



introduction.

Week 1 | Lecture 1 (1.1)



if nothing else, write #cleancode

This Week's Content

■ Lecture 1.1

- Part 1 - Introduction
- Part 2 - Variables, Expressions, and Operators
- Reading: Chapters 1, 2



Teaching Team



Ben
Instructor



Craig
Tutorial TA



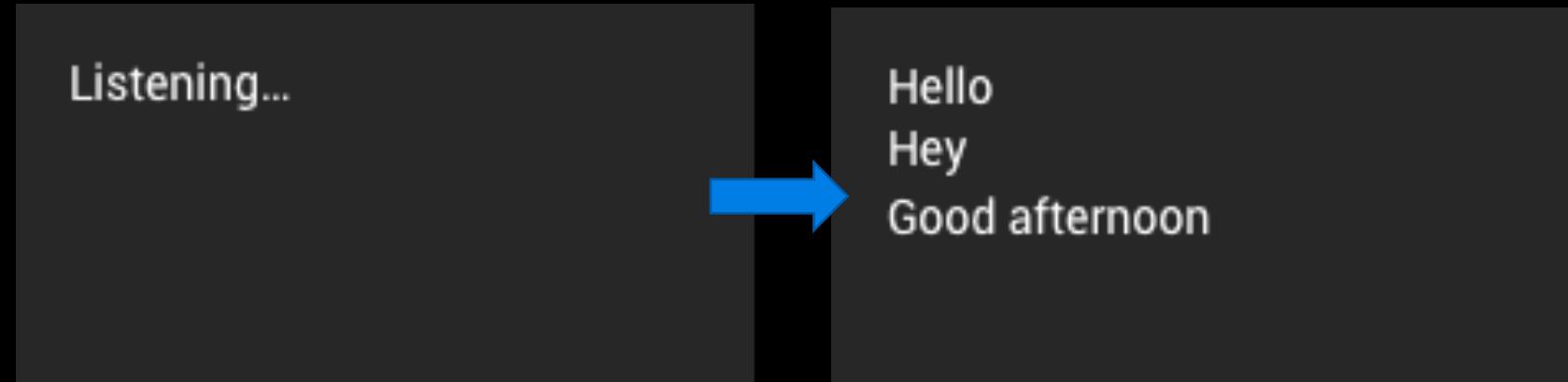
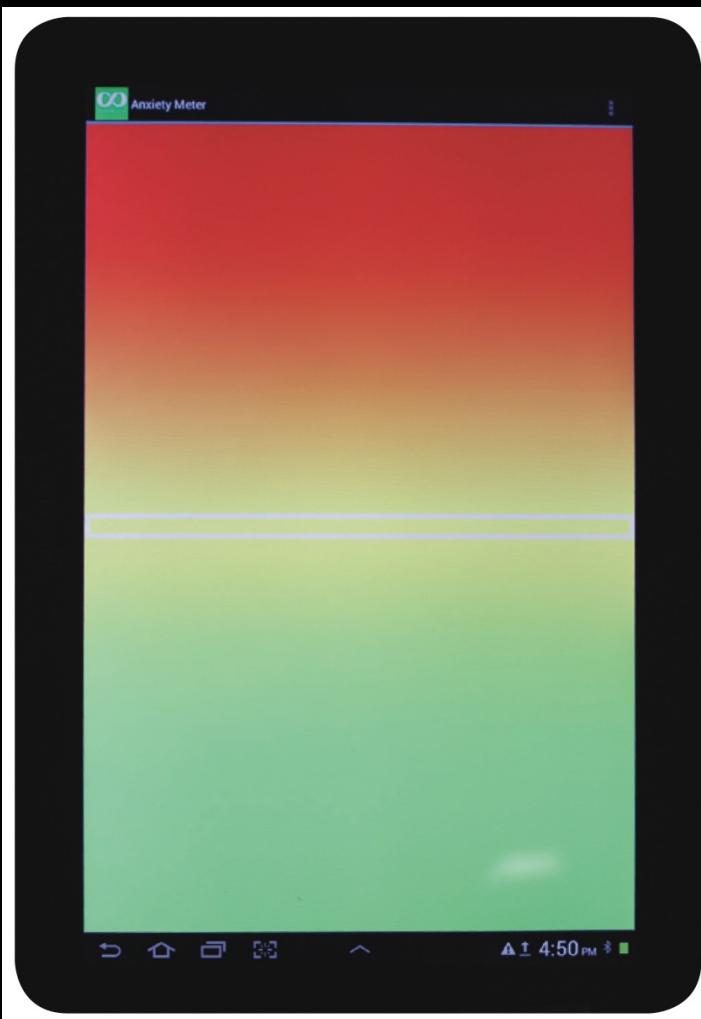
Behrang
Lab TA

Ben

- Bachelor of Electrical & Biomedical Engineering
@ McMaster University 2015
 - Realized the power of programming (and how it can be used for good, not evil)
- Master of Biomedical Engineering
@ University of Toronto 2020
 - Hold up... people will pay me for 'playing' on my computer?
- In between obtaining degrees I spent time programming a few different projects...

