Welcome to

SPIS

Which do you feel is the most influential invention of all time?

[A] Paper

[B] Gunpowder

[C] Electricity

[D] Compass

[E] Antibiotics

What is Computer Science?

What word comes to mind when you think of "Computer Science"?

You can answer up to 5 times.
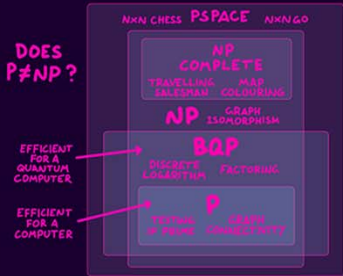
https://bit.ly/spis_cs

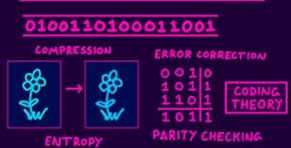# What exactly is Computer Science?

Data * Algorithms * Programming * Binary * Problem Solving
Computational Thinking * Hardware * Creativity * Proofs * Logic * …
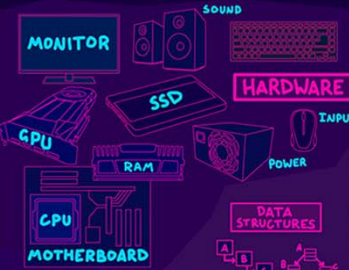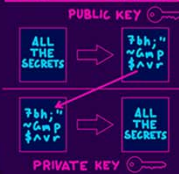
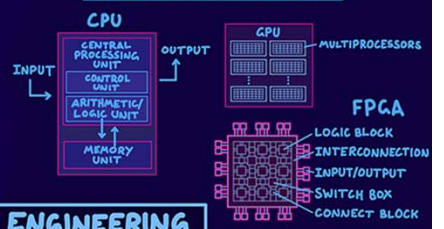# MAP OF COMPUTER SCIENCE

COMPUTATIONAL COMPLEXITY

DOES P≠NP?

NXN CHESS PSPACE NXN GO

NP COMPLETE
TRAVELLING SALESMAN   MAP COLOURING

NP
GRAPH ISOMORPHISM

BQP
DISCRETE LOGARITHM   FACTORING

P
TESTING IF PRIME   GRAPH CONNECTIVITY

EFFICIENT FOR A QUANTUM COMPUTER

EFFICIENT FOR A COMPUTER

INFORMATION THEORY

0100110100011001

COMPRESSION

ENTROPY

ERROR CORRECTION
0 0 1 0
1 0 1 1
1 1 0 1
1 0 1 1

CODING THEORY

PARITY CHECKING

CRYPTOGRAPHY

PUBLIC KEY

ALL THE SECRETS → 7bh;"~ômp ţΛvr

7bh;"~ômp ţΛvr → ALL THE SECRETS

PRIVATE KEY

MONITOR   SOUND

HARDWARE   SSD   INPUT

GPU   RAM   POWER

CPU   MOTHERBOARD

DATA STRUCTURES

A B C D   LINKED LIST   LIST

TREE   GRAPH   STACK   HASHING

SCHEDULING

PROCESSES

SCHEDULER

CPU 1   CPU 2   CPU 3   CPU 4

MULTIPROCESSING

COMPUTER ARCHITECTURE

CPU
CENTRAL PROCESSING UNIT
CONTROL UNIT
ARITHMETIC/ LOGIC UNIT
MEMORY UNIT

INPUT   OUTPUT

GPU   MULTIPROCESSORS

FPGA
LOGIC BLOCK
INTERCONNECTION
INPUT/OUTPUT
SWITCH BOX
CONNECT BLOCK

THEORETICAL COMPUTER SCIENCE

COMPUTABILITY THEORY

TURING MACHINE

ALAN TURING

STATE REGISTER

1: MOVE LEFT
2: MOVE RIGHT
3: FLIP DIGIT

011000111011100101001

INFINITELY LONG TAPE

HEAD

123: STOP

LAMBDA CALCULUS

FORMAL METHODS

START   POSSIBLE STATES   H
A B   E   G
C   F   ALERT
D
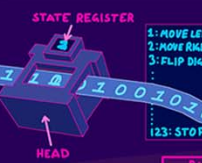
GRAPH THEORY

COMPUTATIONAL GEOMETRY

LOGIC
ZERO   ONE
NOT   OR   AND   XOR   NAND

AUTOMATA THEORY
S₁   S₂

QUANTUM COMPUTATION
$|0\rangle$
$\frac{|0\rangle + |1\rangle}{\sqrt{2}}$
$|1\rangle$

