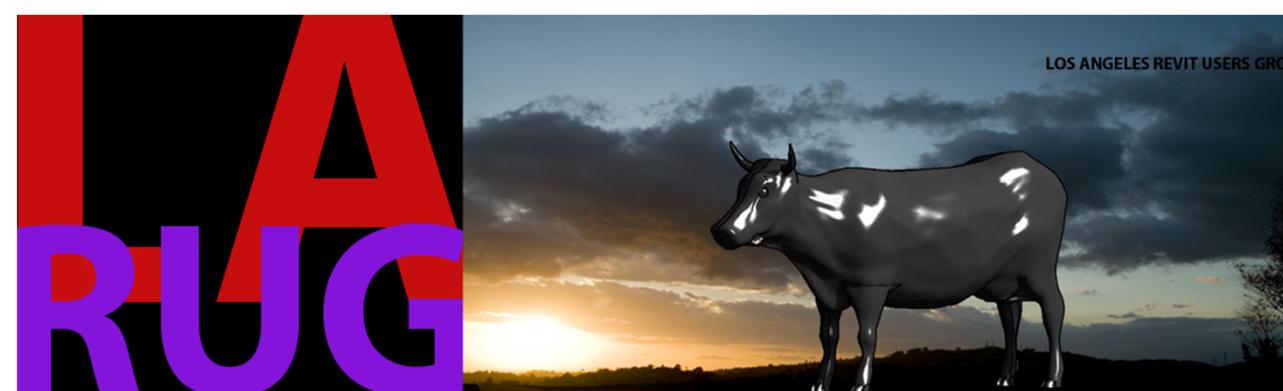


Building Your Tech Stack

How Anyone can Code (in AEC)

By Tadeh Hakopian



WHAT ARE WE TALKING ABOUT?

- My Story
- Where to get started
- Programming languages
- Text Editors
- Online resources and learning
- User groups and mutual support
- Sharing your content
- Leveling Up



WHAT ARE WE TALKING ABOUT?

- This talk is about how to get started with coding for people who don't know much about it
- All the main steps to start use open source tech tools including learning resources
- Anything else is beyond the scope of this talk
- But feel free to ask questions ☺

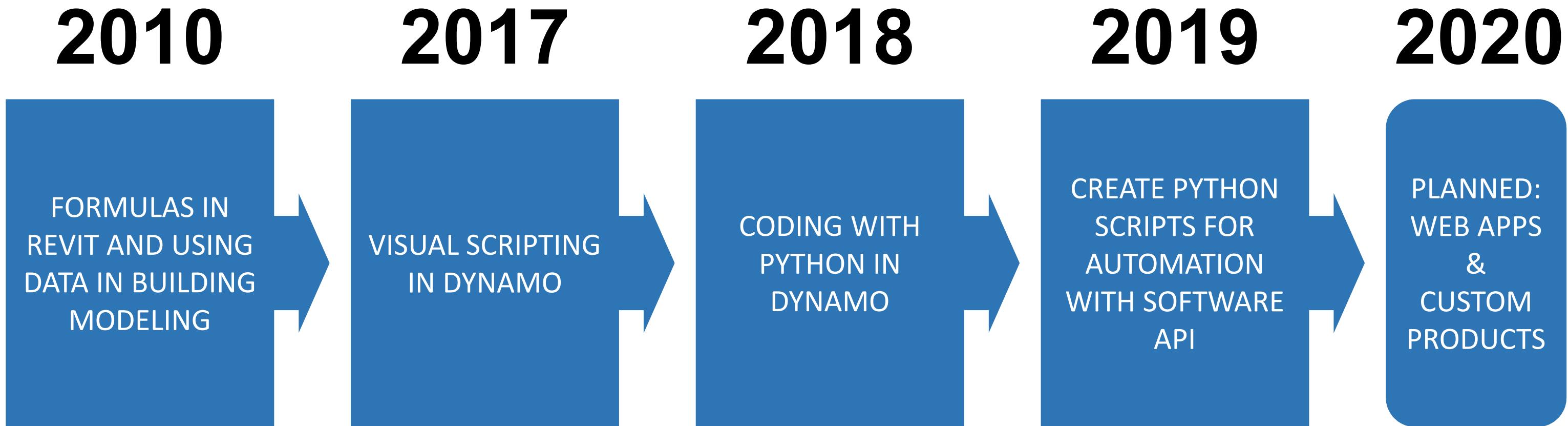


ABOUT ME

- Tadeh Hakopian
- (Todd-A) (Ha-co-pea-on)
- Design Technologist and Developer
- Background in Architecture
- Experience in Architecture, Engineering and Construction disciplines with BIM and VDC workflows
- Course Author and Speaker for BIM, Dynamo and Coding content



MY DEVELOPER PATH

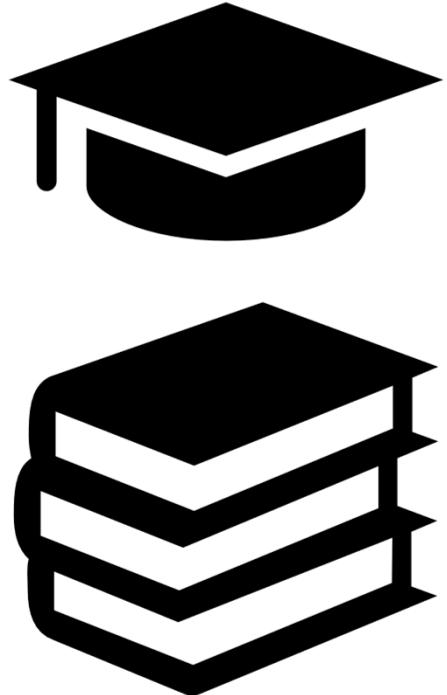


IMPORTANT PARTS

Get out of your comfort zone



There's always something you can learn

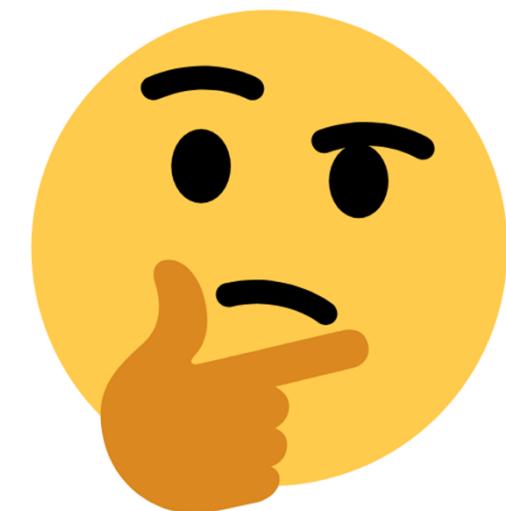


Just try something



CAN YOU BECOME A CODER?

- ✓ Do you like to think through problem solving
- ✓ Are you interested in visual script
- ✓ Do you find yourself reading through posts to solve problems
- ✓ Does long term projects with iterative updates sound like something that would work for you?



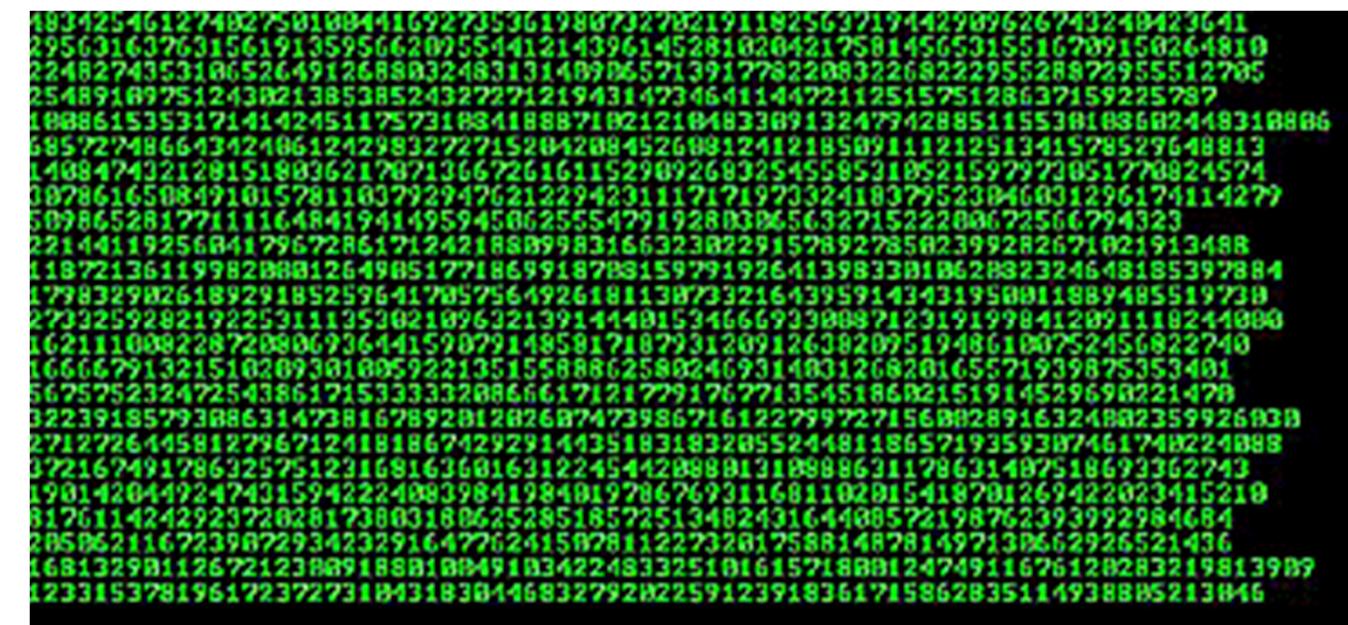
CAN YOU BECOME A CODER?

If any applies to you then you too can code!



WHAT DOES CODING LOOK LIKE?

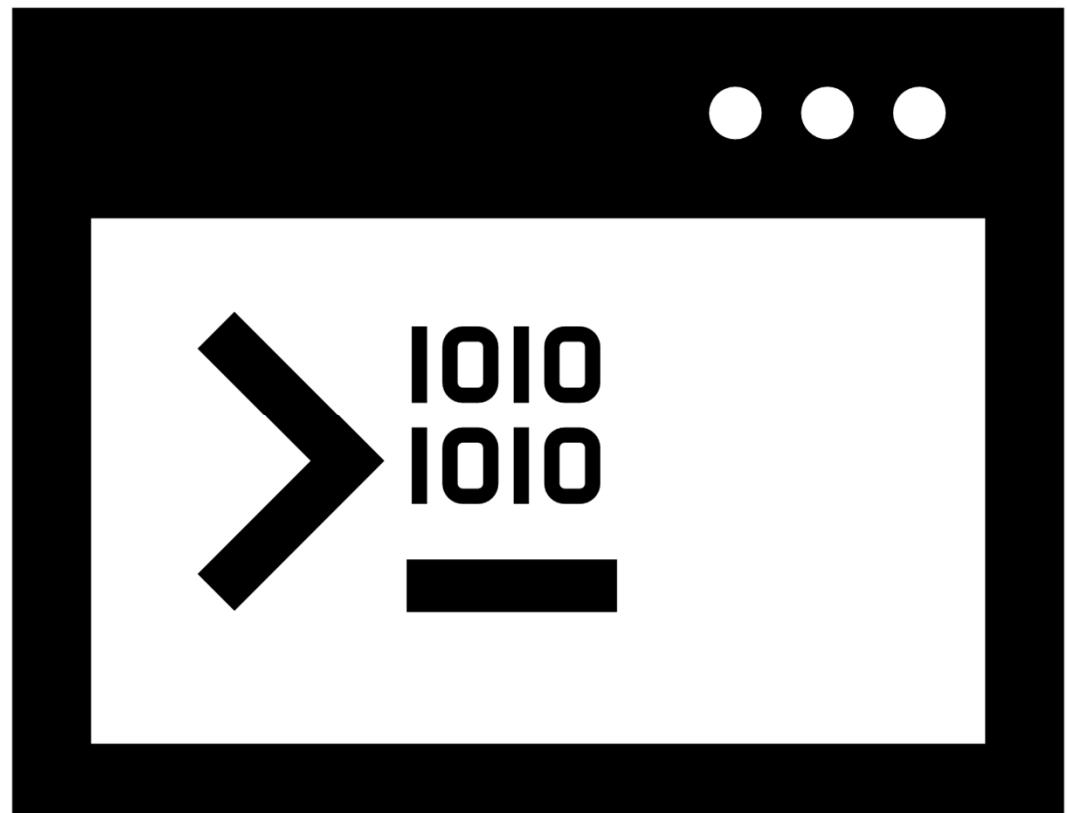
- What do you think of when you think coding?
- Does coding seem like it's all math and writing complex algorithms while wearing a hoodie?
- Feel Intimidated?



