What is Computer Science?

Computer Science Defined?

- “computer science” —which, actually is like referring to surgery as “knife science”
  - **Prof. Dr. Edsger W. Dijkstra**

- “A branch of science that deals with the theory of computation or the design of computers”
  - **Webster Dictionary**

- Computer science "is the study of computation and information”
  - **University of York**

- “Computer science is the study of process: how we or computers do things, how we specify what we do, and how we specify what the stuff is that we’re processing.”
  - **Your Textbook**

Computer Science in Reality

The study of using computers to solve problems.

Fields of Computer Science

- Software Engineering
- Multimedia (Game Design, Animation, Data Visualization)
- Web Development
- Networking
- Big Data / Machine Learning / AI
- Bioinformatics
- Robotics
- Internet of Things
- …

Computers Rule the World!

- Shopping
- Communication / SocialMedia
- Work
- Entertainment
- Vehicles
- Appliances
- Banking
- …

Overview of the Couse

- Learn a programming language
- Develop algorithms and write programs to implement them
- Understand how computers store data and multimedia
- Have fun!

Programming Languages

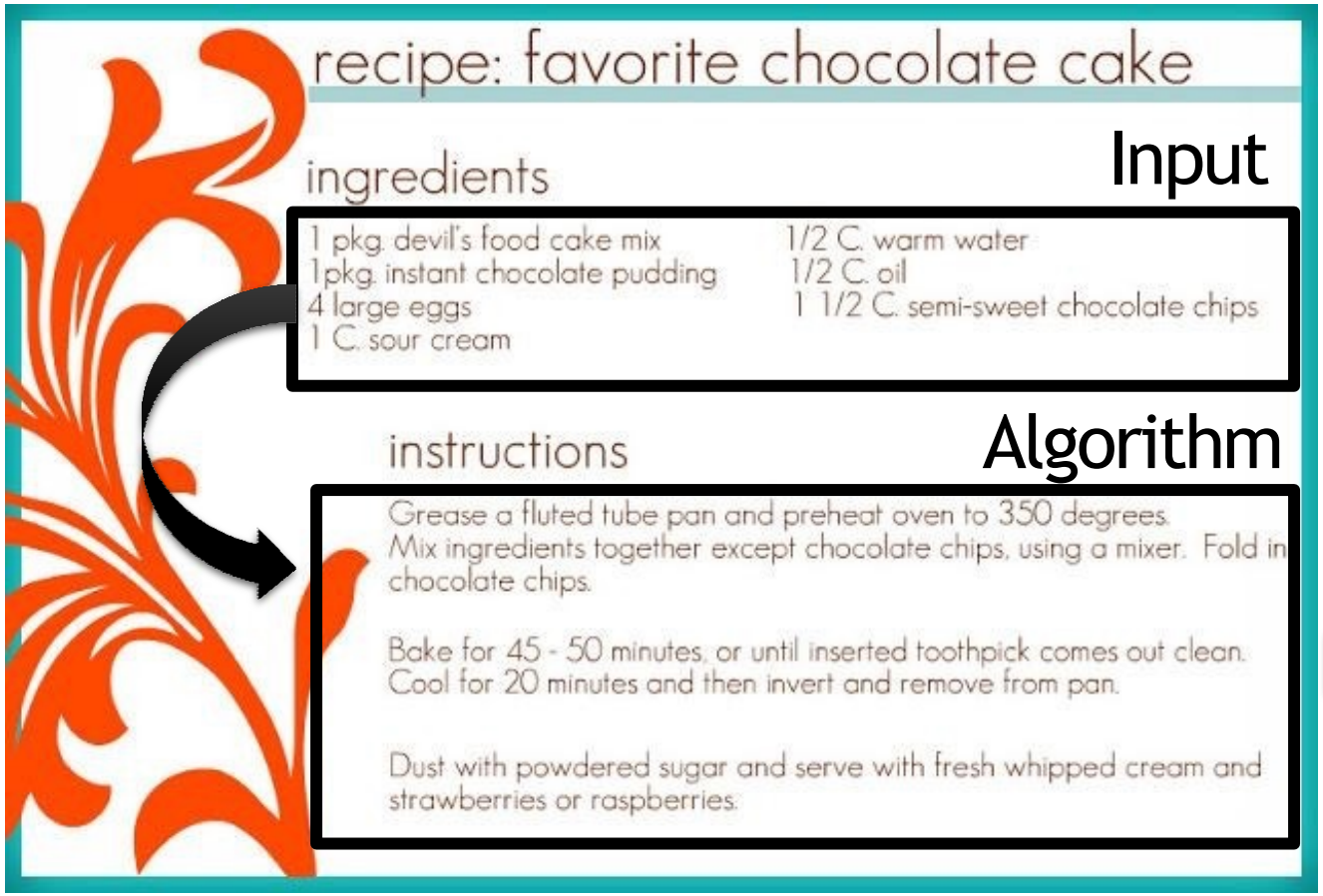
- How we communicate with computers in a way they understand
- Lots of different languages, some with special purposes
- How we write programs to implement algorithms

What's an Algorithm?

- An ***algorithm*** is a finite series of instructions applied to an input to produceoutput.

- Computer programs are made up of algorithms.

The “Recipe” Analogy



Output

But Computers Don’t Understand Cake!

How We Use Numbers

Everything is a power of 10!

Example: 181

How We Use Numbers

Everything is a power of 10!

