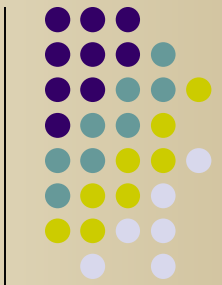
ENGR/CS 101 CS Session Lecture 1

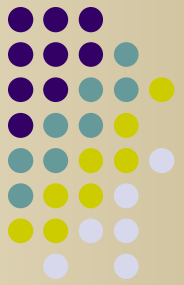


- CS session webpage
  - http://csserver.evansville.edu/~hwang/f14-courses/cs101.html
- Introduction sheet, turn in at the end of class
- The CS session constitutes 1/3 of the final course grade for ENGR/CS 101

Outline

- What is Computer Science?
- Bits to Brains
  - Binary digits (bits)
  - Binary numbers
  - ASCII encoding

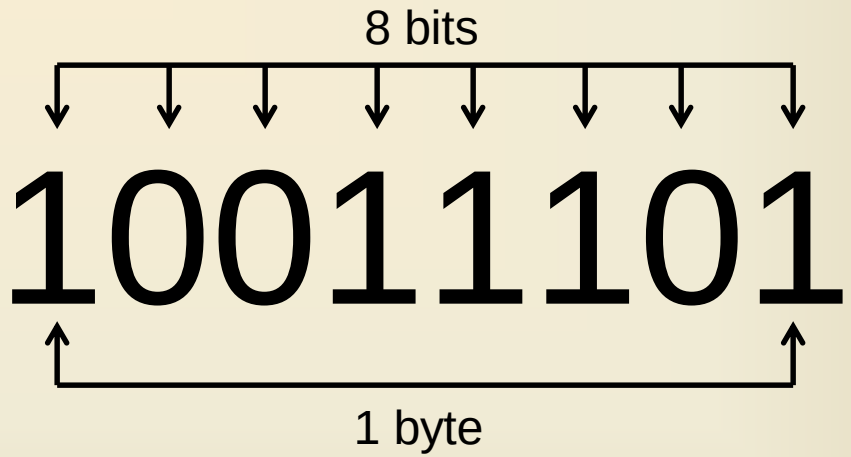
What is Computer Science?



- Short video by University of Washington
  - "Power to Change the World"
- Study of how computer programs are written to solve problems using computation
- Use an engineering approach to design and implement a computer program
- But first, a look at a basic idea underlying computing

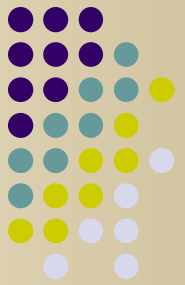
Binary Digits (Bits)

- A *bit* is a digit that can have value 0 or 1.



- A *byte* is (a sequence of) 8 bits
- A *word* is 16, 32, or 64 bits, depending on the machine architecture.