A large block of green binary code, consisting of a sequence of 0s and 1s, filling the right side of the slide.

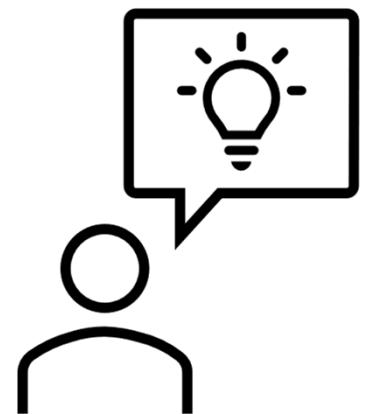
WHAT DOES CODING LOOK LIKE?

- Most Coding is straight forward
- You add lines of text to instruct the computer to complete a process
- Then execute that code in a script to perform the process
- A good chunk of your time is understanding the right problem to solve then debugging the code so it runs correctly

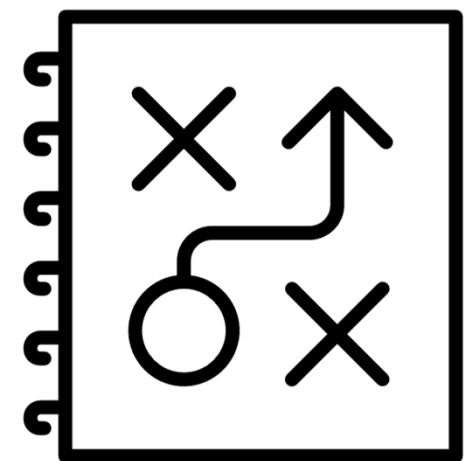


FIRST STEP – WHAT'S YOUR END GOAL?

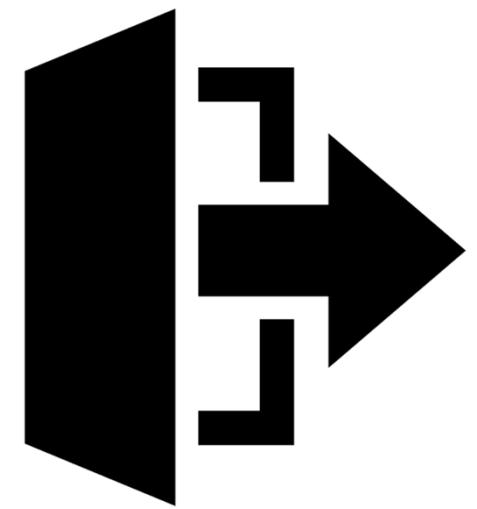
What interests you?



Which problems do you want to solve?

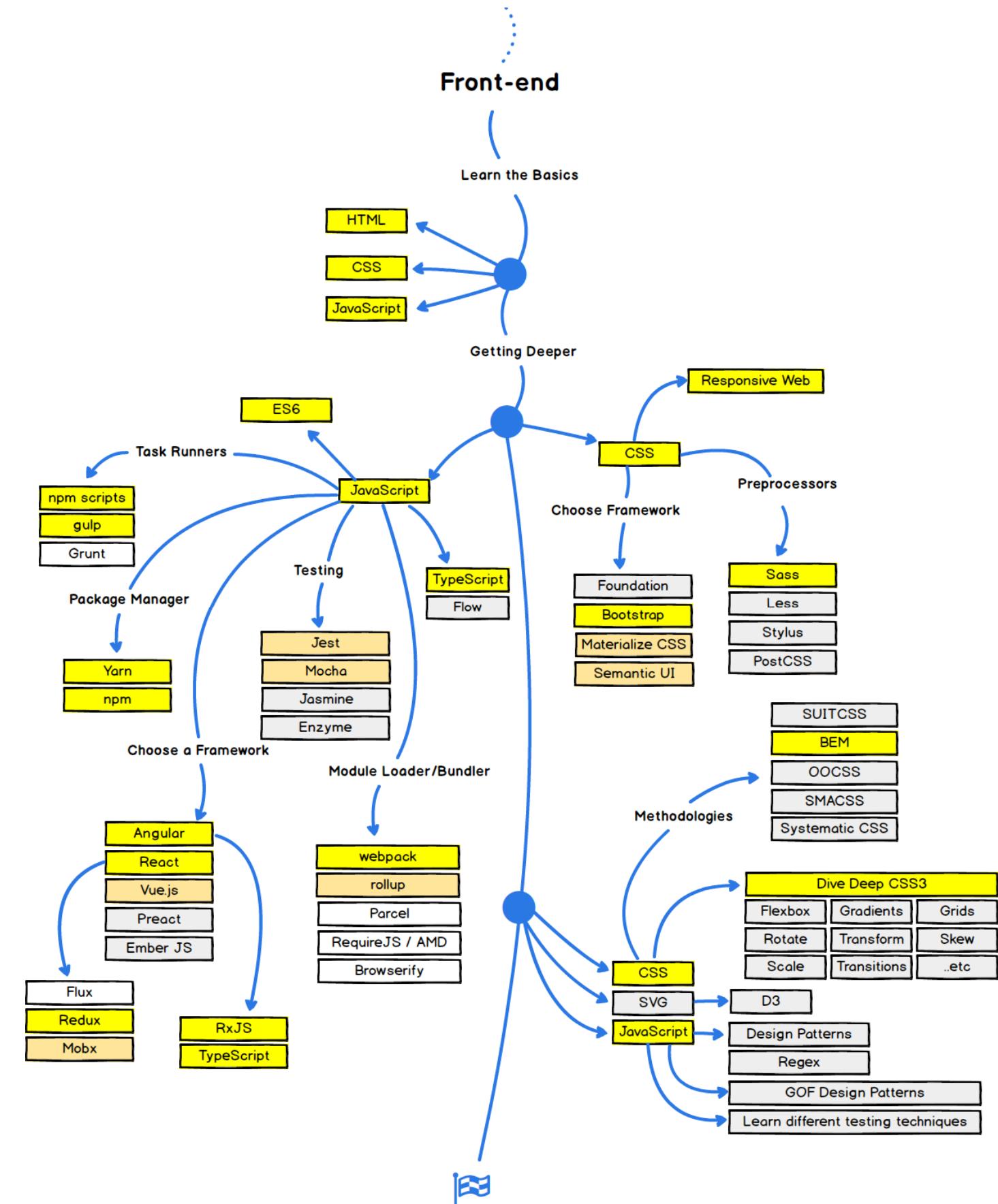


What is the best way to deliver these solutions?



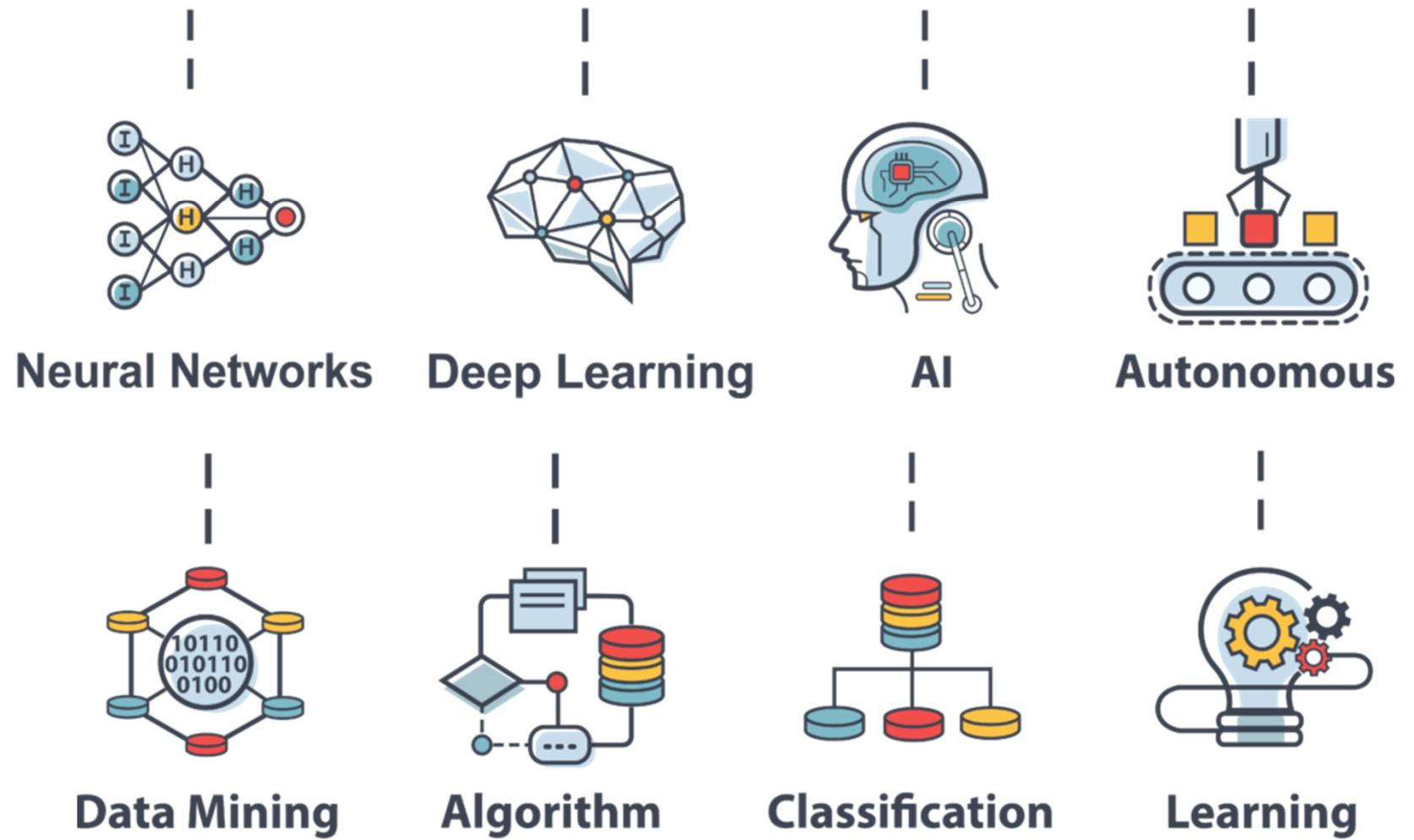
ROADMAP – WEB DEVELOPMENT

- Web Development
- Everything is online and everything is a web tool
- If you want to make web tools then you have to learn about modern web frameworks and languages
- There are easy steps and hard steps but there are lots of steps
- Constantly changing environment but high growth



