

CS 208

Fri, 22 Sep 2023

0 1 2 3 4 5 6 7 8 9

$$347_{\text{ten}} = 3 \times 10^2 + 4 \times 10^1 + 7 \times 10^0$$

01 only symbols available

$$1011_{\text{two}}$$

$$= 1 \times 2^3 + 0 \times 2^2 + 1 \times 2^1 + 1 \times 2^0$$

$$= 11_{\text{ten}}$$

$$\begin{array}{cccc}
 1 & 1 & 0 & 1 \\
 16 & 8 & 4 & 2 \\
 \hline
 & & & 1
 \end{array}
 \text{two} = 16 + 8 + 2 + 1$$

$27_{\text{ten}} =$

$$23_{\text{ten}} = \text{?}_{\text{two}}$$

How many 16's in 23? 1

$$\begin{aligned}
 23_{\text{ten}} &= 16 + 7 && \text{how many 8's in 7} \\
 &= 16 + 0 + 7 && 0 \\
 &= 16 + 0 + 4 + 3
 \end{aligned}$$

$$= 16 + 0 + 4 + 2 + 1 = 10111_{\text{two}}$$



Base 2 mult.'n is easy

$$\begin{array}{r} 1011 \\ 101 \\ \hline 1011 \\ 0000 \\ 0000 \\ 1011 \\ \hline \end{array}$$

$$\begin{array}{r} 157 \\ 29 \\ \hline [a \times 157] \end{array}$$

Decimal is more convenient

Binary is how computers  
store stuff

Converting D  → B  
is a pain  .

# Hexadecimal / base 16

0 1 2 3 4 5 6 7 8 9 A B C D E F  
10 11 12 13 14 15

$$3B_{\text{hex}} = ?_{\text{ten}}$$

$$\begin{matrix} 16^1 & 16^0 \\ 16 & 1 \end{matrix} = 3 \times 16^1 + 11 \times 16^0 = 59_{\text{ten}}$$

$$3B_{\text{hex}} = ?_{\text{two}} = 111011_{\text{two}}$$

0 0 1 1 1 0 1 1

$1AC_{hex} = ?_{two}$

$16^2$	$16^1$	$16^0$	hex	
"	"	"		
256	16	1		

$= 256 + 10 \times 16 + 12$

$= 416 + 12 = 428_{ten}$



~~0001; 1010; 1100~~

$10101100_{two}$

A6<sub>hex</sub>

2 hexadecimal  
digits

10100110 1 byte

1010 4 bits = "nibble"



# Characters

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1963 ASCII

American Standard  
Code for Information  
Interchange

ASCII

$$A = 65 = 41_{\text{hex}} = 01000001$$

$$a = 97 = 61_{\text{hex}} = 01100001$$

# Marking end of line

$\backslash r \backslash n$  ← Windows/DOS  
CR LF Internet protocols

$\backslash r$  ← macOS 1-9

$\backslash n$  ← Unix  
(incl. macOS X 1-14)