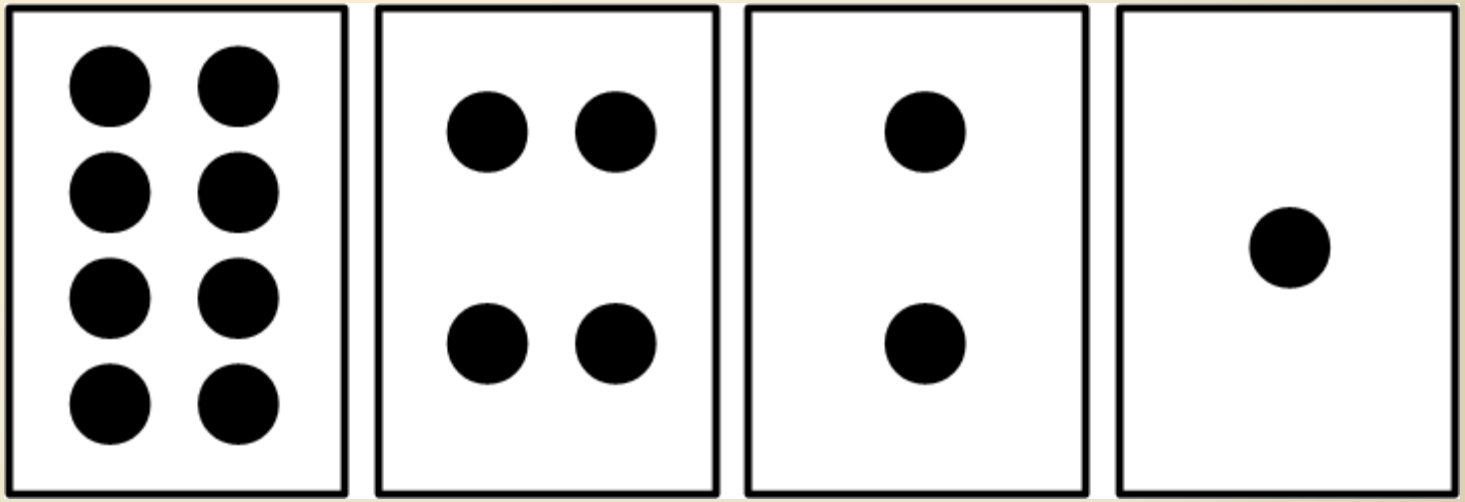
Binary Numbers



- Use the cards to help answer the following questions:
  - What cards can we use to show 3 dots? 6 dots? 11 dots?
  - What is the highest number of dots that we can represent with these cards?
  - What is the smallest number of dots we can represent with these cards?
  - What is the pattern of the dots? How many dots would there be on a fifth card?

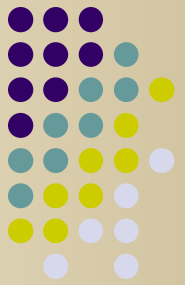
Binary Numbers

- Arrange the cards like so:



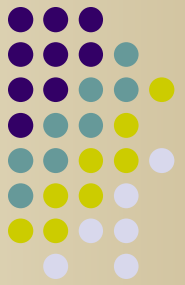
  - Count from 0 to 15 dots by flipping over the cards
  - What is the pattern as you count?

Binary Numbers



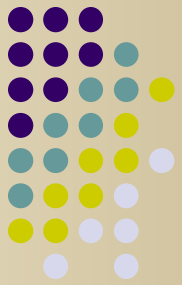
- Each digit place represents a power of the base of the number in decimal. E.g.,
  - $356_{10} = 3 \times 10^2 + 5 \times 10^1 + 6 \times 10^0$
  - $10011101_2 = 1 \times 2^7 + 0 \times 2^6 + 0 \times 2^5 + 1 \times 2^4 + 1 \times 2^3 + 1 \times 2^2 + 0 \times 2^1 + 1 \times 2^0 = 157_{10}$
- What is 01000111_2 in decimal? What is 97_{10} in binary?

Characters



- Computers "speak" bits and bytes, but humans communicate using letters, words, and sentences.
- Need to encode characters into bits. One such encoding is called ASCII (American Standard Code for Information Interchange).
  - Alphabet-based
  - Ordering based on English alphabet
  - Extended for other languages' alphabet symbols

ASCII Encoding (Decimal)



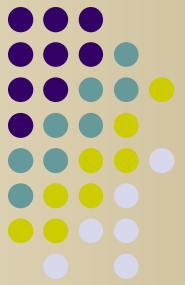
A	65
B	66
C	67
D	68
E	69
F	70
G	71
H	72
I	73
J	74
K	75
L	76
M	77
space	32

N	78
O	79
P	80
Q	81
R	82
S	83
T	84
U	85
V	86
W	87
X	88
Y	89
Z	90
!	33

a	97
b	98
c	99
d	100
e	101
f	102
g	103
h	104
I	105
j	106
k	107
l	108
m	109
,	44

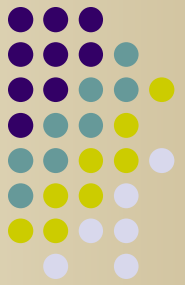
n	110
o	111
p	112
q	113
r	114
s	115
t	116
u	117
v	118
w	119
x	120
y	121
z	122
.	46

Characters



- How many bits will it take to implement ASCII encoding of characters?
- Can you find a mathematical equation to calculate the number of bits needed to represent a number *n*?

In-class Exercise



- Decode the ASCII message on the worksheet
- Write your first name in ASCII in binary
- Turn in the worksheet and the introduction sheet before you leave.