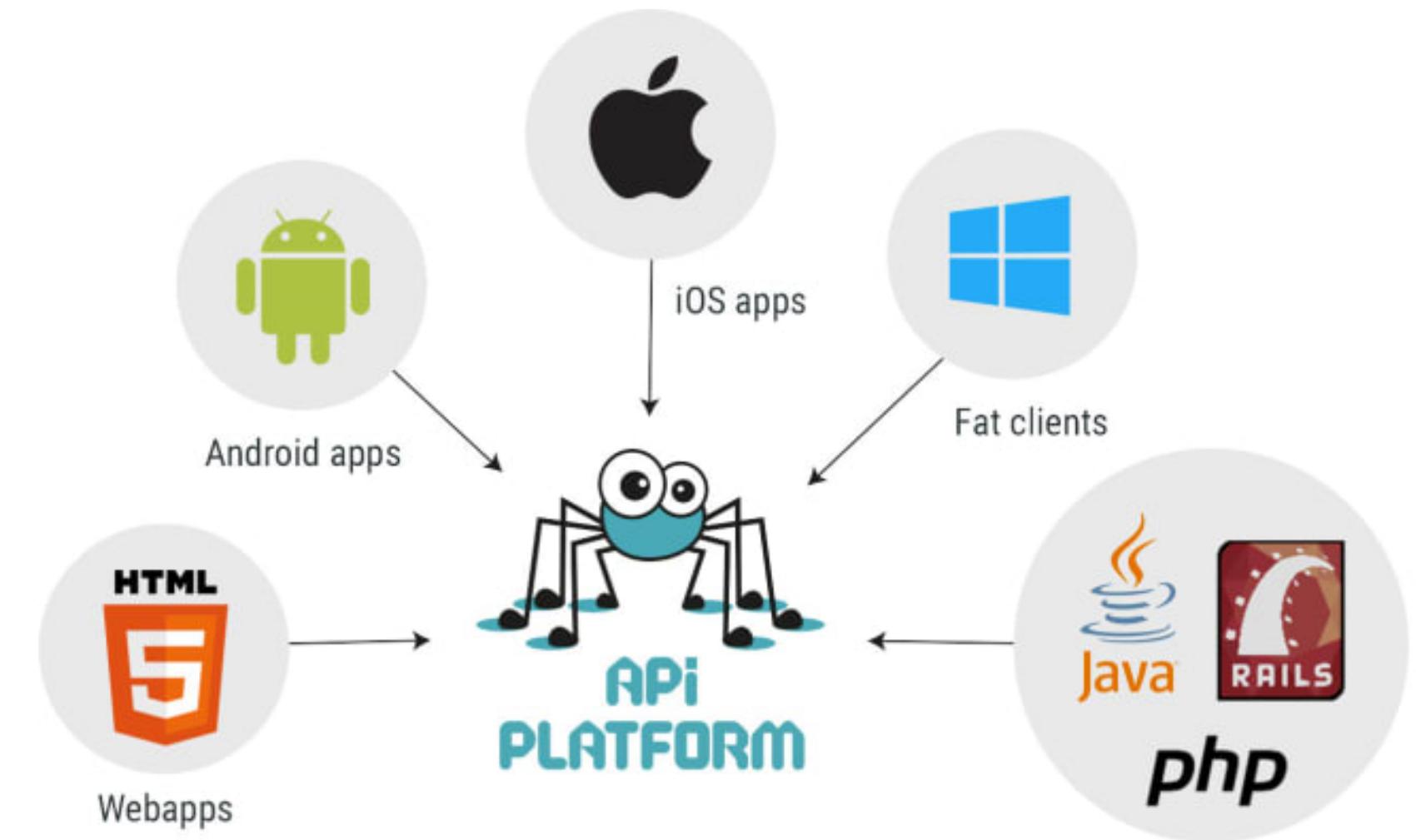
ROADMAP = DATA ENGINEERING

- Machine Learning and AI
- Basically get the computer CPU to do the thinking work for you
- Not one path though there is a lot of variety
- Can get started on large or small scale
- Python heavy scenario which is a good thing



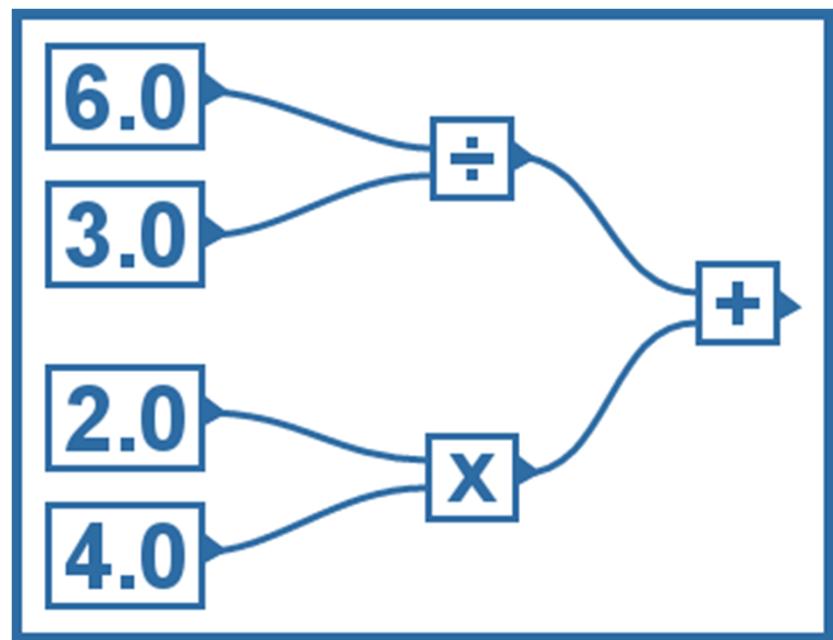
ROADMAP – SCRIPTS AND INTEGRATIONS

- Scripting
- Not interested in being a full time professional software development?
There's always scripting!
- Most software you use has an API that can provide access to the functions of the platform and you can automate tasks
- Just knowing enough to script is extremely useful and pays dividends for any work you do



EASY STEPS

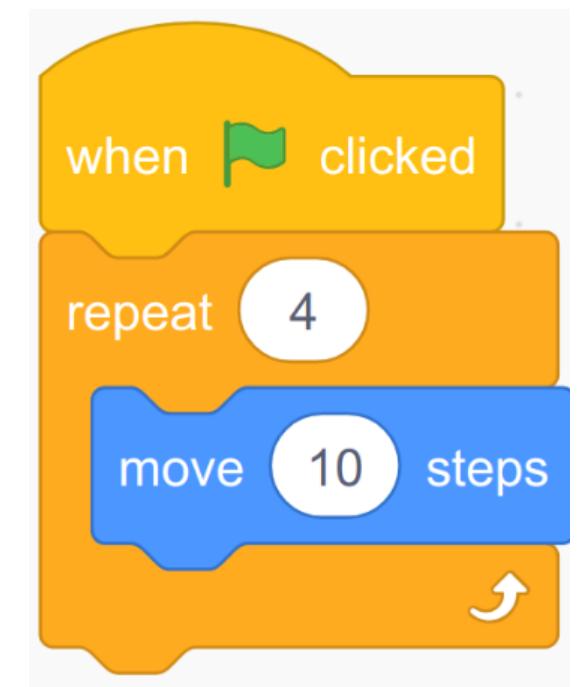
Visual Scripts



HTML / CSS



Scratch



WHICH CODING LANGUAGE DO YOU NEED TO LEARN?

WEB TOOLS

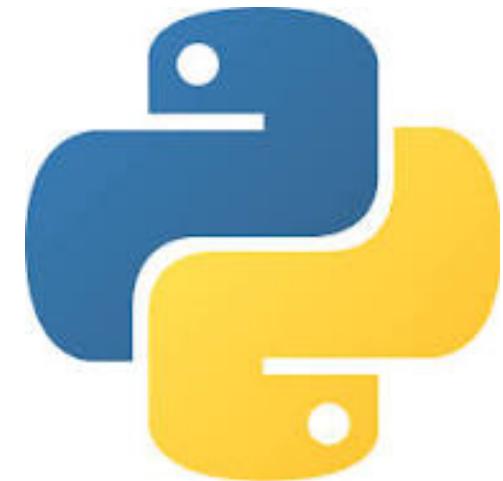
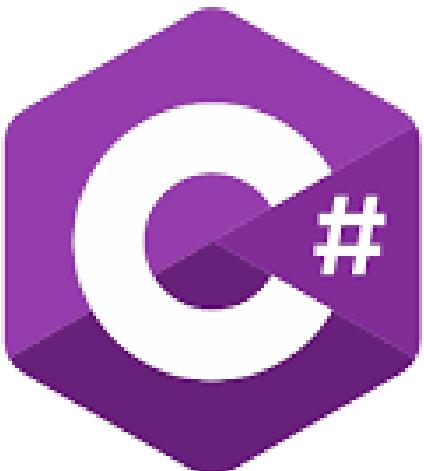
WINDOWS / .NET TOOLS

DATA / ML / AI

JavaScript

C#

Python



WHICH CODING LANGUAGE DO YOU NEED TO LEARN?

- Don't know?
- Just pick Python and go from there
- It does just about everything

"You can't just copy-pase pseudocode
into a program and expect it to work"

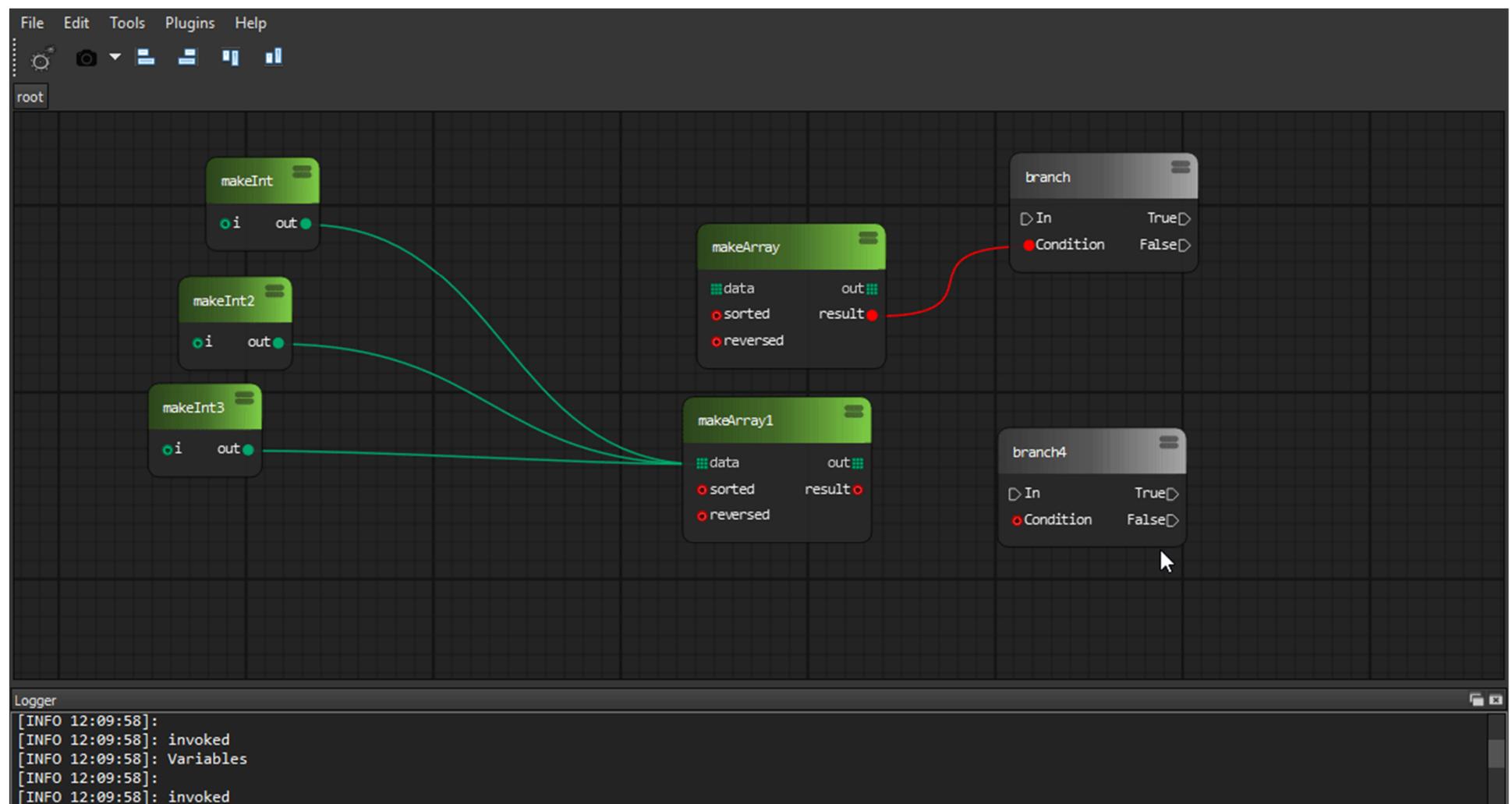


QA



WHICH CODING LANGUAGE DO YOU NEED TO LEARN?