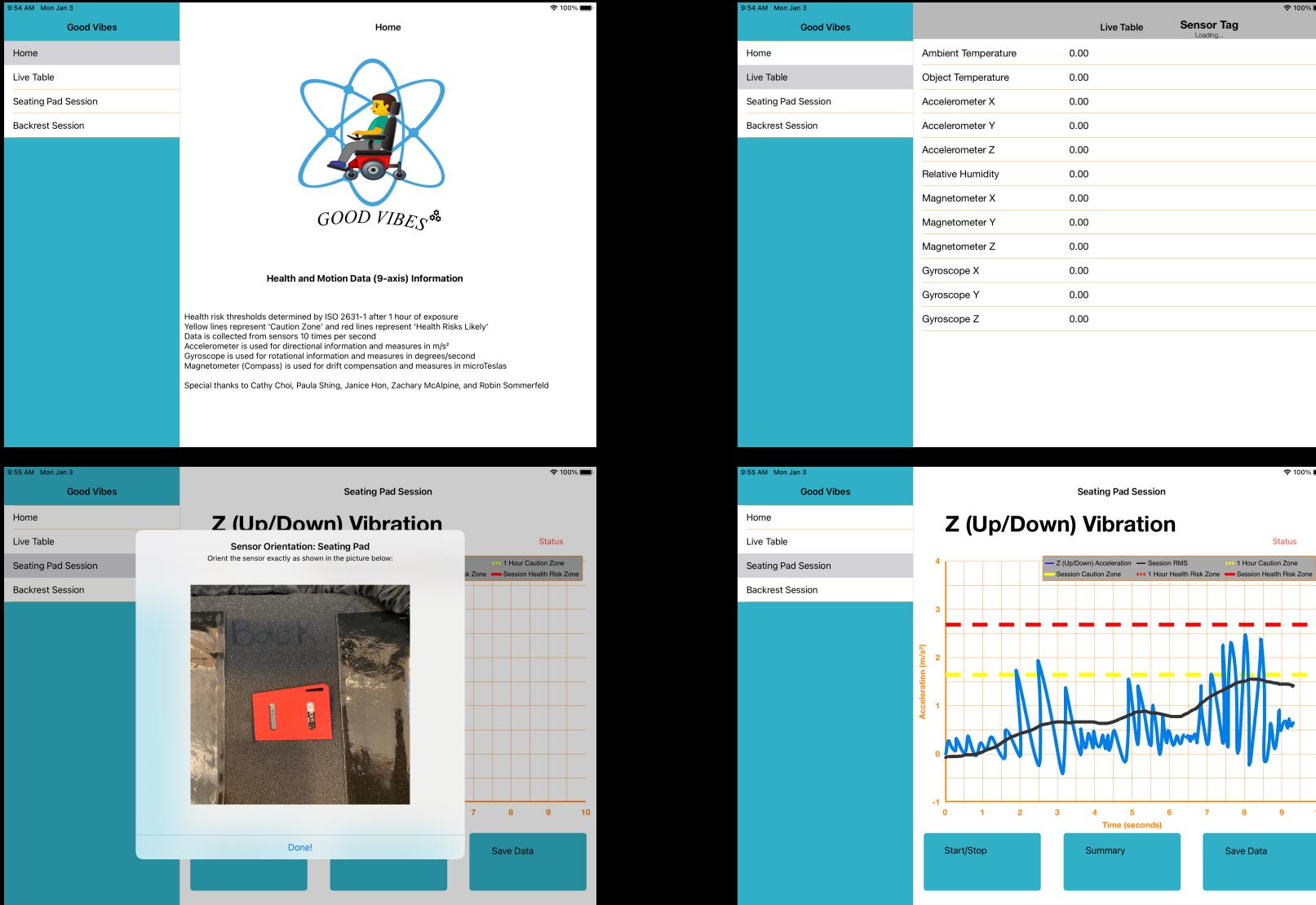


Projects for children with autism spectrum disorder



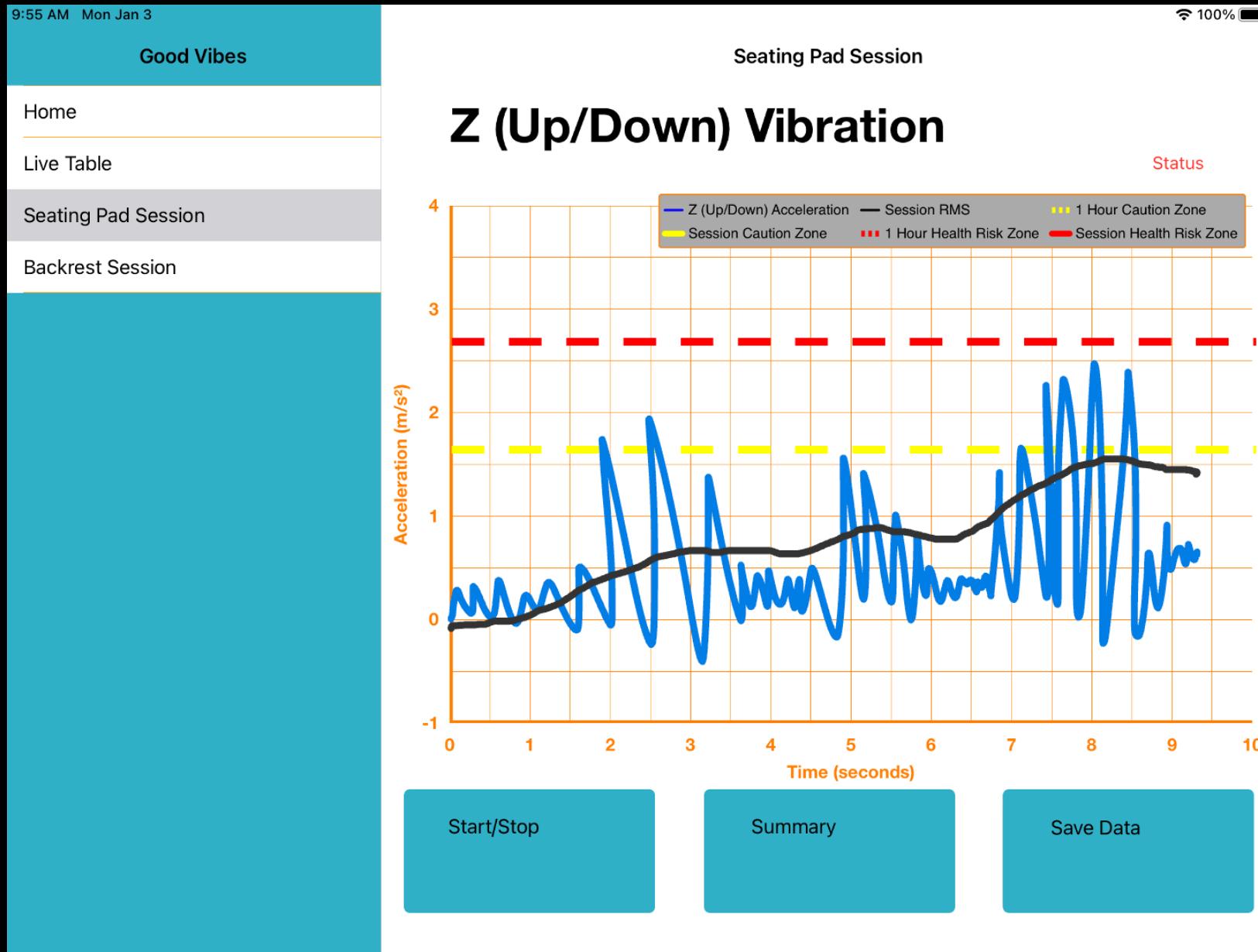
Good Vibes

A wheelchair vibration measurement tool



The image displays five screenshots of the Good Vibes mobile application:

- Home Screen:** Shows a sidebar with "Good Vibes", "Home", "Live Table", "Seating Pad Session", and "Backrest Session". The main area features a stylized atom icon with a person in a wheelchair, and the text "GOOD VIBES" below it.
- Sensor Tag Loading:** Shows the same sidebar. The main area lists sensor data: Ambient Temperature (0.00), Object Temperature (0.00), Accelerometer X (0.00), Accelerometer Y (0.00), Accelerometer Z (0.00), Relative Humidity (0.00), Magnetometer X (0.00), Magnetometer Y (0.00), Magnetometer Z (0.00), Gyroscope X (0.00), Gyroscope Y (0.00), and Gyroscope Z (0.00). A status bar at the top indicates "Sensor Tag Loading...".
- Seating Pad Session Setup:** Shows the sidebar. The main area is titled "Seating Pad Session" and contains a sub-section "Z (Up/Down) Vibration". It includes instructions to "Orient the sensor exactly as shown in the picture below:" and shows a photograph of a red rectangular sensor placed on a dark surface. A legend indicates "Yellow lines represent 'Caution Zone' and red lines represent 'Health Risks Likely'". Buttons for "Done!" and "Save Data" are at the bottom.
- Seating Pad Session Data:** Shows the sidebar. The main area is titled "Seating Pad Session" and displays a graph of "Z (Up/Down) Acceleration" over "Time (seconds)". The graph shows a blue line fluctuating between -1 and 4 m/s². A black line represents the "Session RMS". A legend identifies the lines: "Z (Up/Down) Acceleration" (blue), "Session RMS" (black), "1 Hour Caution Zone" (yellow dashed), "Session Caution Zone" (yellow solid), "1 Hour Health Risk Zone" (red dashed), and "Session Health Risk Zone" (red solid). Buttons for "Start/Stop", "Summary", and "Save Data" are at the bottom.

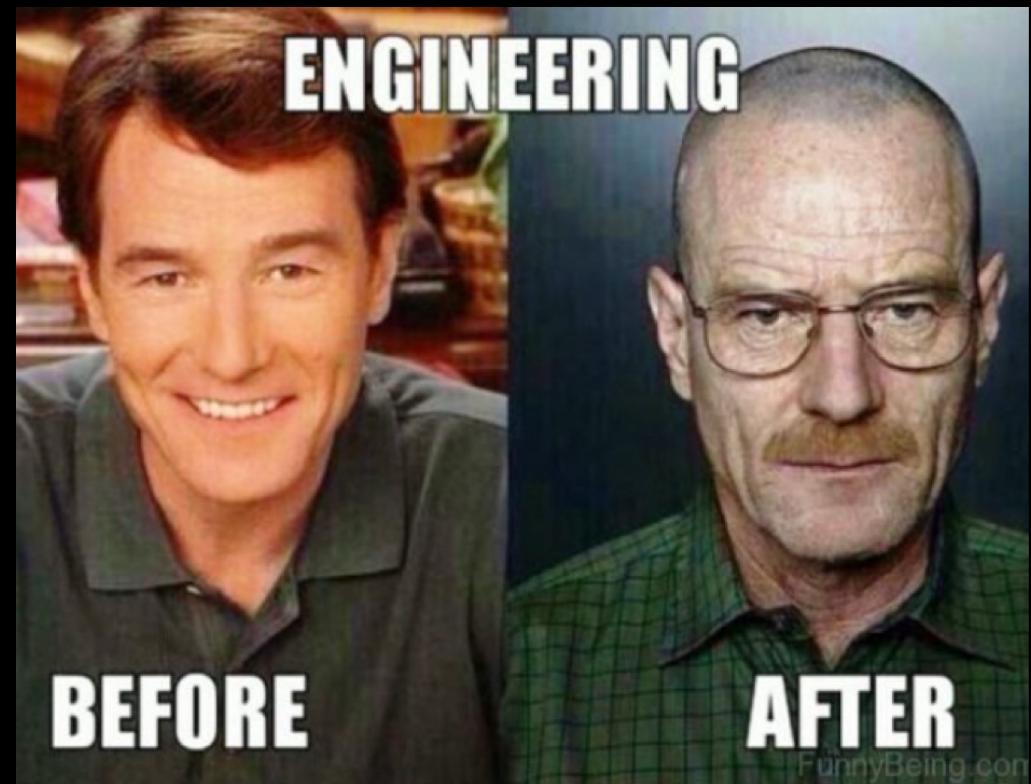


More about Ben...