PARALLEL PROGRAMMING
MAIN JOB
JOB 1   JOB 2   JOB 3   JOB 4
SMALLER JOBS

AND MORE

COMPUTER ENGINEERING

SOFTWARE AND PROGRAMMING LANGUAGES

PYTHON   JAVASCRIPT   WEB APPS
PHP   SWIFT   PERL   BROWSER
JAVA   SQL   APPLICATIONS
C++   C#   OPERATING SYSTEM
C   BIOS
ASSEMBLY   SILICON   MACHINE CODE

JAVASCRIPT
COMPILER
C++
COMPILER
C
COMPILER
ASSEMBLY
COMPILER

COMPILERS

DATA MANAGEMENT

NETWORKING
CONCURRENT/ DISTRIBUTED/ PARALLEL/ SYSTEMS

DATABASES   SQL   DATACENTRES

PERFORMANCE

COMPUTER ANALYSIS

BENCHMARKING

ALGORITHMS

BUBBLESORT(A)
1: GO FROM LEFT TO RIGHT.
2: COMPARE EACH PAIR.
3: IF LEFT ONE HIGHER, SWITCH.
4: DO UNTIL NO MORE SWITCHES.

BUBBLE SORT $O(n^2)$
1 2 3 4 5 6 7 8

MERGE SORT $O(n \log n)$
1 2 3 4 5 6 7 8

ANALYSIS OF ALGORITHMS   ALGORITHMIC COMPLEXITY

SOFTWARE ENGINEERING
FORMAL METHODS   UNIT TESTING   VERSION CONTROL
OBJECT ORIENTED DESIGN

OPERATING SYSTEMS
iOS   macOS

COMPUTER GRAPHICS

COMPUTATIONAL SCIENCE
COMPUTATIONAL PHYSICS   NUMERICAL ANALYSIS
BIOINFORMATICS   COMPUTATIONAL CHEMISTRY

HACKING

OPTIMISATION
FINANCE   LEAGUE OF LEGENDS
AMAZON WAREHOUSE

BOOLEAN SATISFIABILITY
x_1 OR x_2 OR $\bar{x}_3$ (SAT)
$\bar{x}_2$ OR $\bar{x}_2$ OR x_3
$\bar{x}_1$ OR x_2 OR $\bar{x}_3$
$\bar{x}_1$ OR x_2 OR $\bar{x}_3$

SUPER COMPUTING

MACHINE LEARNING
SUPERVISED   NEURAL NETWORK
UNSUPERVISED
CAT
REINFORCEMENT

COMPUTER VISION
FIND THE HUMANS

ARTIFICIAL INTELLIGENCE
A.I.

ROBOTICS

VIRTUAL REALITY

SIMULATION

BIG DATA

APPLICATIONS

NATURAL LANGUAGE PROCESSING
CHATBOTS
- HEY
  HELLO THERE -
- ARE U A ROBOT?
  YES -
- WAIT, I MEAN NO -
- PROVE IT!
  CALCULATING... -
- I MADE YOU CAKE -

KNOWLEDGE REPRESENTATION
SCONES   TEA   FLOUR   BUTTER
BIRTHDAY   CAKE   FOOD   BACON
CELEBRATION   PANCAKE   BREAKFAST

IMAGE PROCESSING

TELEPRESENCE
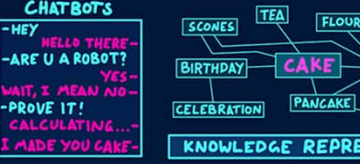
AUGMENTED REALITY

HUMAN COMPUTER INTERACTION

INTERNET OF THINGS

YOUTUBE DOMAIN OF SCIENCE MAP OF COMPUTER SCIENCE

BY DOMINIC WALLIMAN ©2017

Some History

Counting stones: calculus is Latin for pebble

Algebra and Algorithm: Muhammad ibn Musa al-Khwarizmi (850 AD)
https://youtu.be/wPb3XuST8-Q

