Administrivia

- OH: Tuesday (and/or Thursday) 10-11, Soda Alcoves
- hw0 due next week, hw1 due soon after (so start learning C if you don't know it!)

Expectations

- Be respectful, courteous, etc. (come on, we're all college students...)
- Help your fellow classmates
- Have fun! ^__^

Number Representation

- A number $d_n...d_0$ in base B => $d_n \times B^n + ... + d_0 \times B^0$, each digit must be less than B
- For example: 354 in base 7 is $3 \times 7^2 + 5 \times 7^1 + 4 \times 7^0 = 186$ (in base 10)
- In 61c, we'll work with base 2 (binary), and base 16 (hexadecimal)

Number Bases

Decimal	Binary	Hex
0	0b0000	0x0
1	0b0001	0x1
2	0b0010	0x2
3	0b0011	0x3
4	0b0100	0x4
5	0b0101	0x5
6	0b0110	0x6
7	0b0111	0x7
8	0b1000	0x8
9	0b1001	0x9
10	0b1010	0xA
11	0b1011	0xB
12	0b1100	0xC
13	0b1101	0xD
14	0b1110	0xE
15	0b1111	0xF

IEC Prefixes

Name	Abbr	Factor
kibi	Ki	2^{10}=1,024
mebi	Mi	2^{20}=1,048,576
gibi	Gi	2^{30}=1,073,741,824
tebi	Ti	2^{40}=1,099,511,627,776
pebi	Pi	2^{50}=1,125,899,906,842,624
exbi	Ei	2^{60}=1,152,921,504,606,846,976
zebi	Zi	2^{70}=1,180,591,620,717,411,303,424
yobi	Yi	2^{80}=1,208,925,819,614,629,174,706,176

Exercises

1. Fill in the following table.

Decimal	Binary	Hex
29	0b0001 1101	0x1D
159	0b1001 1111	0x9F
33	0b0010 0001	0x21
127	0b0111 1111	0x7F
213	0b1101 0101	0xD5
255	0b1111 1111	0xFF

2. Scientists have discovered an ancient alien civilization on Mars! The aliens seem to have used an alphabet with 132 letters. What is the minimum number of bits required to represent all of the letters?

8 bits, since $2^7 < 132$, and $2^8 > 132$

How many "wasted" combinations are there? What are some things we can use these bits for?

With 8 bits, we can represent $2^8 = 256$ things, so 256 - 132 = 124 extra combinations. These combinations can be used for spaces, newlines, punctuation, etc.

3. Convert the following numbers into IEC format.

2^{23}	8 Mi	2^7	128	2^{61}	2 Ei	2^{44}	16 Ti	2^{37}	128 Gi

4. Convert the following IEC numbers into a power of 2.

128 Ei	2^{67}	8 Ti	2^{43}	16	2^4	64 Ki	2^{16}	256 Pi	2^{58}

5. Bing's magical laptop has 3 TiB of memory (there are 3 Ti unique addresses). How many bits would Bing need to make full use of his memory?

42 bits