University is HARD

- Engineering at university is harder.
- “**Everyone you meet is fighting a hard battle.**”



Being respectful

- Talking
- Cell Phones
- Eating
- Being Late for Lectures



Being respectful

- Talking
- Cell Phones
- Eating
- Being Late for Lectures



Ask Questions!

- Ask questions as much as possible.
- Ask **as soon as** you feel confused!
- Ask each other questions in-person or on Piazza and help if you think you know the answer
- **Never forget** - if you have a question, there's always other people in the room wondering the same thing. They will be thankful you asked it!



Course Information

- **Quercus:**

- APS106H1 S LEC0101 (Website contains all information).

- **Textbook:**

- ***Programming in Python 3.***
- A link to the UofT bookstore where you can purchase the textbook can be found on the Syllabus page.



Grading

Petitions: First-year Office.

Labs (5 in total)

total: 15%

Reflections (6 in total)

total: 5%

Midterm (in-lecture)

total: 30%

Final Exam

total: 50%

Lecture Schedule

Section	Monday	Tuesday	Wednesday	Thursday	Friday
LEC01		9:00-11:00		9:00-11:00	9:00-11:00

- Lectures will be in person in **GB221 (for now...)**.
- If we need to move online, Microsoft Teams links for lectures will be found on Quercus.
- Lecture content can be found on Quercus.

Tutorial Schedule

- Tutorials will be in person in the same room starting this week
- Links for tutorial content will be found on Quercus.

Week	Tut Content	Monday	Tuesday	Wednesday	Thursday	Friday
Week 1	Tutorial 1		TUT0101 11:00-1:00 Location: TBD-GB 119?			

Lab Schedule

- Labs will be in person in GB 144/150 starting this week
- Links for lab content will be found on Quercus.

Week	Lab Content	Released	Due
Week 1 (May 6 - May 10)	<u>Lab 1</u>	Tuesday May 7	Tuesday May 14 @ 11:00 AM
Week 2 (May 13 - May 17)	Lab 2	Friday May 10	Friday May 17 @ 23:00
Week 3 (May 20 - May 24)	Lab 3	Friday May 17	Friday May 27 @ 23:00

Click here
for content.

TENTATIVE

Reflections

- There are 6 weekly reflections throughout the term.
- Reflections are worth a total of 5% of your final grade.
- Full marks for successful completion of all reflections.
- Reflections are used to take the pulse of students in the course.
- Insights from reflections are used to iteratively improve the course week-by-week.
- Reflections are there to help you, so please answer honestly.

Reflections

- Reflection include question like:
 - Did you attend lecture this week? If not, why?
 - Do you understand the topics covered this week?
 - Did you attend tutorial this week?
 - Which lecture section did you attend?
 - What will this code output?
 - Write one word to describe how you feel about the course.

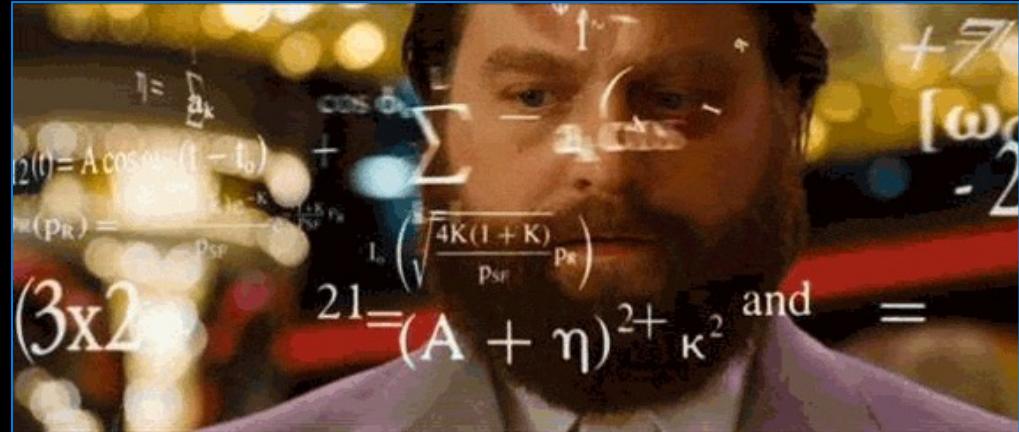
Reflections Schedule

Week	Reflection	Released	Due
Week 1 (May 6 - May 10)	<u>Reflection 1</u>	Friday May 10 @ 11:00	Monday May 13 @ 17:00
Week 2 (May 13 - May 17)	Reflection 2	Friday May 17 @ 11:00	Monday May 20 @ 17:00
Week 3 (May 20 - May 24)	Reflection 3	Friday May 24 @ 11:00	Monday May 27 @ 17:00
Continued...			

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for content.

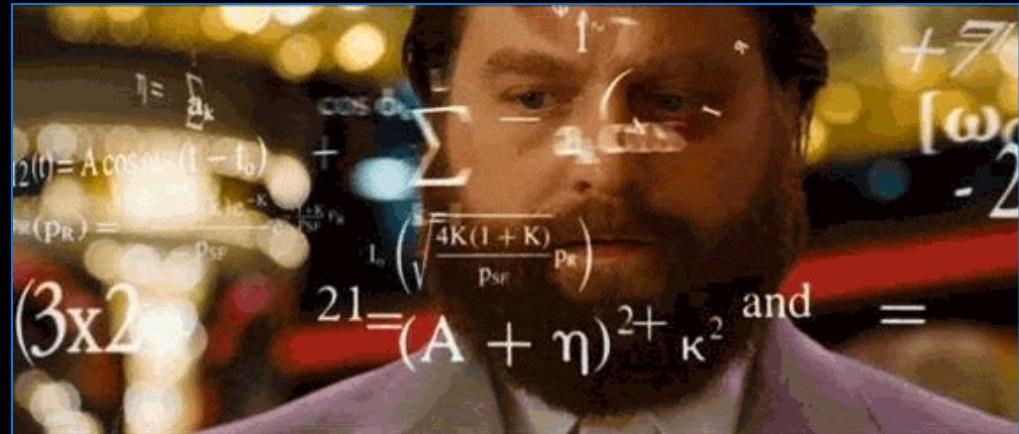
Tips for Success

- Do not wait until the last minute.
- Programming is a **Language**
- Work Together (except during the test/exam):
- Work Smart (effort doesn't necessarily equal progress).
- Time Management.
- Know when (and how) to ask for help.



Tips for Success

- **80%** of your final grade is based on two term tests and an exam.
- For these tests and exams, you'll need to write code.
- You will not be able to achieve a high mark by reading the textbook and lecture notes. You need to **PRACTICE, PRACTICE, PRACTICE!**
- How can you practice writing code?
 - **Lecture Breakout Sessions.**
 - **Labs** (think of this as studying).
 - **Practice Problems.**



Writing A Lot Of Code During The Term

=

Higher Grade

```
31 def __init__(self, path=None, debug=False):
32     self.file = None
33     self.fingerprints = set()
34     self.logduplicates = True
35     self.debug = debug
36     self.logger = logging.getLogger(__name__)
37     if path:
38         self.file = open(os.path.join(path, 'seen_requests'), 'a')
39         self.file.seek(0)
40         self.fingerprints.update(fp.strip() for fp in self.file)
41
42     @classmethod
43     def from_settings(cls, settings):
44         debug = settings.getbool('SUPERVISOR_DEBUG')
45         return cls(job_dir(settings), debug)
46
47     def request_seen(self, request):
48         fp = self.request_fingerprint(request)
49         if fp in self.fingerprints:
50             return True
51         self.fingerprints.add(fp)
52         if self.file:
53             self.file.write(fp + os.linesep)
54
55     def request_fingerprint(self, request):
56         return request_fingerprint(request)
```

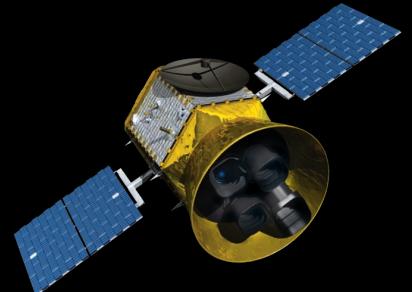
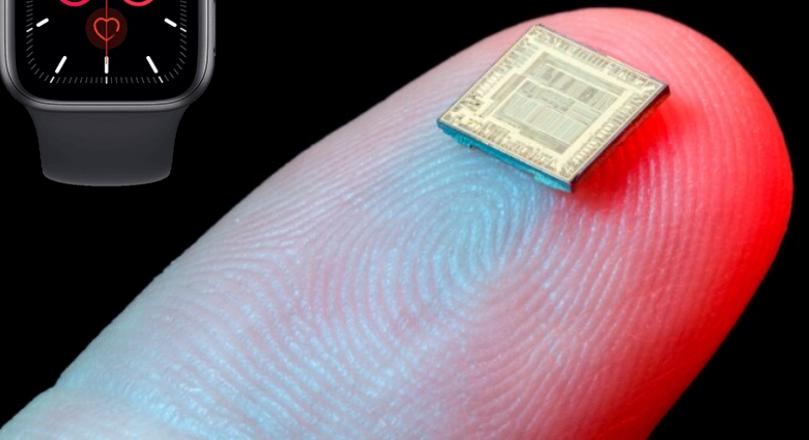
What is this course all about?