Charles Babbage: "father of the computer" (1850 AD)
Ada Lovelace: "first programmer" (1850 AD)
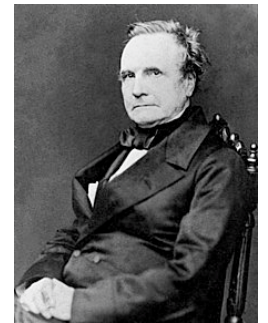
Alan Turing" "father of computer science" (1945 AD)

CS != programming

programming : CS ::
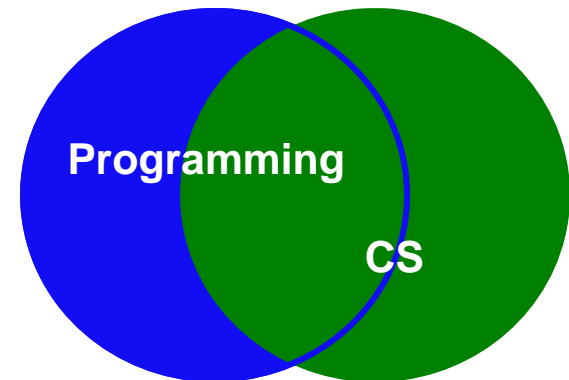
"not equal to"

`CS != programming`

programming : CS ::

    surfing : San Diego

    machining : engineering

    grammar : literature

    equations : mathematics

Programming   **CS**

a vehicle, not a destination

CS == *computing* science

Computer Science is...

The science of using and processing
large amounts of information
to automate useful tasks
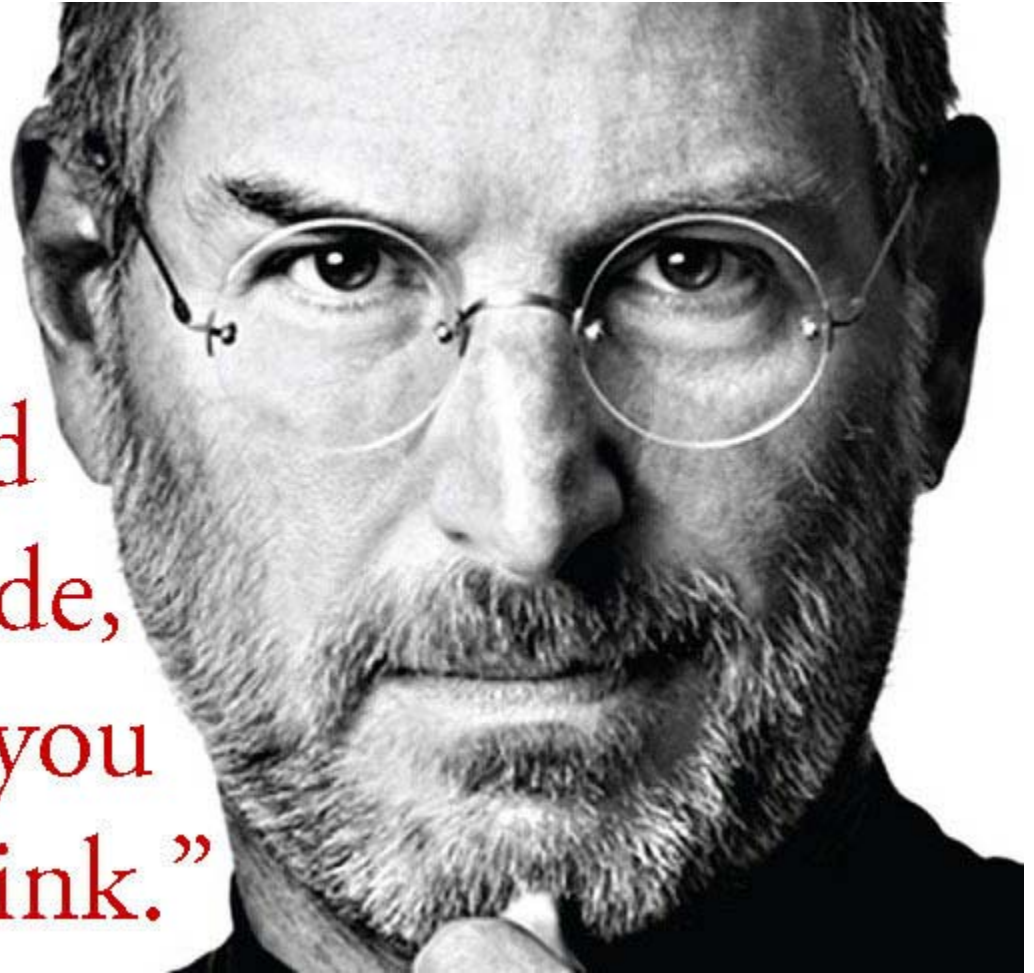and learn about the world around us
(using a computer)