- By the way if you like visual scripts there's even an open source project called PyFlow which makes Python accessible to non-coders.
- <https://wonderworks-software.github.io/PyFlow/>
- So long as you learn the code you're off to a good start.



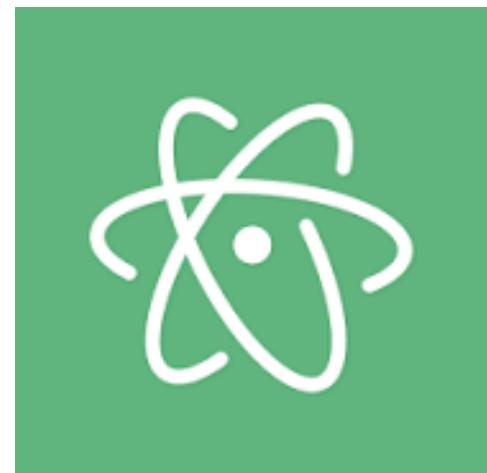
GET AN EDITOR!

- If you can't write code then you can't do much
- Text editors are helpful to write and format code
- You can type all your code on Windows Notepad but that sucks
- They include helpful auto-complete, error checking and debug systems
- Text editors can also run code and create virtual environments to deploy code

```
1 /*  
2  * Off-canvas mobile menu navigation  
3  */  
4  
5 .button__mobile-menu {  
6  position: relative;  
7  padding: 0;  
8  border: none;  
9  background: transparent;  
10 color: white;  
11 font-size: 18px;  
12  
13 @include respond-to($break-mobile-header) {  
14  display: none;  
15 }  
16  
17 &:after {  
18  content: "";  
19  display: inline-block;  
20  vertical-align: bottom;  
21  height: 25px;  
22  width: 30px;  
23  background-repeat: no-repeat;  
24  background-position: center;  
25  background-size: 20px;  
26  background-image: url(../images/svg/icon-nav.svg);  
27  margin-left: 5px;  
28  
29 .layout__hero-wrapper & {  
30  background-image: url(../images/svg/icon-nav-shadow.svg);  
31  background-size: 30px;  
32  background-position: center bottom;  
33 }  
34 }  
35  
36 &.js-overlay--mobile-menu-active:after {  
37  margin-left: 0;  
38  background-size: 20px;  
39  background-position: center 20px;
```

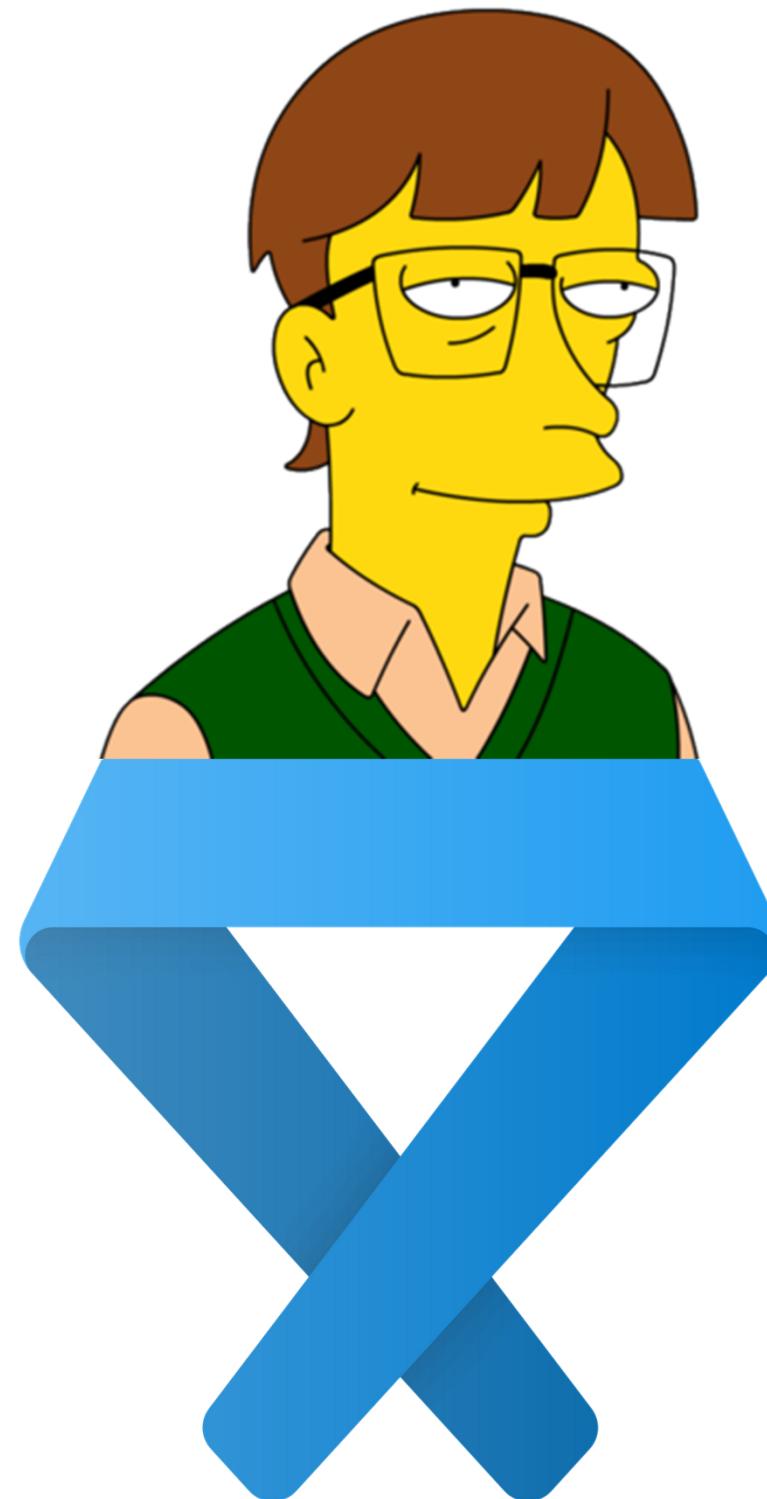
GET AN EDITOR!

- There are a lot of editors out there which to choose from
- Vim
- Sublime Text
- Atom
- Gnat
- Brackets
- Komodo
- Notepad++
- Regular Notepad
- Maybe 20-30 more out there...



GET AN EDITOR!

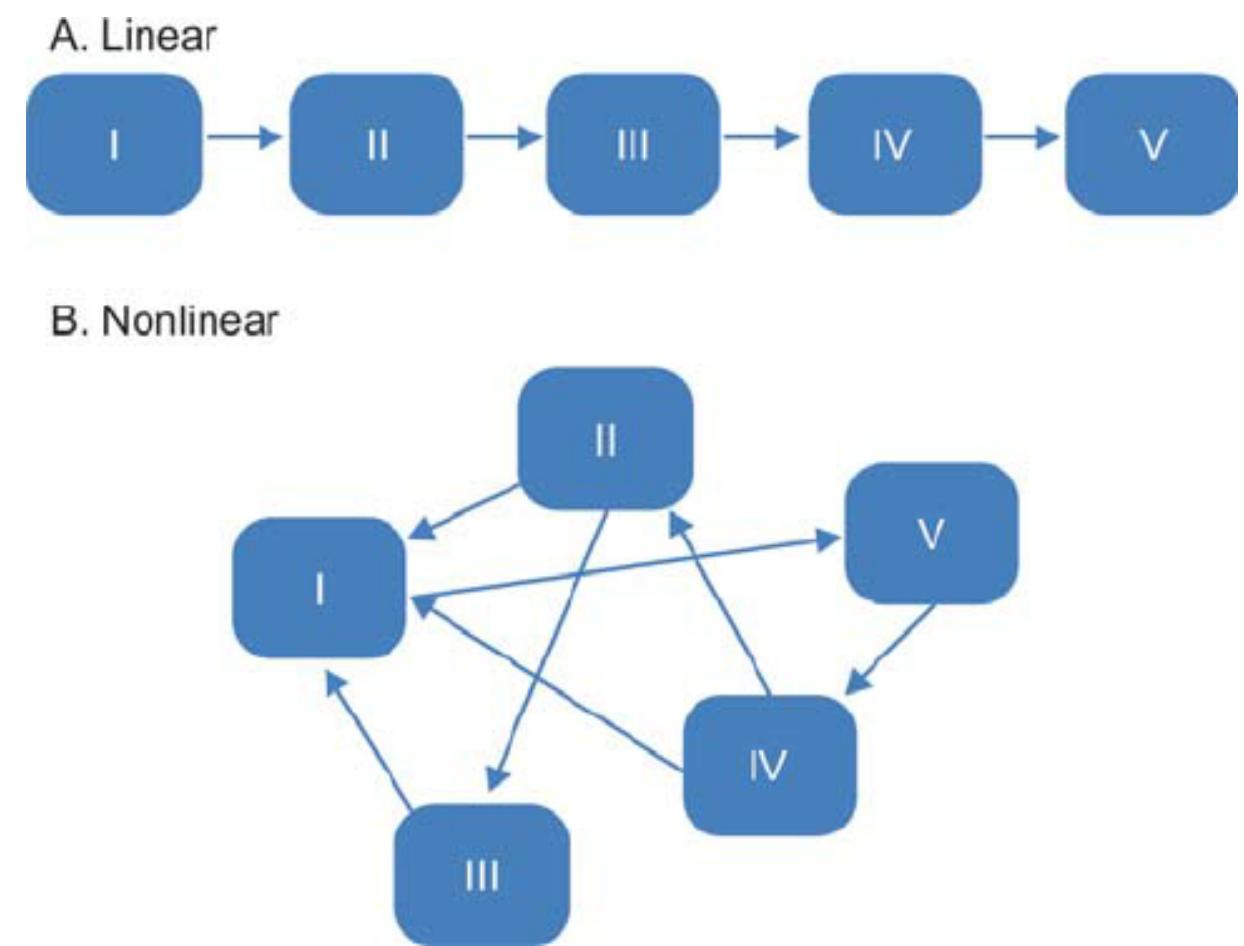
- Or just get Visual Studio Code
- Easy for beginners and has a lot of expansion capability as you grow as a programmer
- <https://code.visualstudio.com/>



LEARNING STYLES

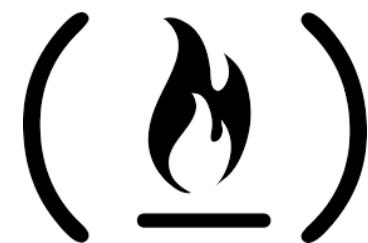


Linear and Non-Linear



LEARNING RESOURCES

- There are many free resources to start coding on any language you want to learn
- If you are a beginner then any of these are a good start for the basics
- Code Academy
- Edx
- Udemy
- Pluralsight
- SoloLearn
- Treehouse
- FreeCodeCamp
- Udacity
- And Many more....