- Learn the **fundamentals** of programming.
- **Programming as a tool** used in engineering.
- **Engineering design** through programming.

Why Programming?



StartUp **HERE**



Why Programming?

- Computers are everywhere:
 - Learn to interact with them.
 - Simplifies our jobs.
- Entrepreneurial opportunities (\$\$\$).
- Necessary for engineering jobs.
- Research and development.
- Because it's fun!



 **KORE**
GEOSYSTEMS

\$1,000,000 Investment.

Owner of **McEwen Mining Inc.**

CEO of **Franco-Nevada Corporation**

President of **Cisco Systems Canada**

COO of **Goldcorp**

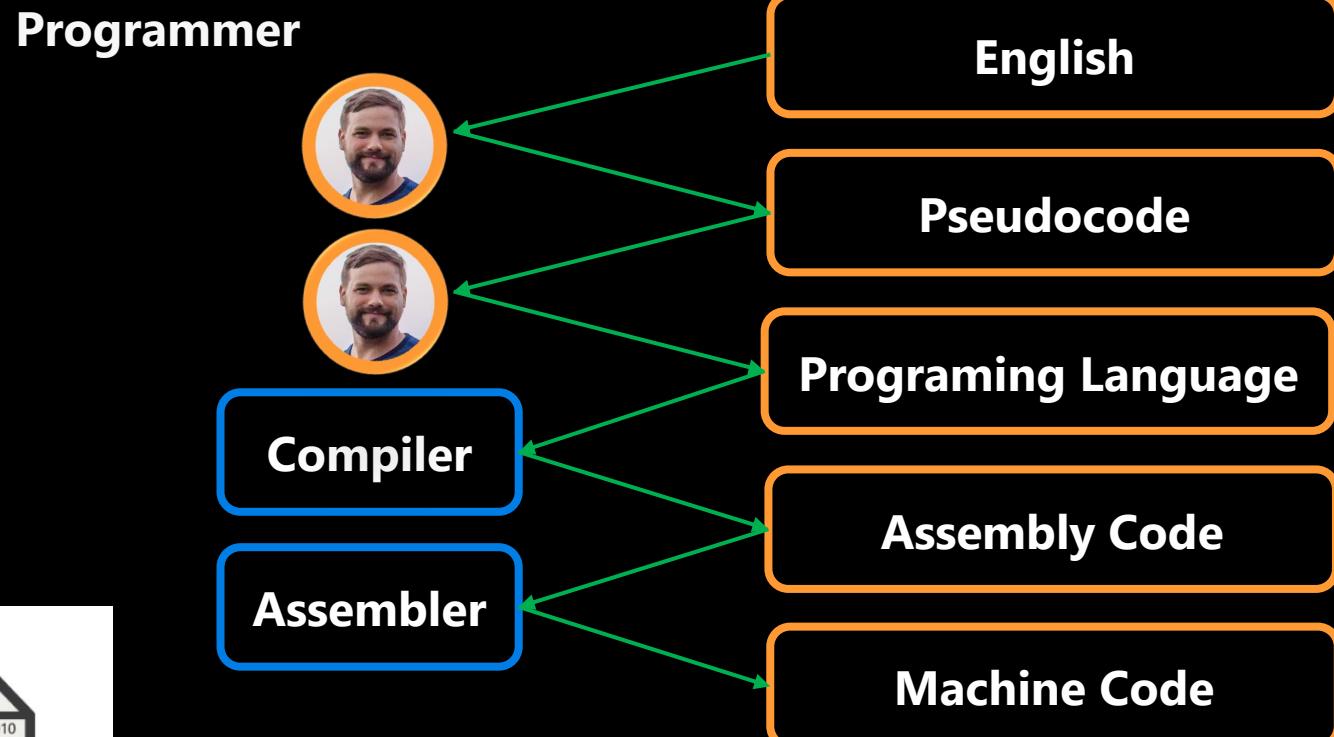
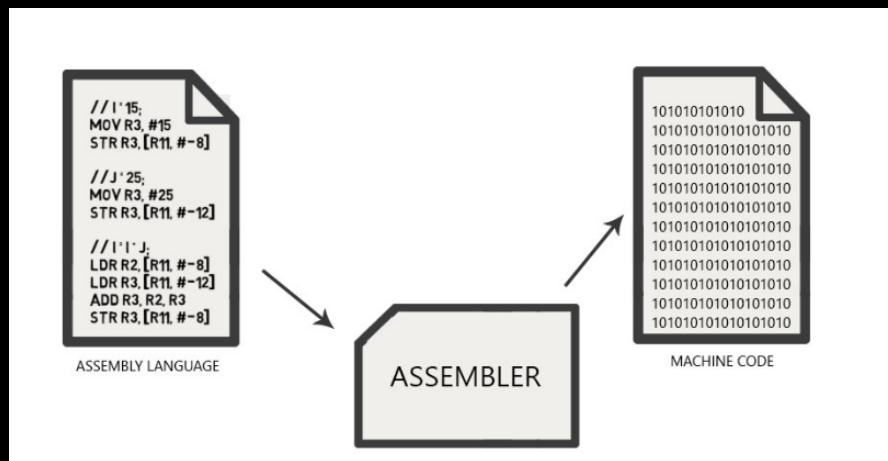
SHARK on ABC's **Shark Tank**

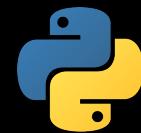


What is Programming?