"equal to"

Do you agree with the following statement?

- I believe that there are some people who are "naturally logical thinkers" and some people who are not.
    - A. Yes
    - B. No

Steve Jobs
1955-2011
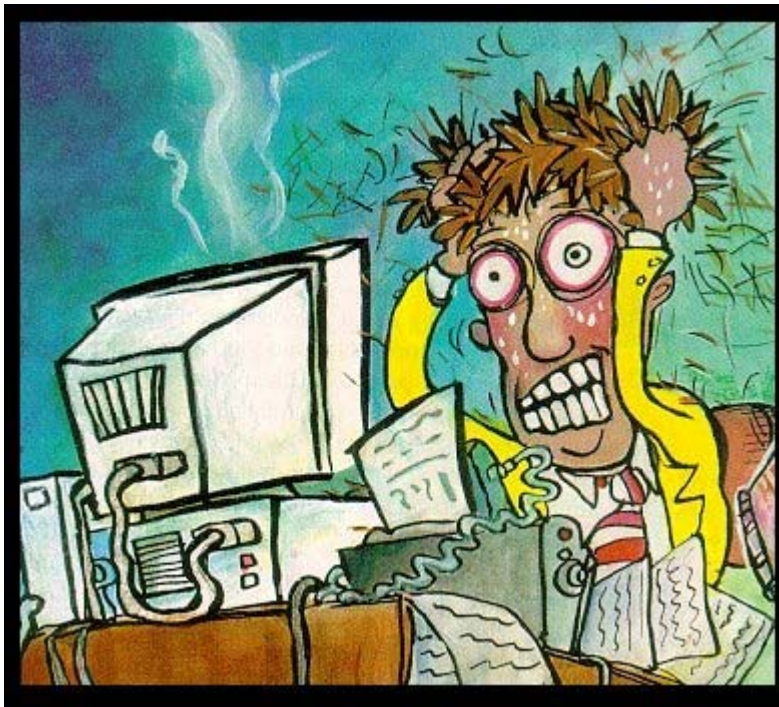"Everyone should learn how to code, it teaches you how to think."

Expect it to be…
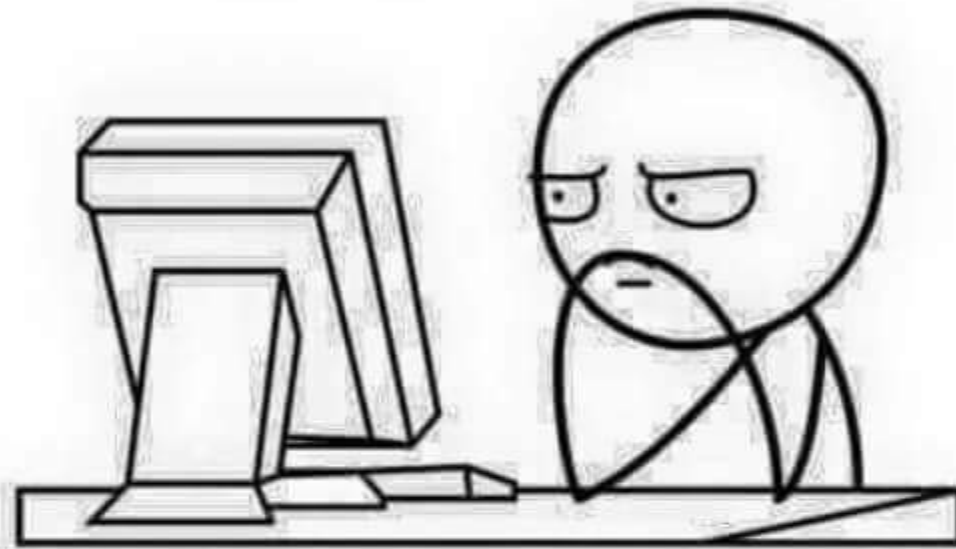
Thrilling!
And..