PLURALSIGHT



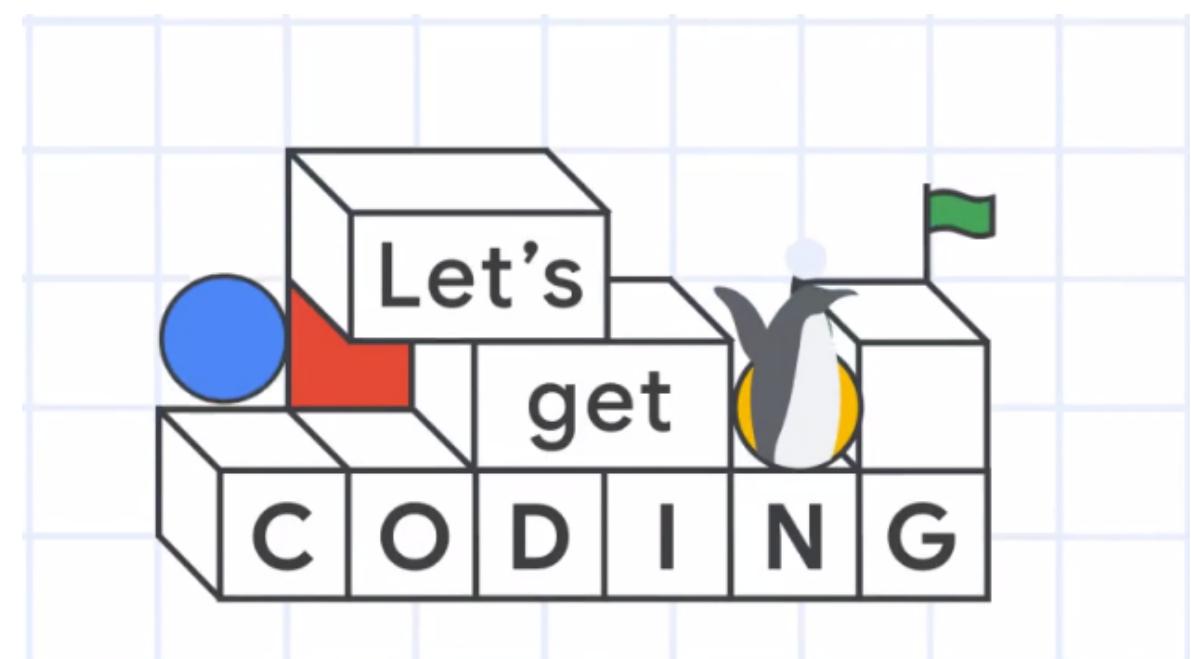
treehouse



UDACITY

LEARNING RESOURCES

- Or Just take Google's learning series about software basics
- You can finish these lessons in a day or two
- Python
 - <https://developers.google.com/edu/python>
- JavaScript
 - <https://learndigital.withgoogle.com/digitalgarage/course/learn-programming-with-javascript>



LEARNING RESOURCES

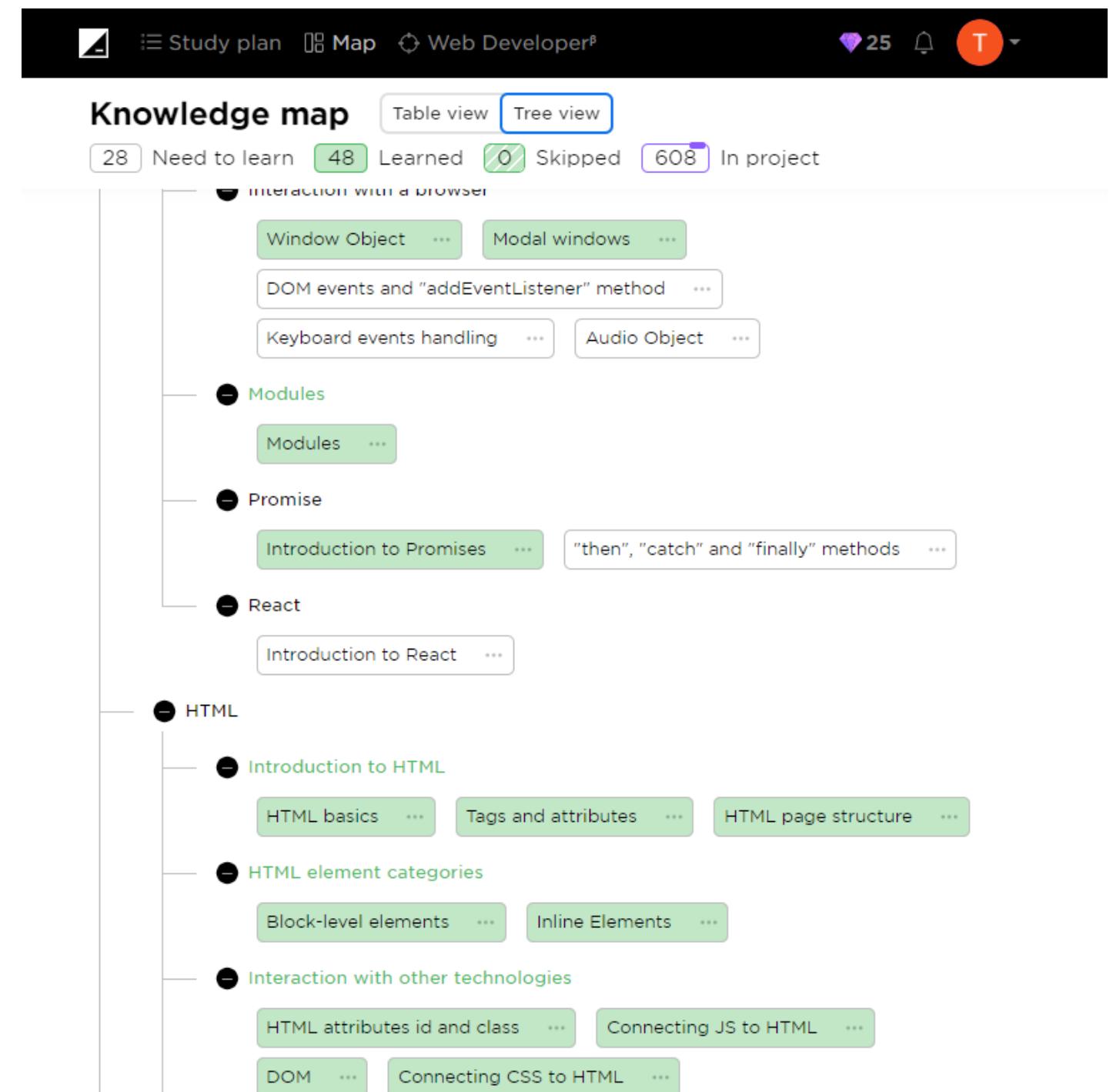
- Protip: You can get free access to Linkedin Learning Courses with a LA Public Library account.
- Linkedin Learning has learning paths that format courses in different programming topics for you with certifications
- Register LA Library account online:
- <https://www.lapl.org/about-lapl/contact-us/e-card/e-card-registration>
- Linkedin learning login :
- <https://www.lynda.com/portal/sip?org=lapl.org>



Linkedin LEARNING

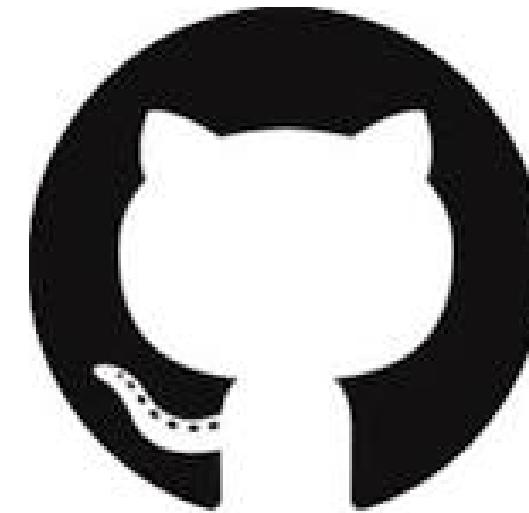
LEARNING RESOURCES

- My Preference – Hyperskill by JetBrains
- Multiple learning paths
- Non-Linear
- Comprehensive
- Includes community of learners
- Reinforces learning
- hyperskill.org



SHARE YOUR CODE

- Github is an online repository for versions of your code
- Sometimes you want to version control the code in case you have to roll back to an earlier version
- Or release a specific public version of code while you test the working code
- Easy to use and can host wikis and most file types for anyone to access
- Quickstart guide:
<https://docs.github.com/en/github/getting-started-with-github/quickstart>



Create a new repository

A repository contains all the files for your project, including the revision history.

Owner  octocat / Repository name ✓

Great repository names are short and memorable. Need inspiration? How about [potential-eureka](#).

Description (optional)

NEED HELP? – ASK THE INTERNET!

- Ask questions with keywords to get the results you need
- Stack Overflow – First place to ask for help on actual code problems
- Reddit – Lots of subreddits on many coding languages that can provide support on your issues
- Quora – Question and Answer site for general and specific tech problems

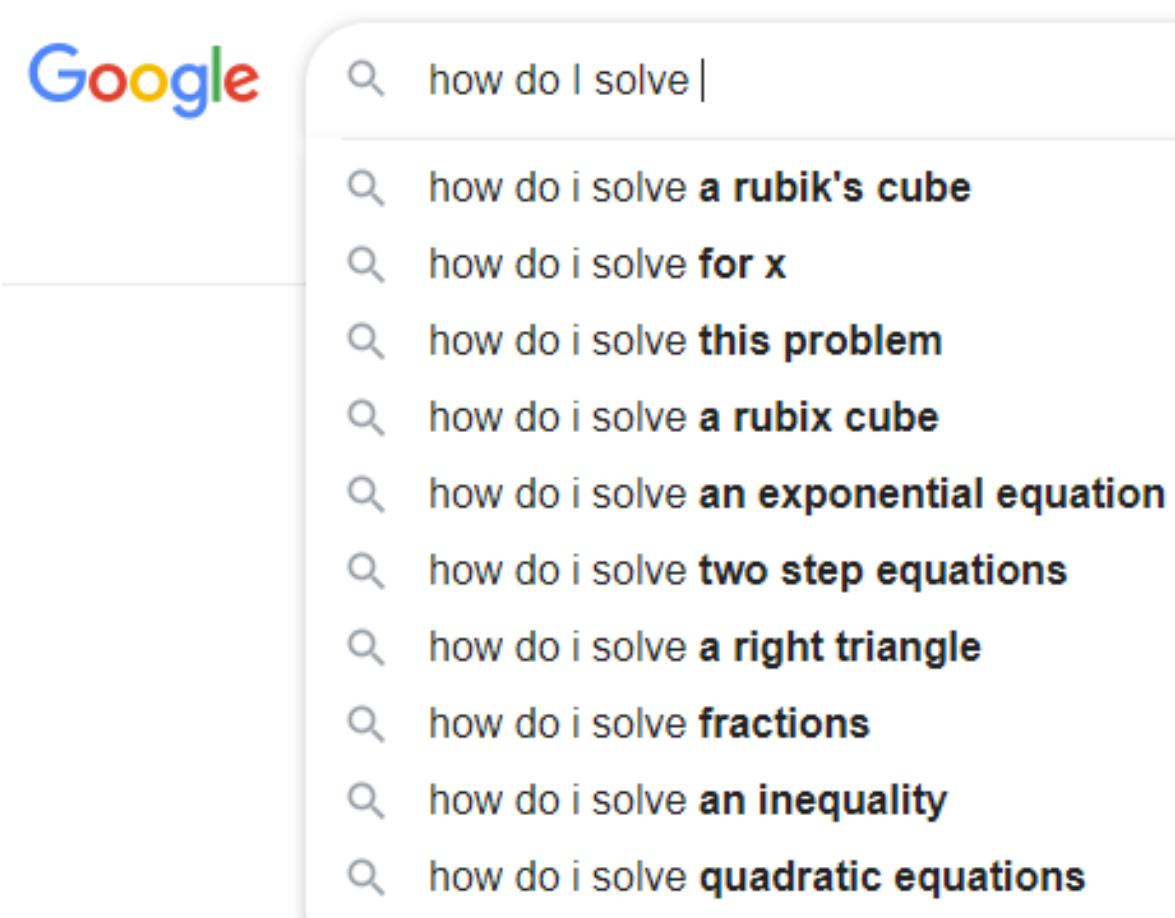
Quora

 stackoverflow

 reddit

NEED HELP? – ASK THE INTERNET!