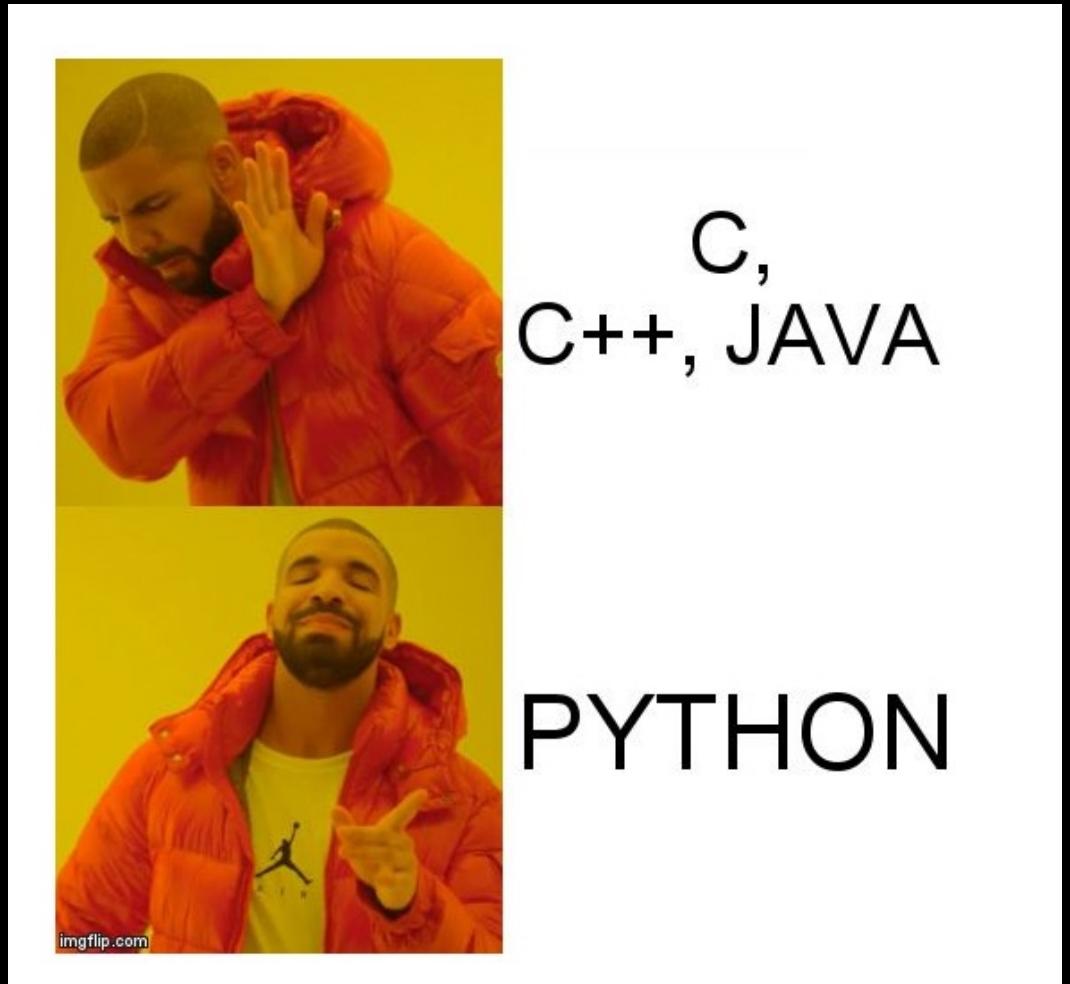
- A way of telling a computer what to do.
- A computer can't infer (...yet).
 - Need to tell a computer every single step it needs to do in a language it can understand.
 - How would you request an egg for breakfast to a chef and to a computer/robot?
- **To a Chef**
 1. Sunny-side up, please!
- **To a Computer**
 1. "Turn on stove"
 2. "Take out pan"
 3. "Take one egg out of fridge"
 4. "Crack egg"
 5. "Pour egg into pan"
 6. "Wait 5 minutes"

How to Program a Computer.



 Why Python?

- High-level language making it more like a readable, human language than other low-level languages.
- Simple and clear syntax.
- Large open-source community.
- Used by Google, Firefox, Dropbox, Youtube, Instagram, Yelp, NASA, CIA, etc.
- The Artificial Intelligence (AI) community overwhelmingly uses Python.



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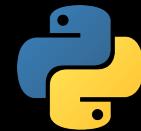
```
public class HelloWorld
{
    public static void main(String[ ] args)
    {
        system.out.println("Hello World!");
    }
}
```



```
print("Hello World!")
```

Lower-Level

Higher-Level



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Increasing
Program Size

Matlab, SQL

C++, Java, Python

C, Fortran, Pascal

Assembly Code

Machine Code



Increasing
Ease-of-Use

 Why Python?

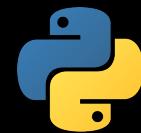
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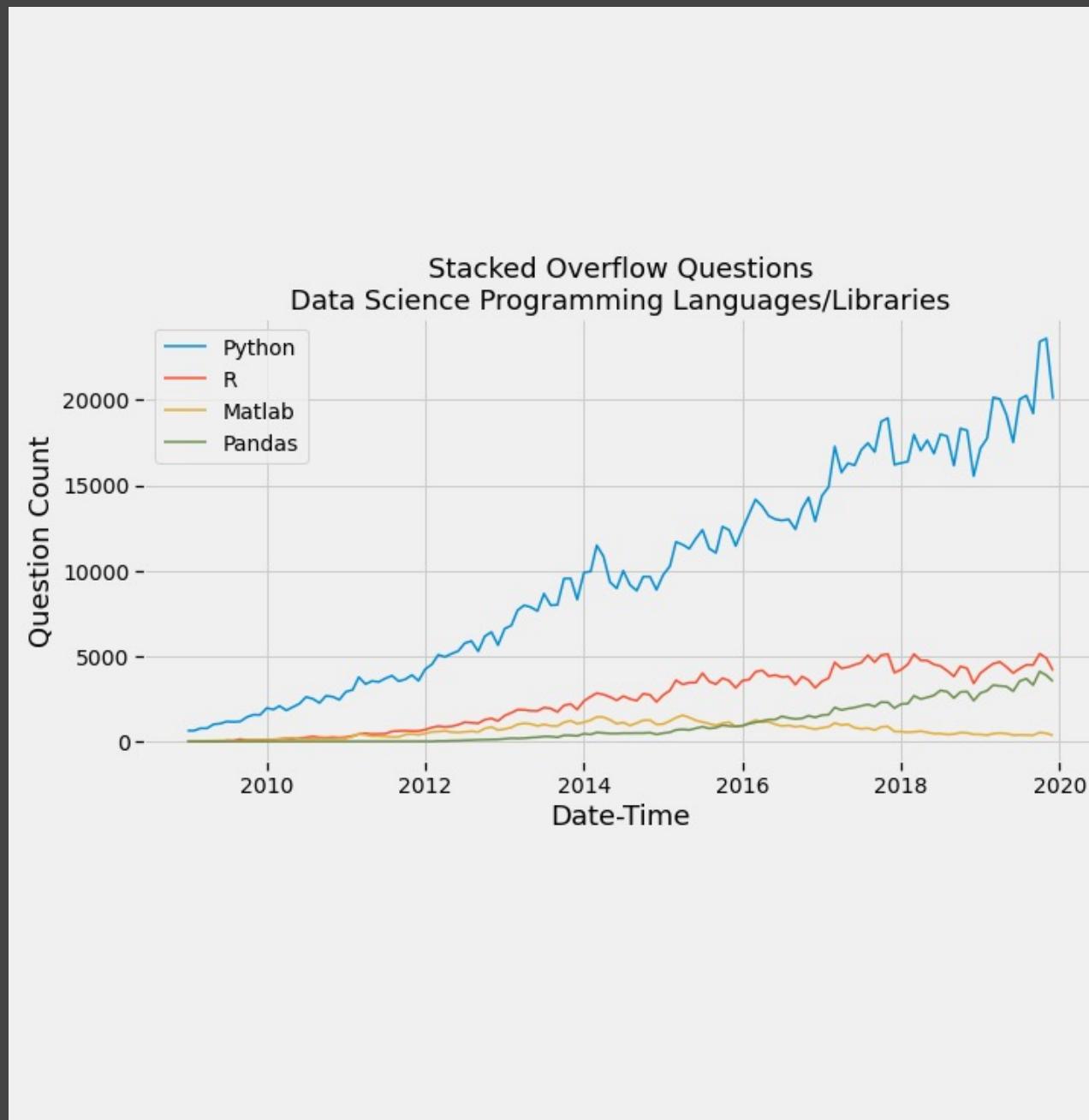
```
if x > 10:  
    print("x is greater than 10")
```



You don't know Python.
Can you figure out what this code does?

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 Why Python?

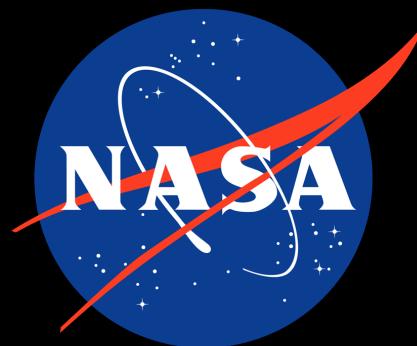
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SPACEX

yahoo!



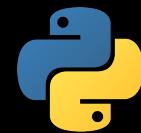
Google

KORE
GEOSYSTEMS

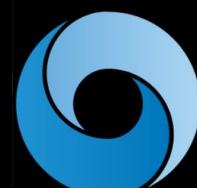
Spotify®



TESLA

 Why Python?

- High-level language making it more like a readable, human language than other low-level languages.
- Simple and clear syntax.
- Large open-source community.
- Used by Google, Firefox, Dropbox, Youtube, Instagram, Yelp, NASA, CIA, etc.
- The Artificial Intelligence (AI) community overwhelmingly uses Python.

 PyTorch LANDING AI Azure
Machine Learning XGBoost TensorFlow scikit
learn DeepMind

Why Engineers?

- Ok, so we've explained why coding is important and why we're learning to code in Python.
- **BUT**, you're all different types of engineers, right?
 - Mechanical
 - Materials
 - Civil
 - Chemical
 - Mineral
- Why do these kinds of engineers need to know how to code?