Expect it to be…

Thrilling!
And…

The most frustrating thing you've ever done!

But, there is no magic

- You can understand everything. Really.
- NEVER guess.

Never let your computer know that you are in a hurry.

Computers can smell fear.
They slow down if they know that
you are running out
of time.

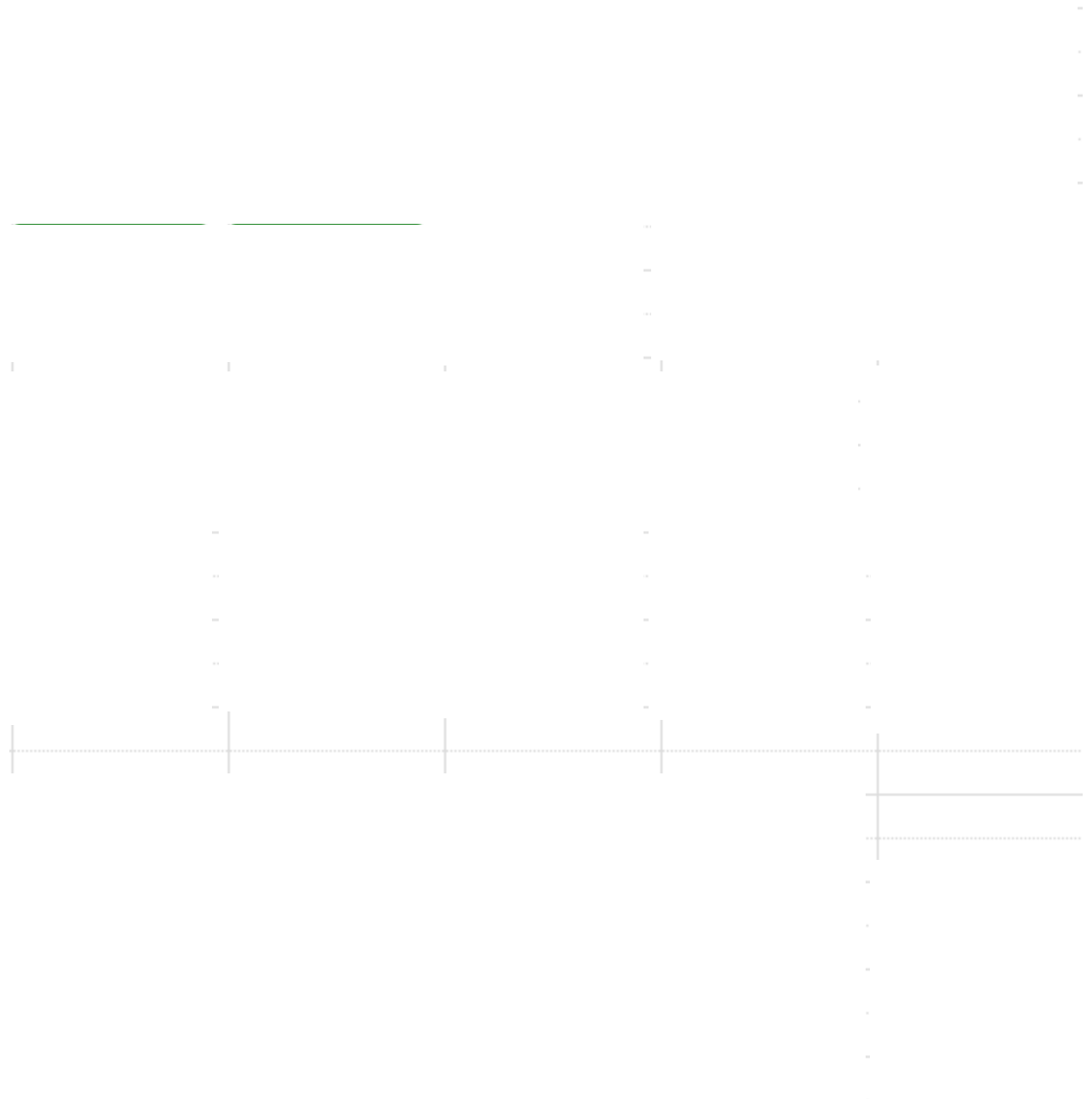# SPIS at a Glance

FoCS

Lectures
Labs
1-on-1 meetings

APS

Facets

Social events

Lunch
Fun-time
Closing circle

SPIS at a Glance

FoCS
- Lectures
- Labs
- 1-on-1 meetings

APS

Facets

Social events
- Lunch
- Fun-time
- Closing circle

	Mon	Tue	Wed	Thu	Fri
8:45 – 10	FoCS CSE 2154	APS Lecture CSE 2154	FoCS CSE 2154	APS Discussion CSE 2154	FoCS CSE 2154
10:15 – 11:30	FoCS CSE 2154	FoCS CSE 2154	FoCS CSE 2154	FoCS CSE 2154	Breadth CSE 4258 / Depth CSE 2154
11:30 –			SPIS Lunch Cafe Ventanas		
1:15p – 2:45p	FoCS CSE 2154	Lab Hours CSE B230 / CSE B240	Lab Hours CSE B230 / CSE B240	Lab Hours CSE B230 / CSE B240	Lab Hours CSE B230 / B240 / One-On-One Meeting Faculty office
3p – 5p	Lab Hours CSE B230 / CSE B240	Facets CSE 1202	Fun Time (Non-academic activity) CSE 1202	Facets CSE 1202	**3:30p – 5p** Closing Circle CSE 1202
7p – 9p	Open Lab Hours CSE B230 / CSE B240	Open Lab Hours CSE B230 / CSE B240		Open Lab Hours CSE B230 / CSE B240	**7p – 11:30p** Board Game Night CSE 4140

SPIS Academics Site

https://ucsd-cse-spis-2019.github.io/

- Agenda
- Calendar
- Lecture notes
- Homework assignments: APS and enrichment videos
- Lab assignments
- Extra information

- Online textbook: "CS for All"
  https://www.cs.hmc.edu/csforall/
- Feedback repos