- Or just ask Google
- Google is your friend



SUPER POWERS FOR SUPER USERS

20 lines (16 sloc) | 471 Bytes

```
1 # Enable Python support and load DesignScript library
2 import clr
3 clr.AddReference('ProtoGeometry')
4 from Autodesk.DesignScript.Geometry import *
5 clr.AddReference('RevitNodes')
6 from Revit.Elements import *
7
8 famtype = IN[0]
9 pbc = Point.ByCoordinates(0,0,0)
10 output = []
11
12 for x in range(0, 100, 20):
13     for y in range(0, 100, 20):
14         for z in range(0, 100, 20):
15             pbc = Point.ByCoordinates(x,y,z)
16             col = FamilyInstance.ByPoint(famtype,pbc)
17             output.append(col)
18
19 OUT = output
```



R PS - XYZ matrix Family PY

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17             output.append(col)
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19 OUT = output
```

QA



SOFTWARE PROJECTS BY PEOPLE FROM AEC

PyRevit By Ehsan



Hypar



Layer by Zach Soflin



Testfit



SOFTWARE PROJECTS BY PEOPLE FROM AEC

Blender 3D



blender

BlenderBIM by
Dion Moult



BLENDERBIM
ADD-ON

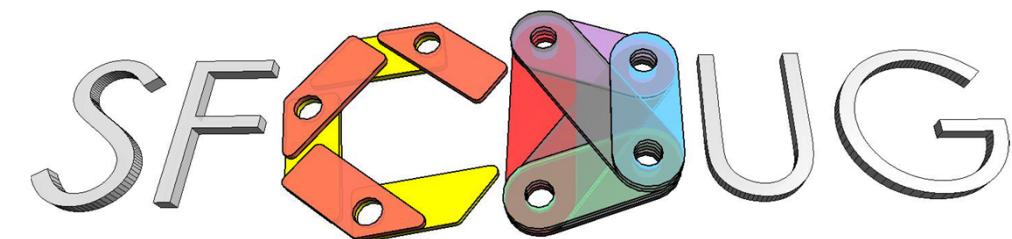
GROUPS

- There are many groups to follow that provide workshops, training guides, hackathons and events
- Find them locally or online and connect with the people there
- Ideally connect with some meetup groups with real tech professionals where you can meet and talk shop

meetup

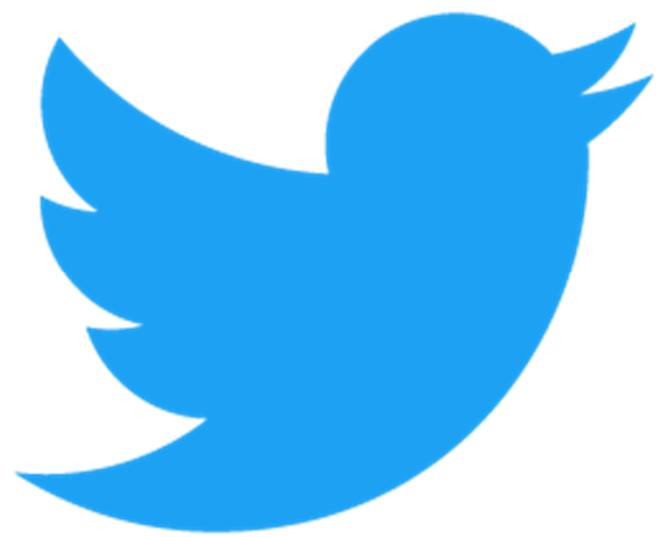


CORE
studio



PEOPLE TO FOLLOW

- Ehsan Iran-Nejad - @eirannejad
- Ian Keough - @ikeough
- Jose Oliveira - @TugaBIM
- Sol Amour - @solamour
- Gavin Crump - @thebimguru
- Thomas Mahon - @Thomas__Mahon
- Wassim Jabi - @wassimj
- Gui Talarico - @gtalarico
- Lisa Marie Mueller - @lm2_me
- Find More on the interwebs!

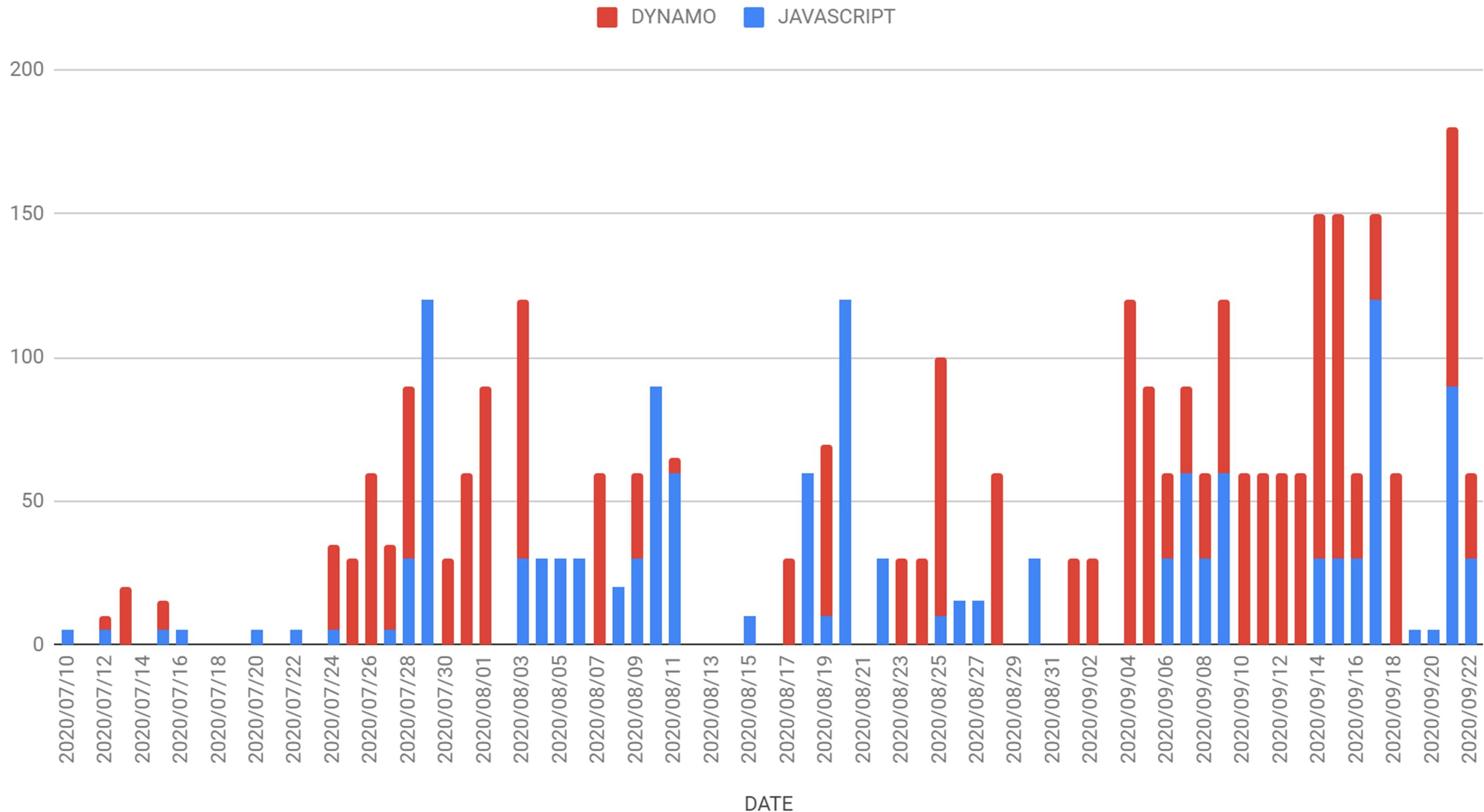


HOW LONG DOES IT TAKE?

- Becoming capable of writing code on your own on a regular basis can take time but most people can do it
- Speed of learning depends on how much time you put in
- How often you code (daily is best)
- If you're working on real projects
- Keep a journal of time spent coding
- More than zero effort put into the work every day to see progress

LEARNING METHOD	TIME TO LEARN CODING
Self-Study	6 – 12 months
College Degree	4+ years
Coding Bootcamp	3 – 6 months

MORE THAN ZERO MINUTES



PROJECTS TO TRY OUT

- After you get started coding and have a handle on it create some projects and get your own product portfolio going
- Python in Grasshopper - <https://developer.rhino3d.com/guides/rhinopython/your-first-python-script-in-grasshopper/>
- Python in Dynamo - <https://dynamopythonprimer.gitbook.io/dynamo-python-primer/>
- Data Science in AEC - <https://www.edx.org/course/Data-Science-for-Construction-Architecture-and-Engineering>
- Web Development with Autodesk Forge - <https://learnforge.autodesk.io/#/tutorials/dashboard>
- Automate the Boring stuff - <https://automatetheboringstuff.com/>

HOW LONG DOES IT TAKE?

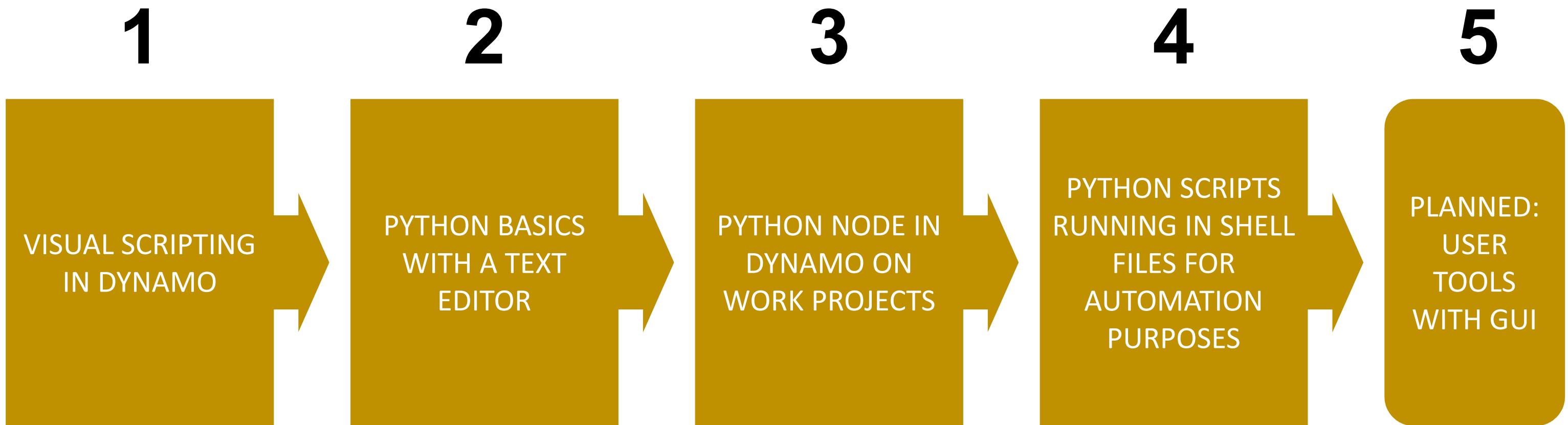
- However you are never really going to stop coding
- The programming environment always changes and you have to keep up to date
- Get used to learning new things and trying them out
- The ride never ends...



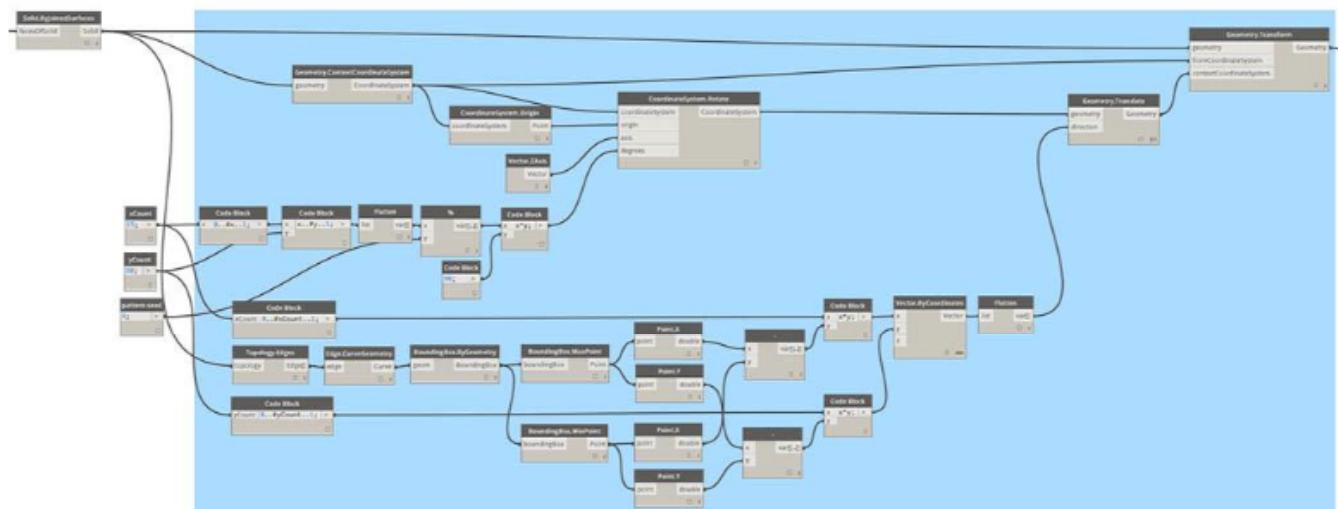
QA



MY LEARNING PATH



MY EXAMPLES