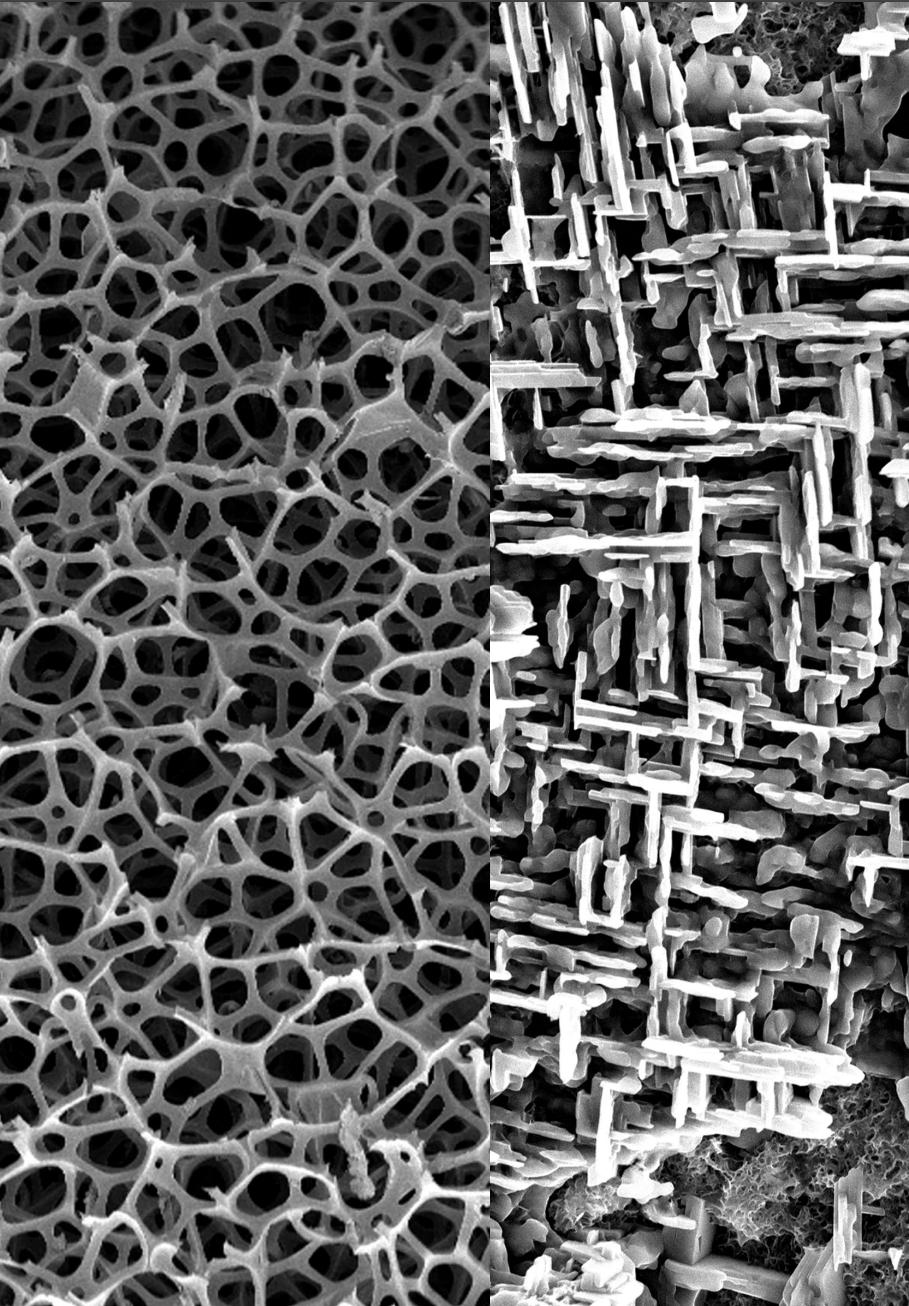
Mechanical Engineers

- Design Airplanes
- Micro Fluid Systems
- Automotive Engines
- Hydraulic Dams



Materials Engineers

- Biomaterials
- Design of Materials
- Manufacturing with Materials
- Sustainable Materials Processing



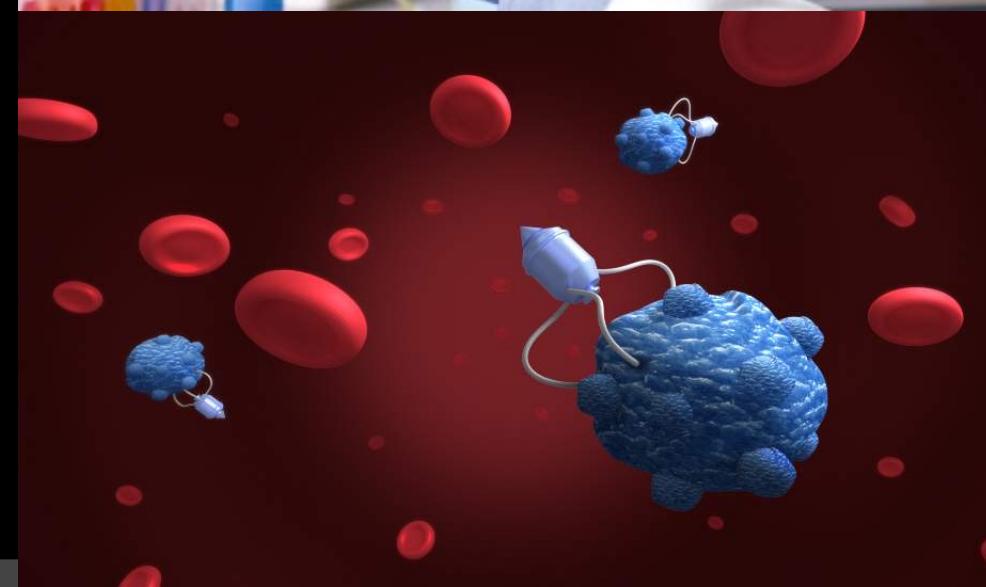
Civil Engineers

- Design Buildings
- Test Concrete
- Manage Water Supply System
- Design Bridges



Chemical Engineers

- Chemical Manufacturing Processes
- Petroleum Extraction
- Nanotechnology
- Manufacturing Computer Components



Mineral Engineers

- Mine Design
- Mineral Processing
- Mineral Exploration
- Mining Finance
- Mineral Extraction



Why Engineers?

- Again, why do engineers need to know how to code?
- In the 20th century, engineers didn't need to know how to code.
- In the 21th century, coding is an **essential skill** and any engineer without solid coding abilities will be at a major disadvantage.

```
31     dev = None
32     self.file = None
33     self.fingerprints = set()
34     self.logduplicates = True
35     self.debug = debug
36     self.logger = logging.getLogger()
37     if path:
38         self.file = open(os.path.join(path, 'fp.log'), 'w')
39         self.file.seek(0)
40         self.fingerprints.update(self._load_fingerprints())
41
42     @classmethod
43     def from_settings(cls, settings):
44         debug = settings.getboolean('debug')
45         return cls(job_dir=settings['job_dir'],
46                    request_log=settings['request_log'],
47                    request_fp=settings['request_fp'],
48                    logduplicates=settings['logduplicates'],
49                    debug=debug,
50                    logger=logging.getLogger())
51
52     def request_seen(self, request_fp):
53         fp = self.request_fingerprint(request_fp)
54         if fp in self.fingerprints:
55             return True
56         self.fingerprints.add(fp)
57         if self.file:
58             self.file.write(fp + '\n')
59
60     def request_fingerprint(self, request_fp):
61         return request_fp
```

Why Engineers?

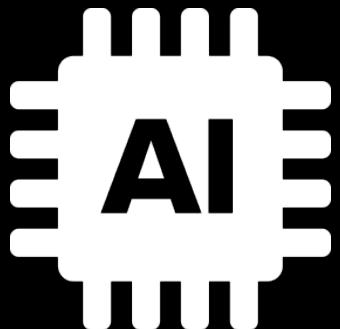
- Five technology trends have changed the game for engineers.



