Exploring Computer Science

Digital

Analog

- Stored or transmitted signal is direct analogy to original information
- Record: depth of groove varies with sound
- Telephone: current generated in proportion to sound pressure
- AM radio: amplitude of wave directly related to sound

Analog pros/cons

- Simplicity
- Authenticity
- Cheap

- Easily distorted
  - Dust on record
  - Electric motors interfere with radio
  - Stretching of tapes

Digital

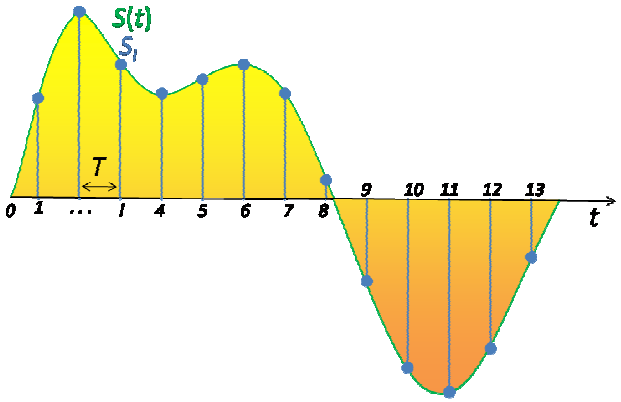
- Systems which process numbers
- Derivation of ‘digit’

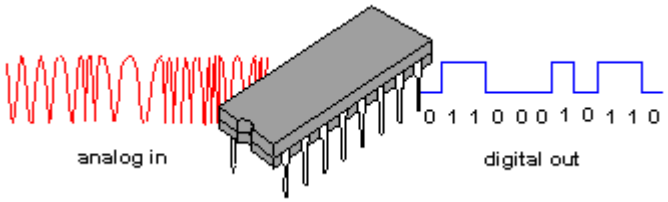
- Copies are always exactly the same
- Lots of manipulations possible

- Loss in sampling

Digital audio

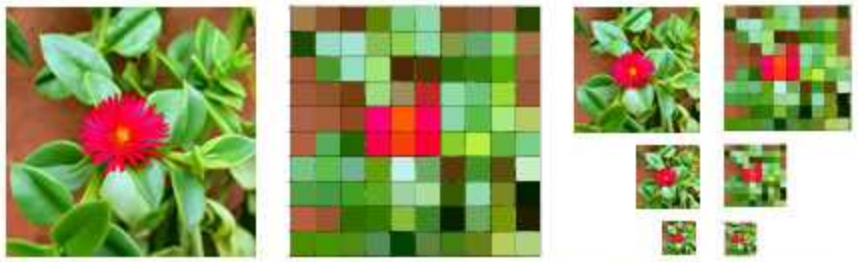
- Sample at a series of discrete time intervals
- For CDs, log 44100 entries for every second
  - Sample rate of 44.1kHz
- Each entry is sound pressure to 5 decimal digits for each audio channel
  - 16-bit





Digital imagery

- Store color/shade information so many times in an inch
- Convert color information to number
  - Limited number of colors can be represented