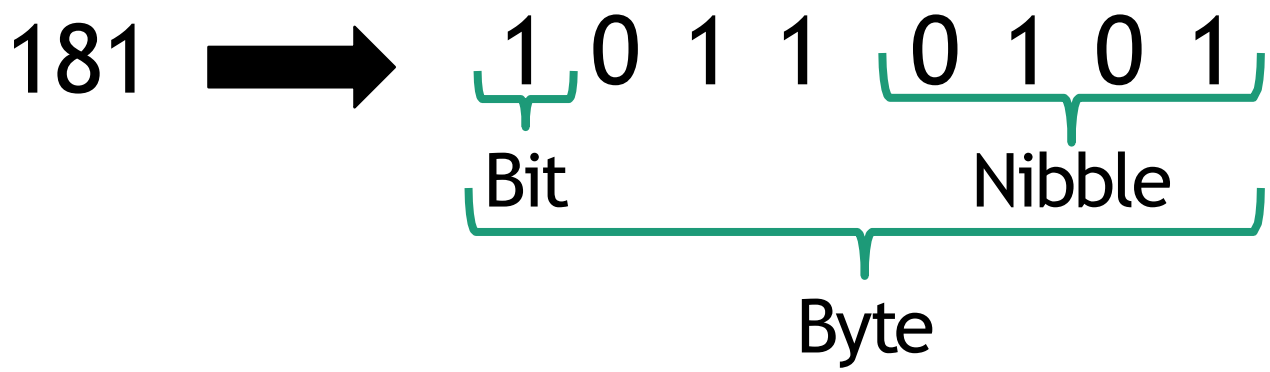
Example: 181

10^3	10^2	10^1	10^0
0	1	8	1

$1000*0 + 100 * 1 + 10*8 + 1*1 =$ 181

How Computers Store Information

Everything is stored in ***binary*** as a series of 1's and 0's



2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	0	1	1	0	1	0	1

128*1 + 64*0 + 32*1 + 16*1 + 8*0 + 4*1 + 2*0 + 1*1 = 181

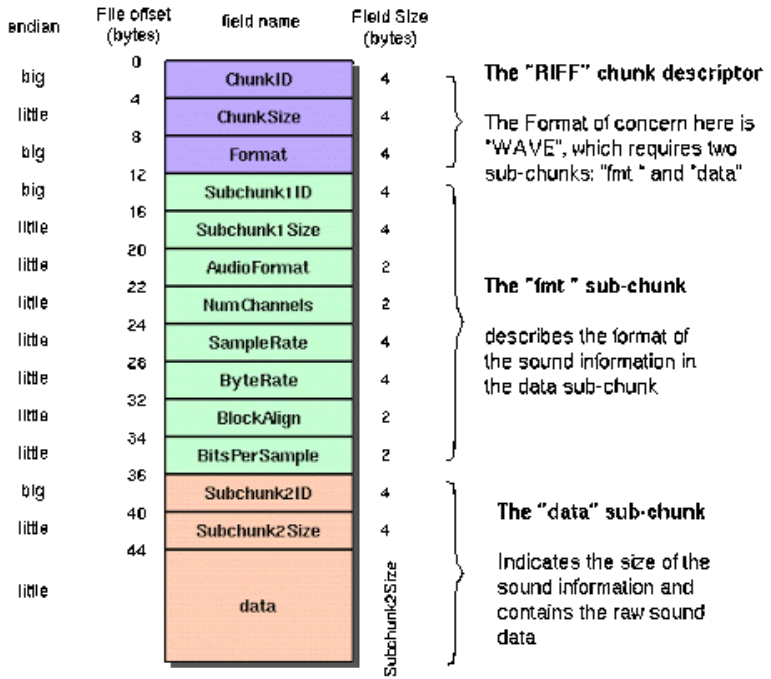
Storing Complex Data

Storing text and other more complex information requires an ***encoding*** format to describe the data in binary/numerical representation.

ASCII

Decimal	Character
65	A
66	B
67	C
68	D
69	E
70	F
...	...

WAV Audio Format



You Try!

ASCII

Decimal	Character
65	A
66	B
67	C
68	D
69	E
70	F
…	…

- Let's spell the word "ACE" in binary (all capital letters)
- First convert the letter to the decimal value
  - A = 65
- Now convert 65 to binary

2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
0	0	0	0	0	0	0	0

You Try!

ASCII

Decimal	Character
65	A
66	B
67	C
68	D
69	E
70	F
…	…

- Let's spell the word "ACE" in binary
- First convert the letter to the decimal value
  - A = 65
- Now convert 65 to binary

2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
0	0	0	0	0	0	0	0

$2^7 = 128$
That is far too large.
Leave it zero.

You Try!

ASCII

Decimal	Character
65	A
66	B
67	C
68	D
69	E
70	F
…	…

- Let's spell the word "ACE" in binary
- First convert the letter to the decimal value
  - A = 65
- Now convert 65 to binary

2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
0	1	0	0	0	0	0	0

$2^6 = 64$
That is less than or equal to 65.
Let's mark this with a 1.

You Try!

ASCII

Decimal	Character
65	A
66	B
67	C
68	D
69	E
70	F
…	…

- Let's spell the word "ACE" in binary
- First convert the letter to the decimal value
  - A = 65
- Now convert 65 to binary

2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
0	1	0	0	0	0	0	1

All we need now is a 1 (65 – 64 = 1).
Let's mark the 2^0 position with a 1.

You Try!

ASCII

Decimal	Character
65	A
66	B
67	C
68	D
69	E
70	F
…	…

- Let's spell the word "ACE" in binary
- First convert the letter to the decimal value
  - A = 65
- Now convert 65 to binary

2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
0	1	0	0	0	0	0	1

$$2^7(0) + 2^6(1) + 2^5(0) + 2^4(0) + 2^3(0) + 2^2(0) + 2^1(0) + 2^0(1) = 65$$

You Try!

ASCII

Decimal	Character
65	A
66	B
67	C
68	D
69	E
70	F
…	…

- A = 65 = 01000001
- Try to convert capital C and E to binary on your own!