```
import clr
clr.AddReference('ProtoGeometry')
from Autodesk.DesignScript.Geometry import *

solid = IN[0]
seed = IN[1]
xCount = IN[2]
yCount = IN[3]

solids = []

yDist = solid.BoundingBox.MaxPoint.Y-solid.BoundingBox.MinPoint.Y
xDist = solid.BoundingBox.MaxPoint.X-solid.BoundingBox.MinPoint.X

for i in xRange:
    for j in yRange:
        fromCoord = solid.ContextCoordinateSystem
        toCoord =
        fromCoord.Rotate(solid.ContextCoordinateSystem.Origin,Vector.ByCoordinates
(0,0,1),(90*(i+j%val)))
        vec = Vector.ByCoordinates((xDist*i),(yDist*j),0)
        toCoord = toCoord.Translate(vec)
        solids.append(solid.Transform(fromCoord,toCoord))

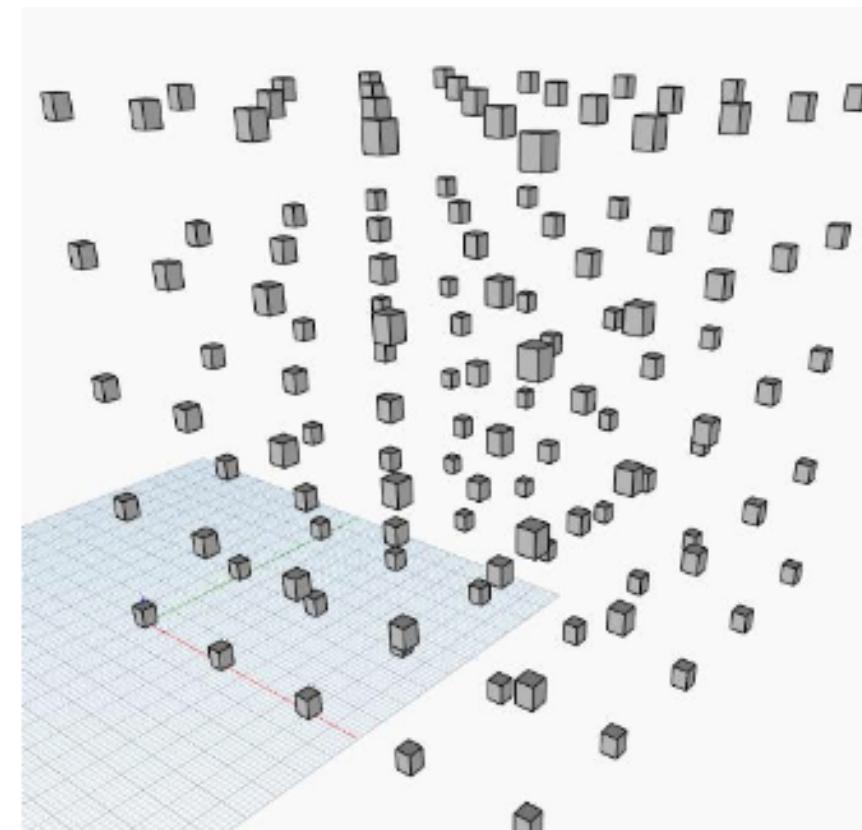
OUT = solids
```

MY EXAMPLES

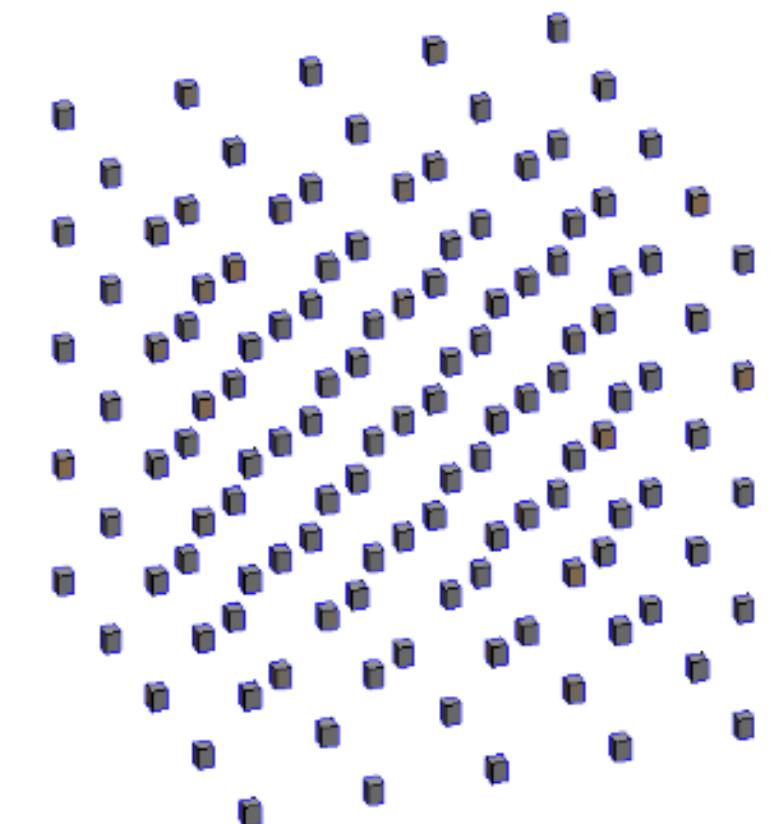
Python in Dynamo