Option to tell us your preferred name …

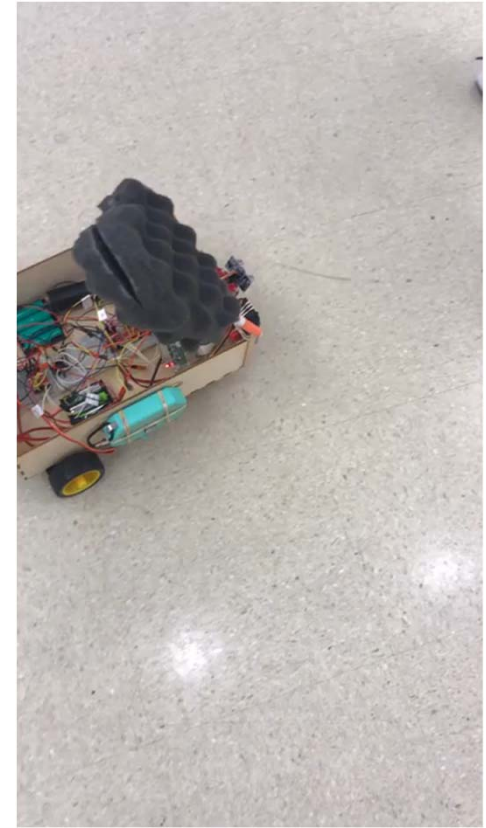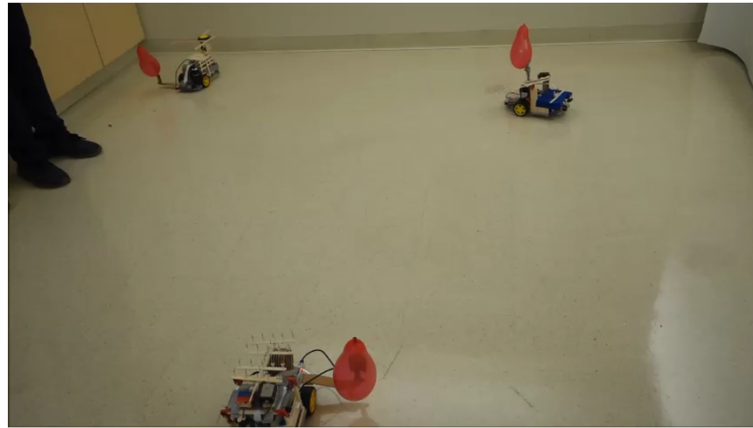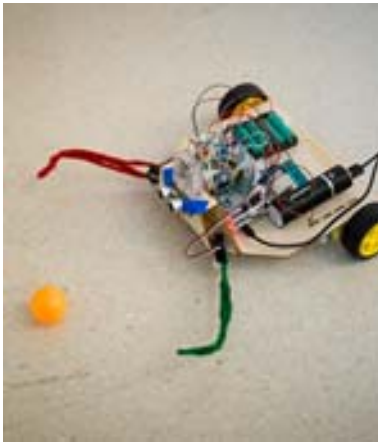https://bit.ly/spisnames

Schedule

- ## First four weeks

  - FoCS and APS

- ## Last week: projects

  - Webapps

  - Robotics

  - Data science/machine learning

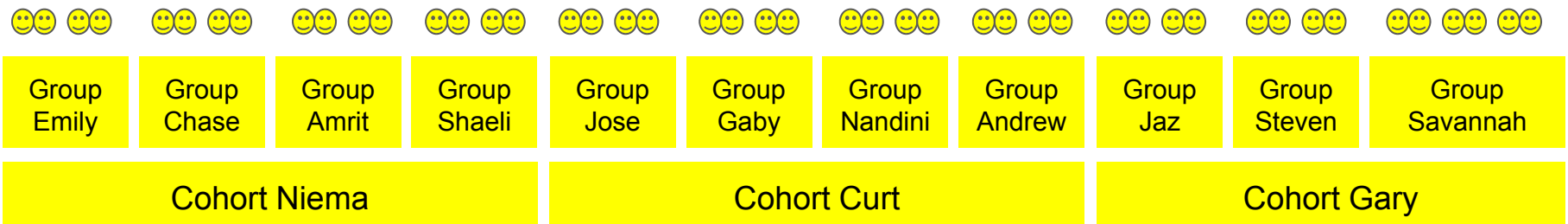# Robotics

Structure

- Pair partner   FoCS labs

- Groups of 4 (or 6) with a mentor   mentor lunch on Wed

- Cohort of 16 (or 14) with an instructor   1-on-1 meetings on Fri

Group Emily	Group Chase	Group Amrit	Group Shaeli	Group Jose	Group Gaby	Group Nandini	Group Andrew	Group Jaz	Group Steven	Group Savannah
Cohort Niema				Cohort Curt				Cohort Gary		

Pair Programming

- Driver – navigator
- Switch roles
- Come prepared

Chronicles of Pair Programming

When I am the driver

When I am the observer

Daniel Stori {turnoff.us}

Expectations

- Attendance is expected: FoCS and APS lectures/discussion, facets, closing circle, 1-on-1 meetings, mentor lunch, (regular) lab hours

- Have contact info of your mentors and give them your contact info. Let them know if
  - You're going off campus
  - You are missing SPIS components where attendance is expected
  - Anything out of the ordinary is happening

- Wear your lanyards
- Be engaged
- Have fun