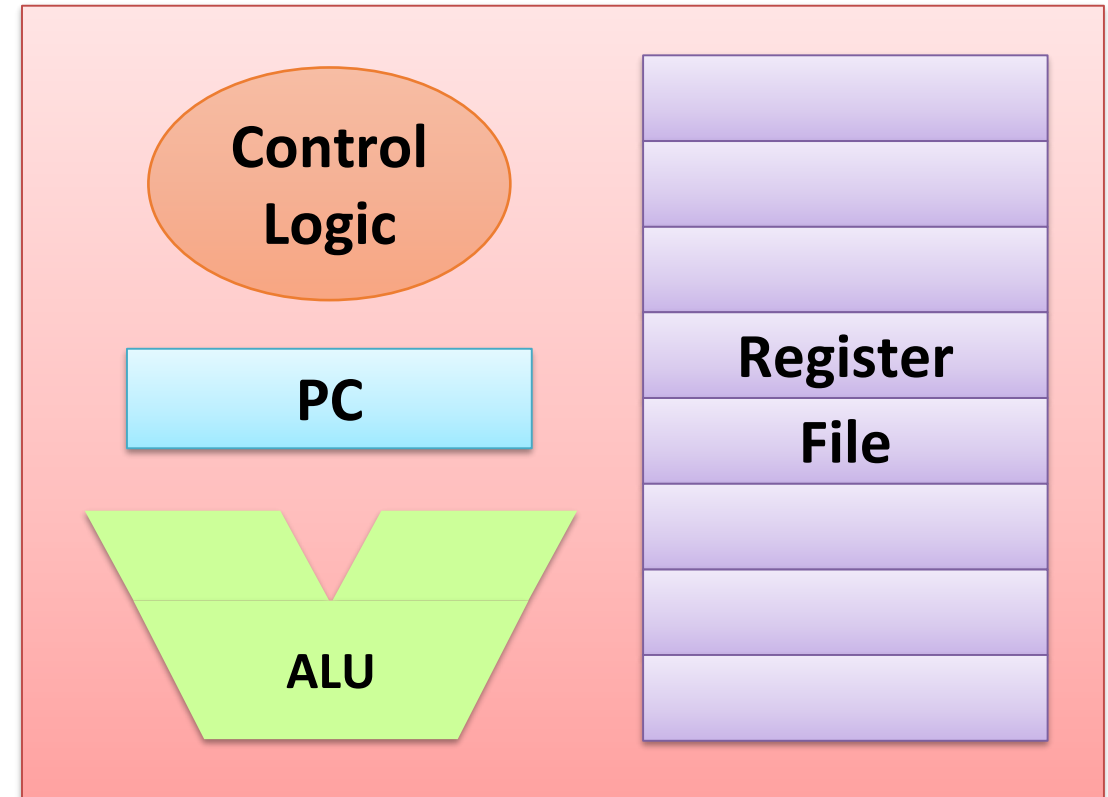
앞으로 이동

오른쪽으로 회전 90

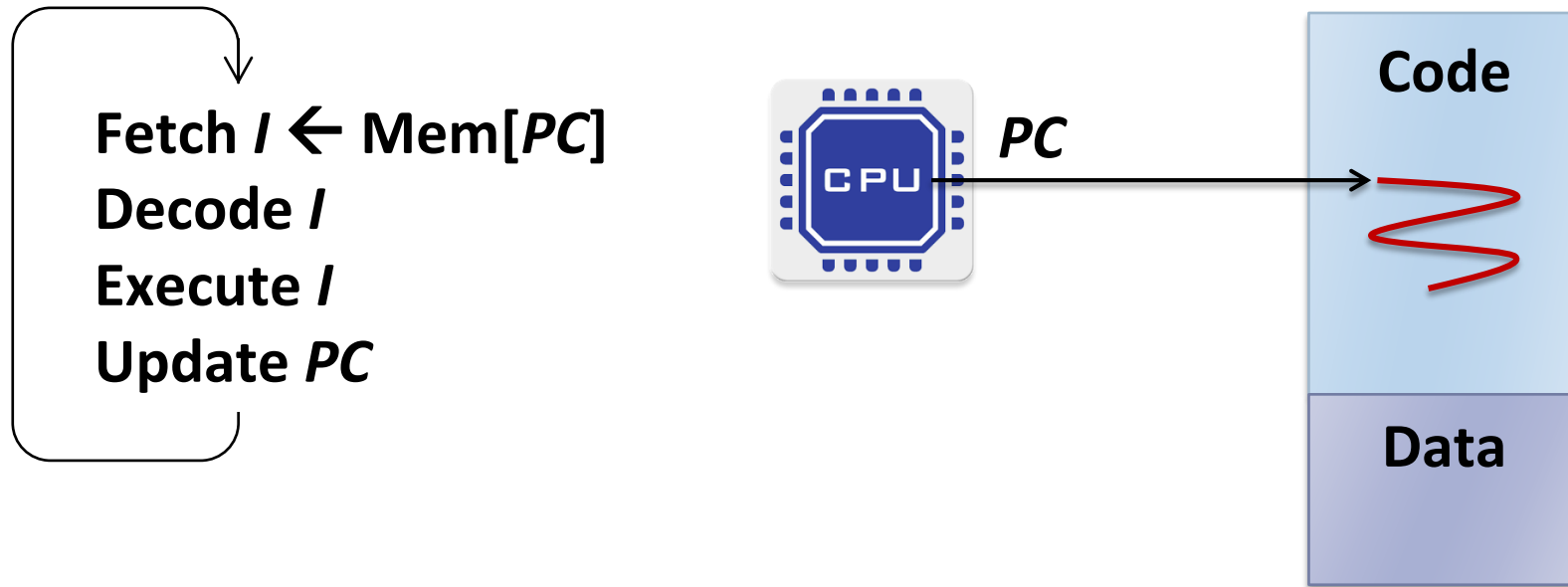
CPU

■ Central Processing Unit

- PC (Program Counter)
 - Address of next instruction
- Register file
 - Heavily used program data
- ALU (Arithmetic & Logic Unit)
 - Arithmetic operations
 - Logical operations
- Control logic
 - Control instruction fetch, decoding and execution



The (Dumb) Life of CPU



Data transfer instructions
Arithmetic/Logical instructions
Control transfer instructions

Programming Elements: Data Types

- Integer: 8-bit, 16-bit, 32-bit, 64-bit
 - Unsigned
 - Signed (Two's complement)
- Floating point
 - Single precision: 32-bit
 - Double precision: 64-bit

Programming Elements: Operations

- **Computation**
 - Arithmetic operations: Addition, Subtraction, Multiplication, Division
 - Logical operations: AND, OR, XOR, NOT, Logical shift left/right, Arithmetic shift/right, ...
- **Memory access:** Load & Store
- **Conditional branch**
 - Conditional: IF ... THEN ... ELSE
 - Loops: FOR, WHILE, ...
- All problems that can be solved by programming can be decomposed into these elements (+ I/O).