```
R PS - XYZ matrix Family PY
1 # Enable Python support and load DesignScript library
2 import clr
3 clr.AddReference('ProtoGeometry')
4 from Autodesk.DesignScript.Geometry import *
5 clr.AddReference('RevitNodes')
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16             col = FamilyInstance.ByPoint(famtype,pbc)
17             output.append(col)
18
19 OUT = output
```

Solids in Dynamo



Elements in Revit



Exploring Python Nodes in Dynamo from Autodesk University

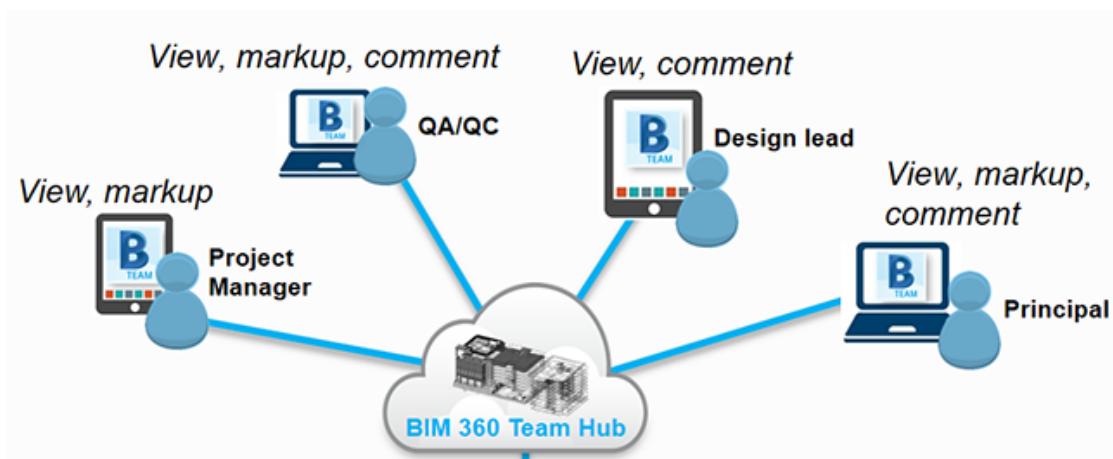
<https://www.autodesk.com/autodesk-university/class/Exploring-Python-Nodes-Dynamo-2019#presentation>

MY EXAMPLES

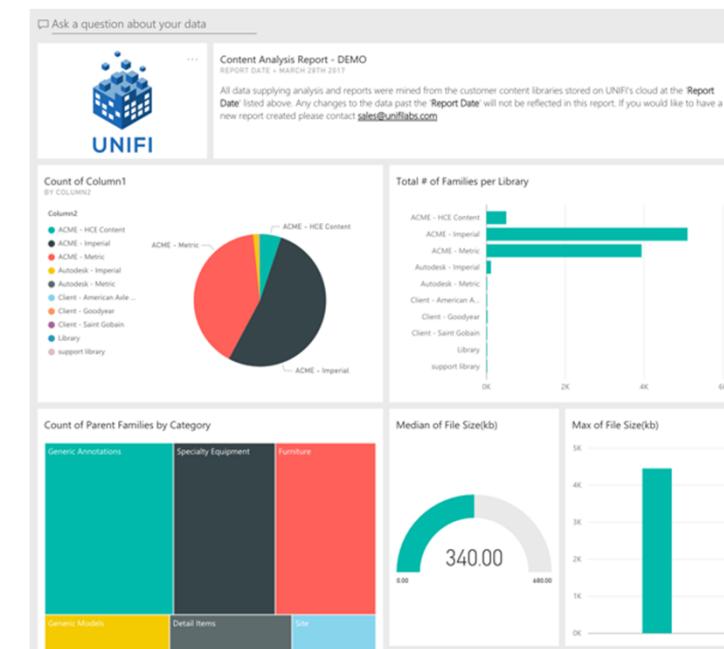


HMC DIGITAL PRACTICE GOALS

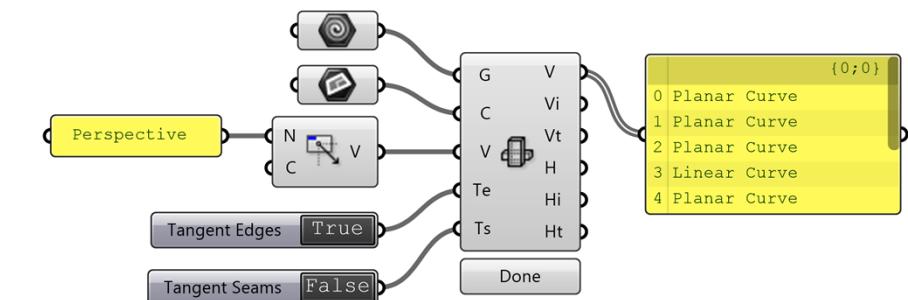
Cloud Native Teams



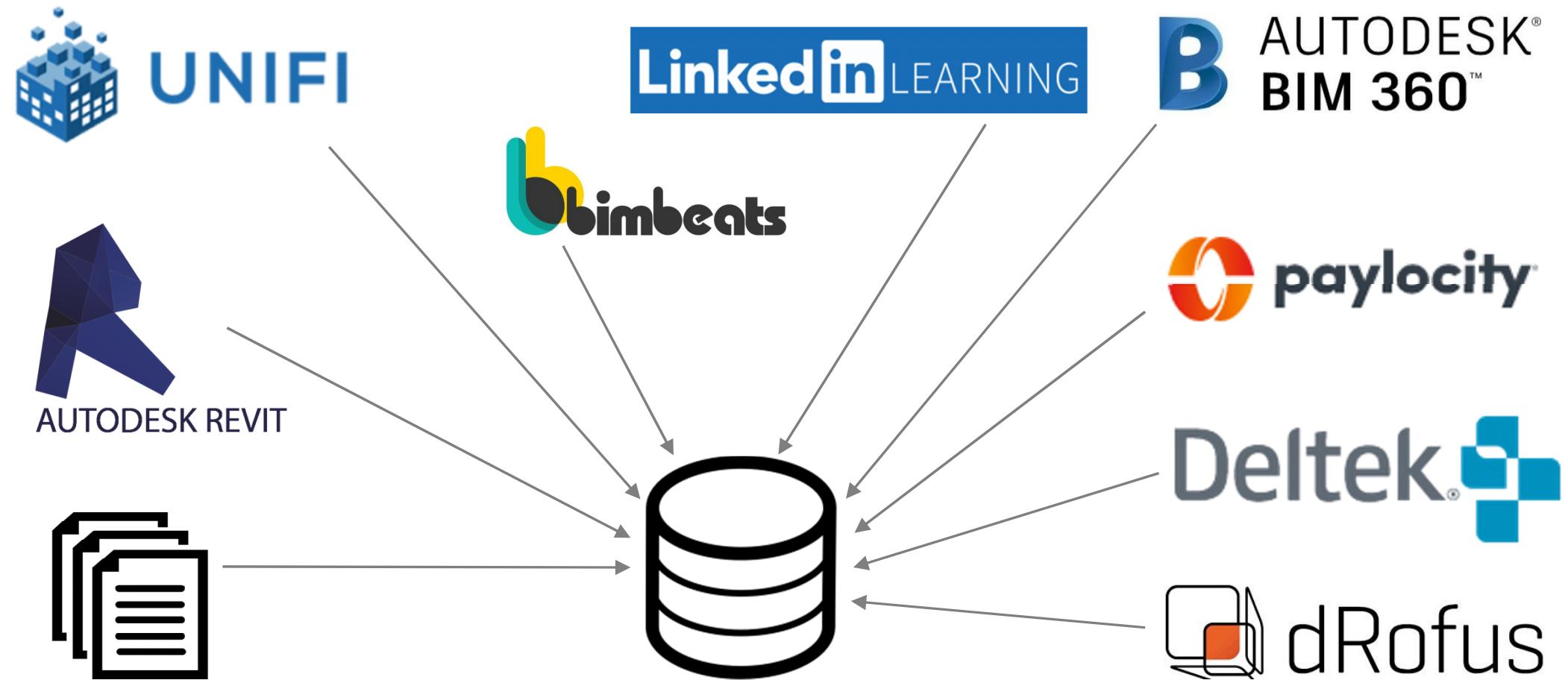
Data Driven Design



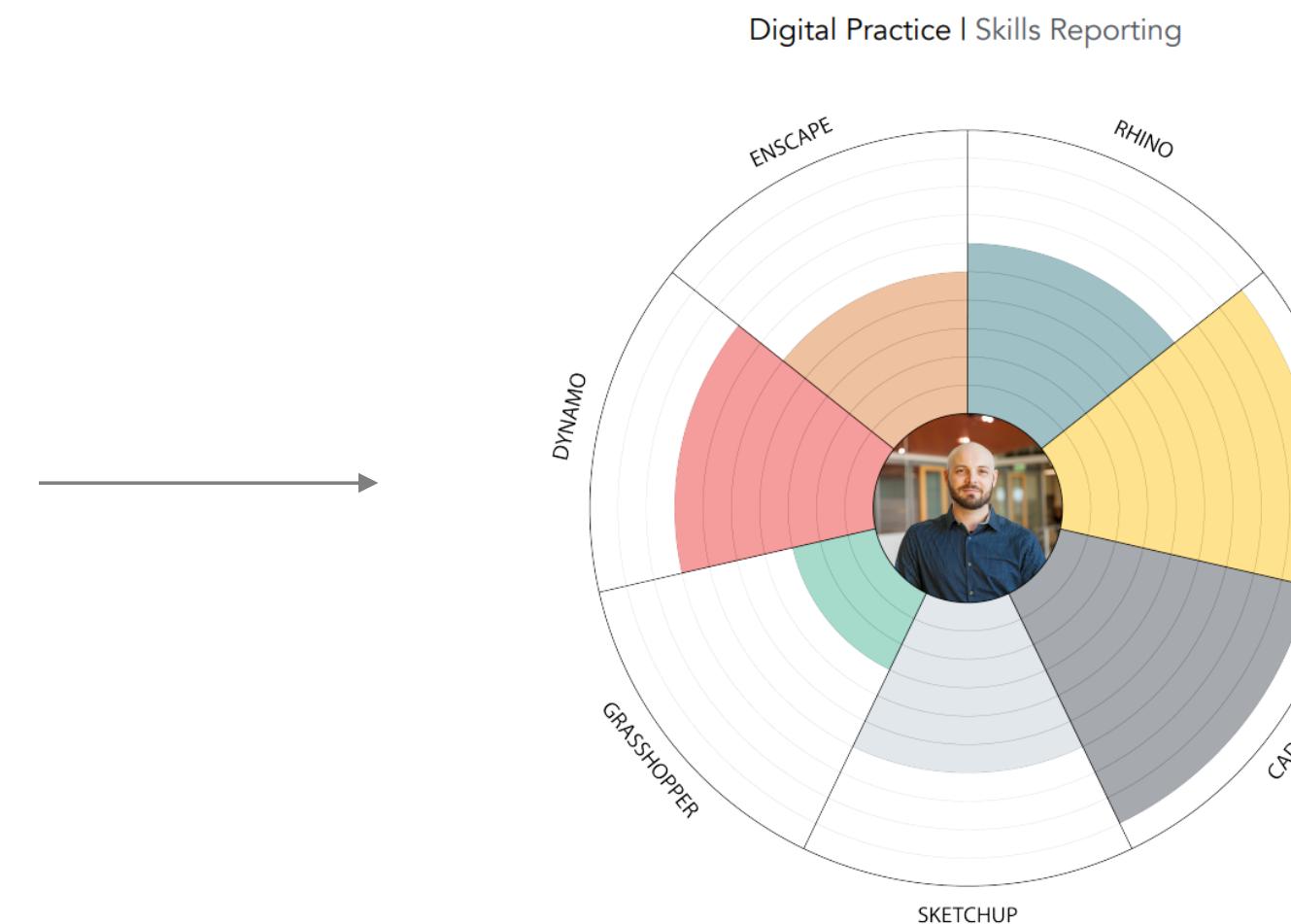
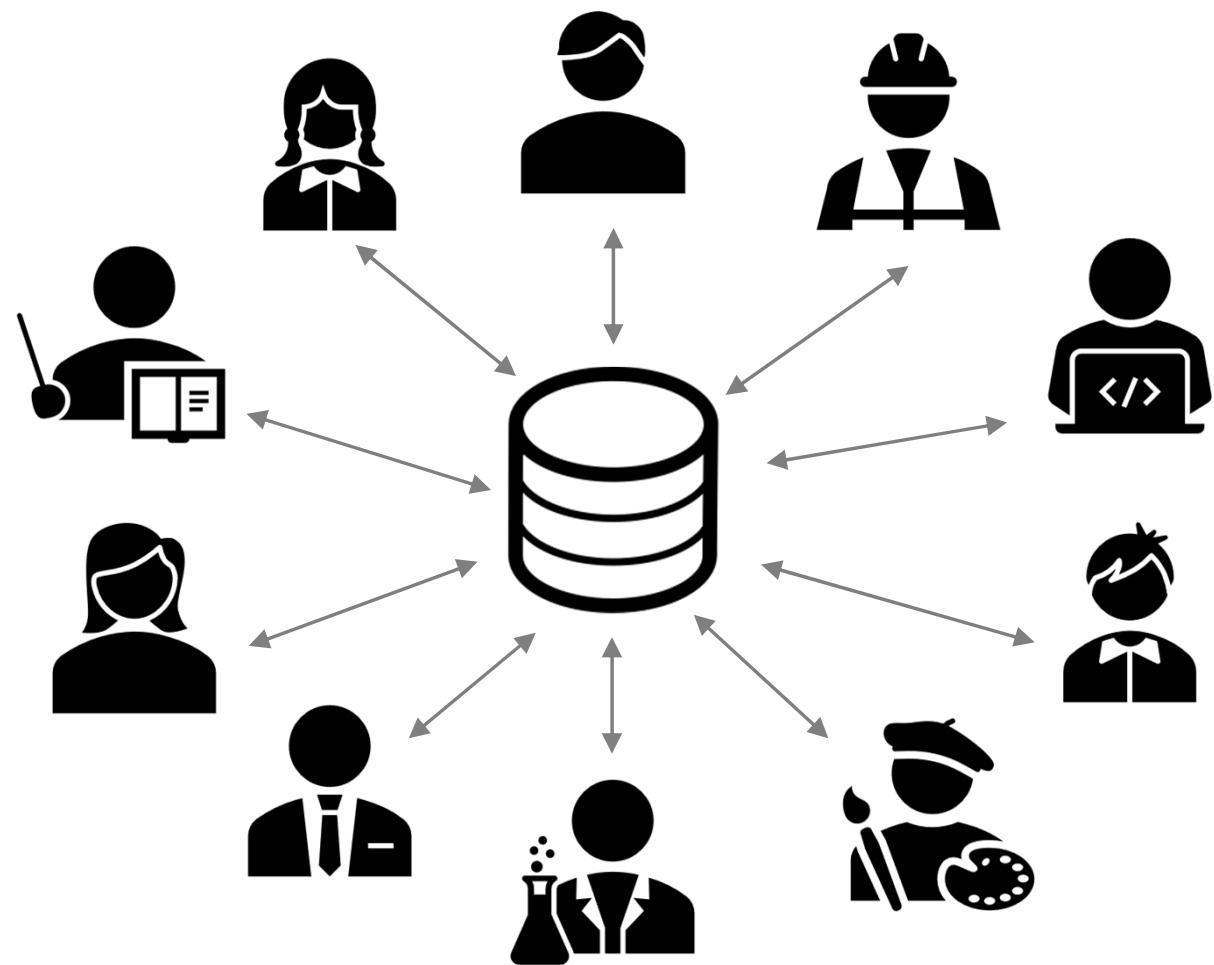
Analysis



DATABASE CREATION



DATABASE CREATION



NOW FOR SOMETHING COMPLETELY DIFFERENT

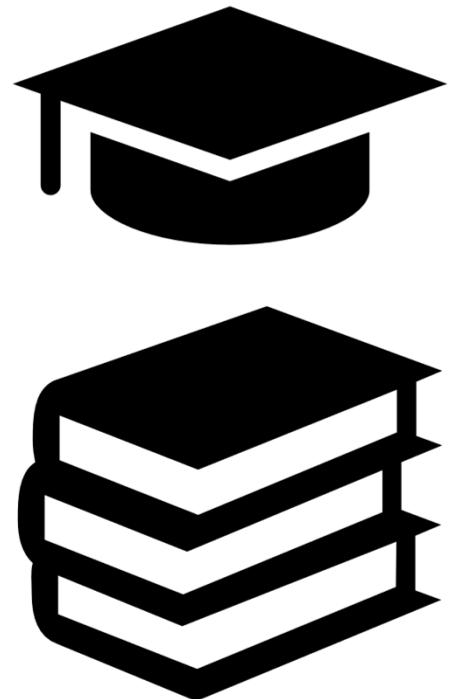


IMPORTANT PARTS, AGAIN

Get out of your comfort
zone



There's always something
you can learn



Just try something



THAT'S IT! GET GOING! THANKS!

- **Tadeh's Contacts:**
- Twitter - @tadeh_hakopian
- Linkedin - <https://www.linkedin.com/in/thakopian/>
- Github Decks - <https://github.com/thakopian/Presentations>
- Email – thakopian@gmail.com



UPCOMING TALKS:

- AEC TECH 2020 - Oct 16 - <https://www.aectech.us/agenda>
- ENR FUTURE TECH PANEL - Oct 15 - <https://www.enr.com/future-tech/agenda>
- PYGOTHAM – Oct 02 - <https://2020.pygotham.tv/>
- AUTODESK UNIVERSITY 2020 - Nov 17 - <https://www.autodesk.com/autodesk-university/conference/overview>
- 2021 – MORE TO COME !

QA