The Cloud



Cheap Sensors



Artificial
Intelligence



Big Data



The Internet
Of Things

Mechanical Engineers

Realtime Diagnostics & Tuning



CNET

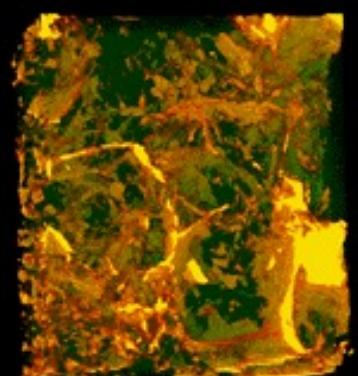
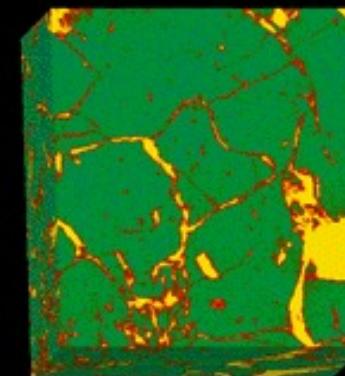
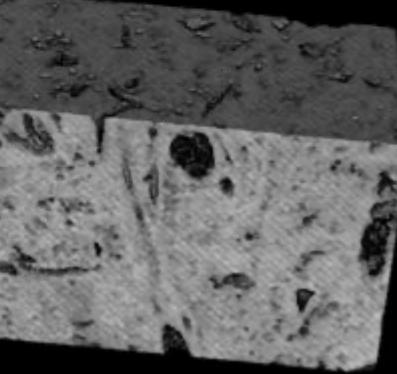
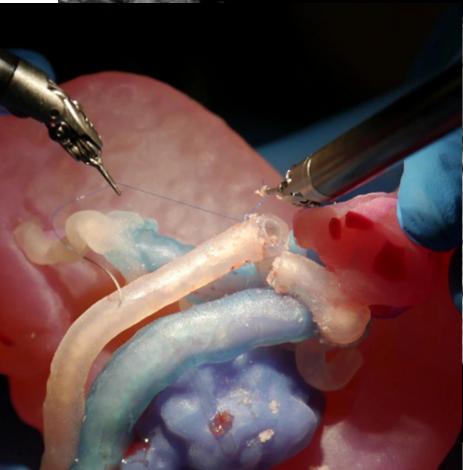
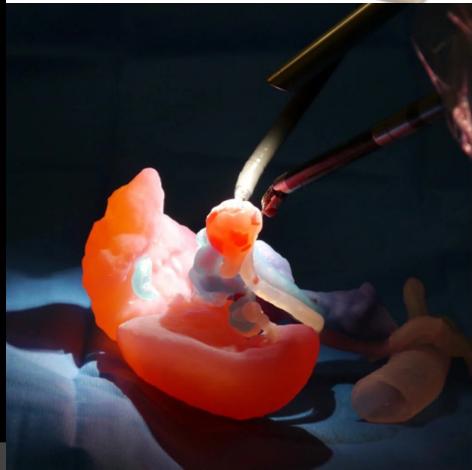
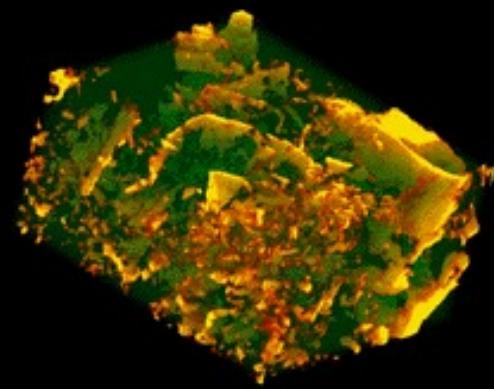
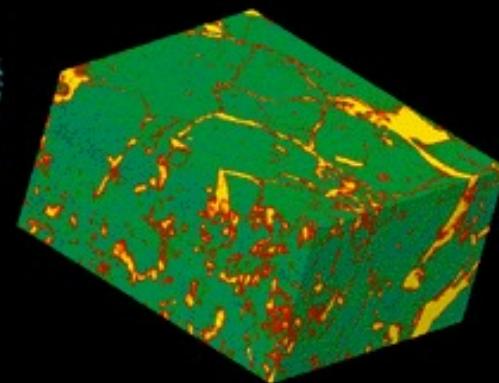
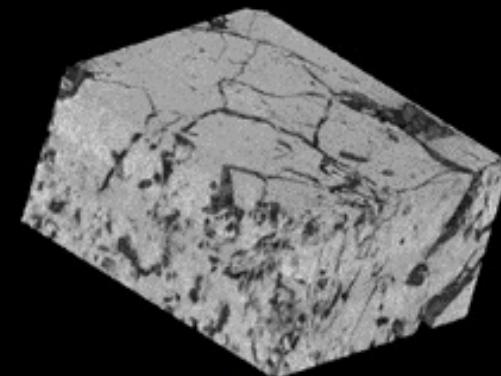
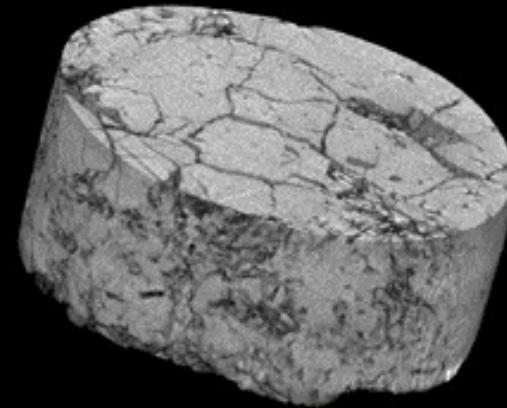
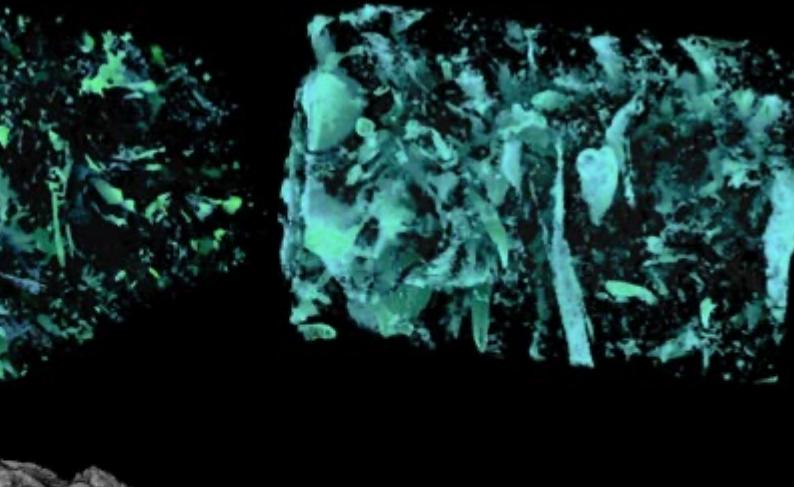
Tech Money Home Wellness Home Internet