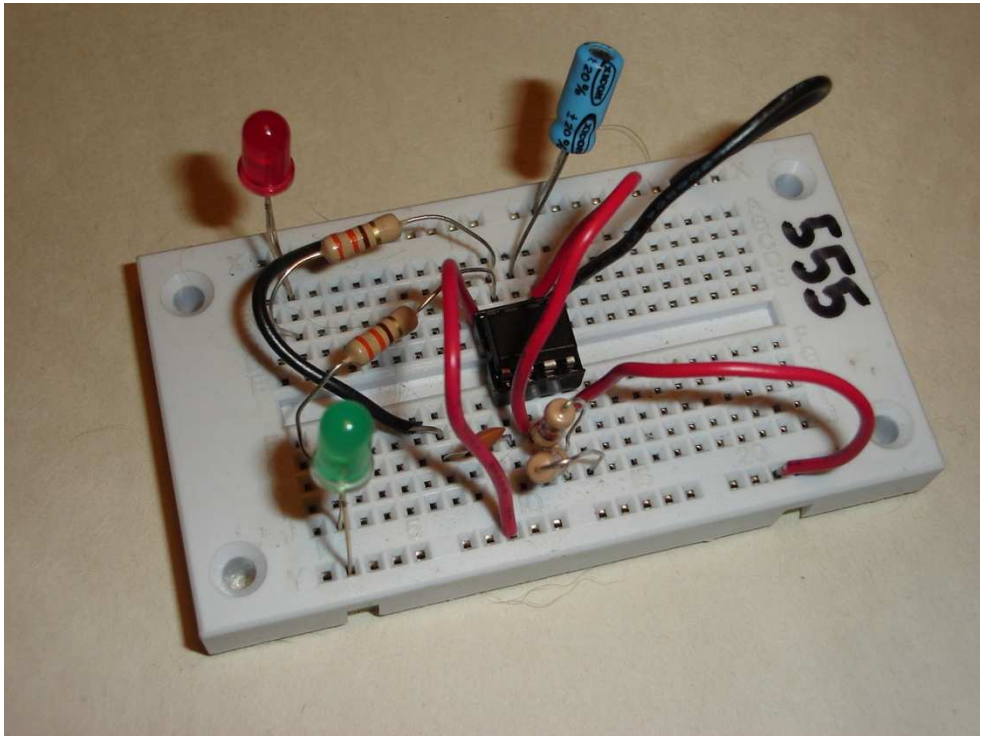


Compression

- Give up information for smaller storage size

Blinking LED

- Analog voltage change in (capacitor discharge)
- Digital signal out (on or off)



Today: 7-segment display

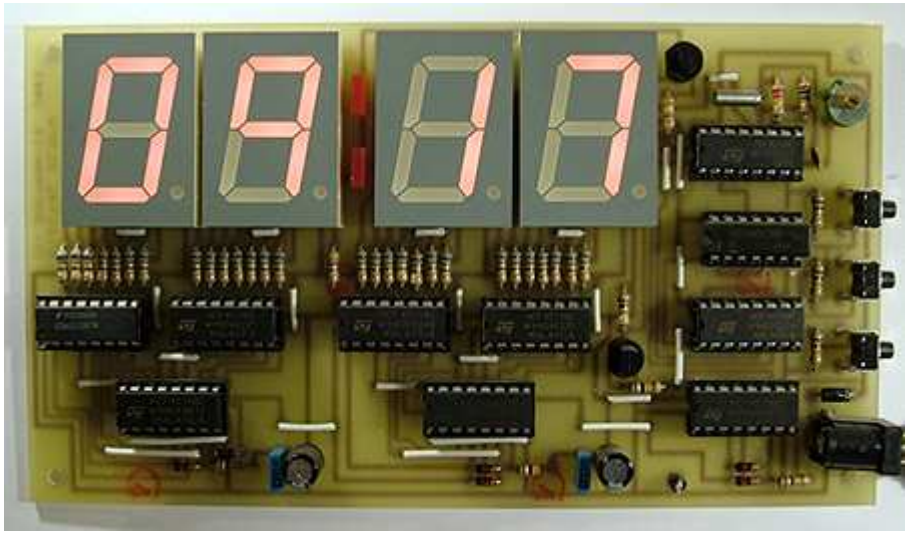
- Build a digital circuit – a little less guidance!

Binary

- Two symbols: 0 and 1
- In computers: bits (for binary digit)
- Cheaper to make hardware using switches
- Switches have two states: on and off

Binary for 7-segment display

- Uses fewer switches than controlling segments separately
- Now we can use computer devices as input



Convert from binary

$2^4 = 16$	$2^3 = 8$	$2^2 = 4$	$2^1 = 2$	$2^0 = 1$
0	1	1	0	1

8 + 4 + 1 = 13

$2^4 = 16$	$2^3 = 8$	$2^2 = 4$	$2^1 = 2$	$2^0 = 1$
1	1	1	0	0

16 + 8 + 4 = 28

ASCII

Binary	Glyph
100 0001	A
100 0010	B
100 0011	C
100 0100	D
100 0101	E
100 0110	F
100 0111	G
100 1000	H
100 1001	I
100 1010	J
100 1011	K
100 1100	L
100 1101	M
100 1110	N
100 1111	O
101 0000	P
101 0001	Q
101 0010	R
101 0011	S
101 0100	T
101 0101	U
101 0110	V
101 0111	W
101 1000	X
101 1001	Y
101 1010	Z

Count to 1023 on your fingers