Cars > Auto Tech

Tesla can tune your Model S or X's suspension via software update

Materials Engineers

Digital Image Analysis of Material Microstructure



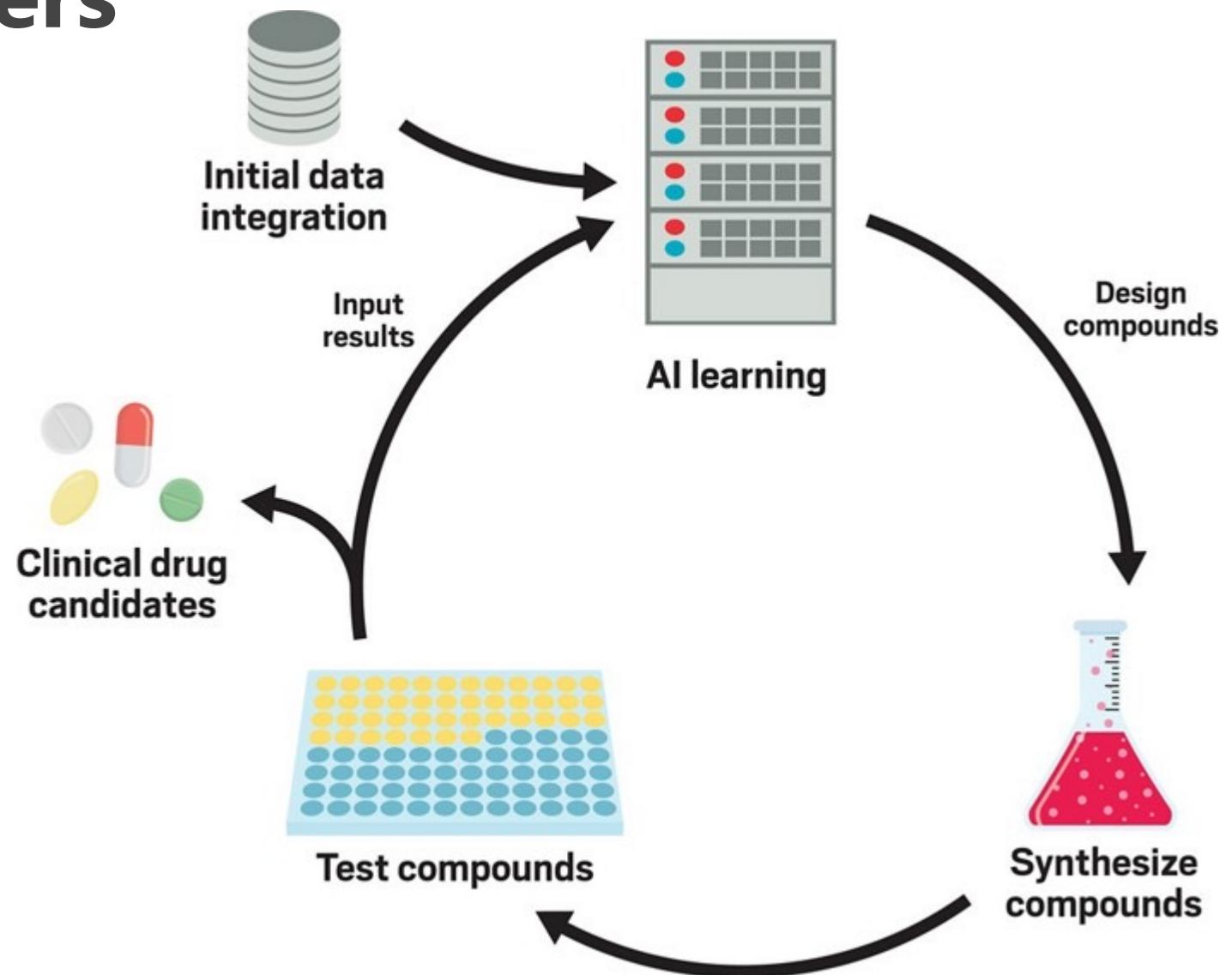
Civil Engineers

Urban Transportation Disrupted

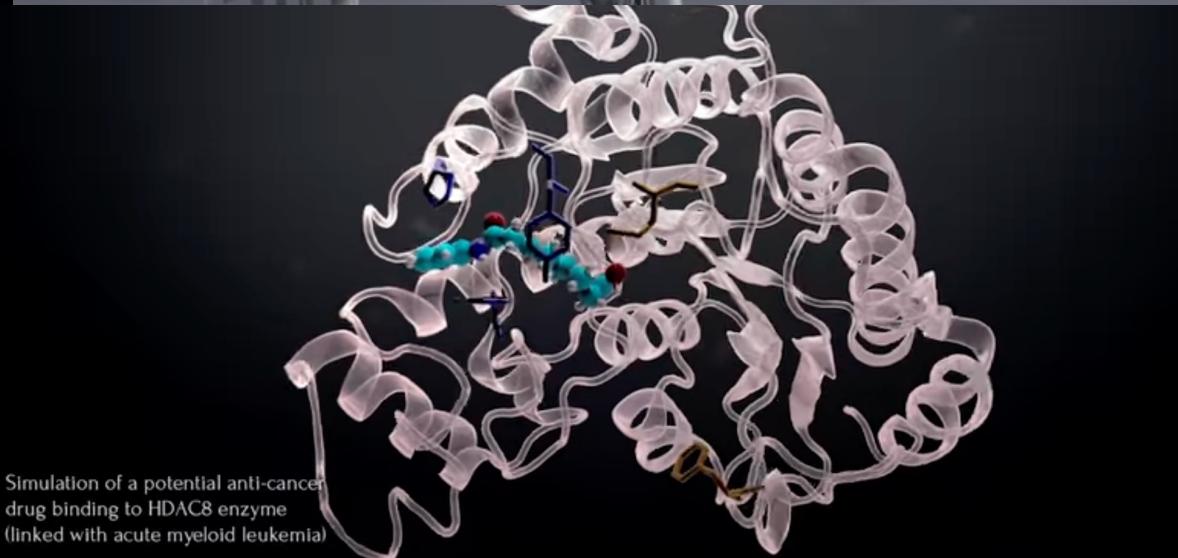


Chemical Engineers

Synthesizing new compounds



Sci-fi Inspiration



Simulation of a potential anti-cancer drug binding to HDAC8 enzyme (linked with acute myeloid leukemia)

Mineral Engineers

Semi-Autonomous Mines



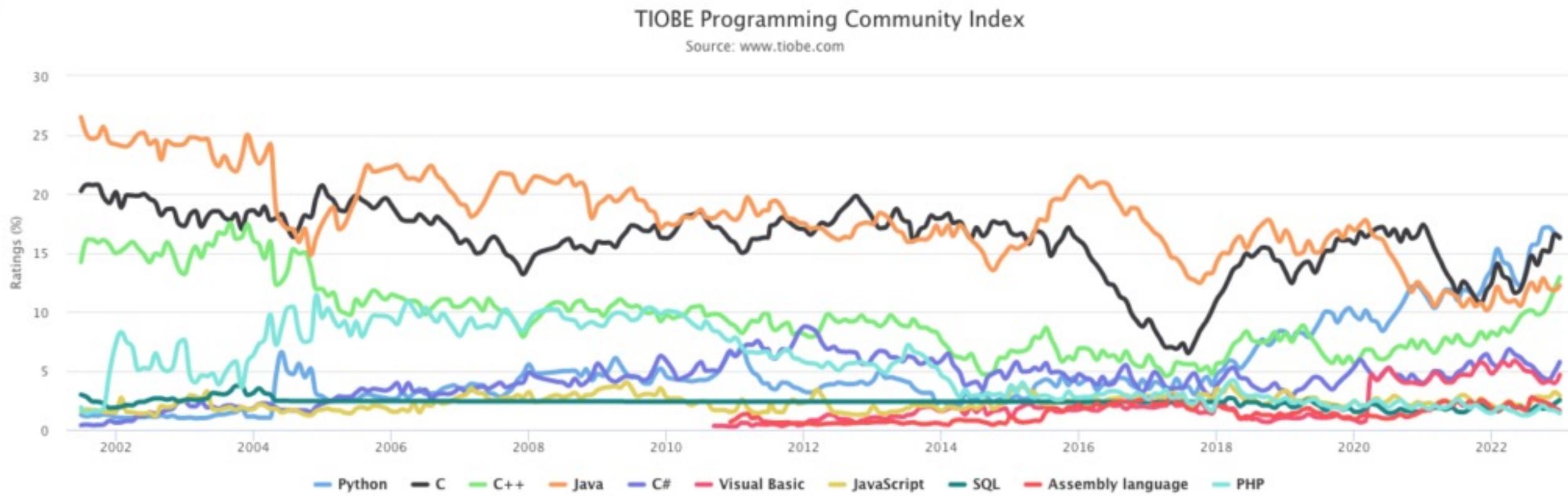
Programming Skills Are In Demand

- According to the *Developer Survey by StackOverflow*, Python was one of the most in-demand technologies of 2018, 2019, 2020, and 2021.
- As of 2021, it is ranked as the world's 2nd most popular programming language among professional software developers as well as the first most wanted programming language.

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```

Python Skills Are In Demand

- According to the *TIOBE Index*, Python overtook C and Java in 2022 as the world's most popular programming language



One of the reasons for choosing Engineering!

- Finally! A course that isn't Chem, Bio, Physics, or Math
- This (as well as your engineering design course) is what separates you from many other sciences
 - And makes you **MUCH** more valuable....

Programmer



What my friends think I do



What my mom thinks I do



What society thinks I do



What my boss thinks I do



What I think I do



What I actually do

Wondering how something works?

- How Does That Work?
 - Modules -> Course Resources -> How Does That Work? (HDTW)

How Does That Work? (HDTW)

How Does That Work (HDTW) is a series of short instructional videos focused on the tools we use in this course.

Week 1

[HDTW - Installing Python & Anaconda](#)

[HDTW - Jupyter Notebooks](#)

[HDTW - Anaconda Navigator](#)

[HDTW - IDEs & PyCharm](#)

[HDTW - UofT JupyterHub](#)

introduction.

Week 1 | Lecture 1 (1.1)

if nothing else, write `#cleancode`