

Please download Anaconda:  
**Anaconda.com**



# COMPUTER SCIENCE FOR MEDICINE

Plastic Surgery and Neurosurgery Interest Groups  
November 16, 2022  
*Session 1*



# AGENDA

## 1

### INTRODUCTION

- Computers
- Operating Systems
- Memory
- Activity Monitor
- Big O Notation
- Thinking like a Programmer
- Best Practices

## 2

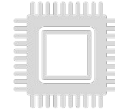
### WALKTHROUGH

- Basic Python Syntax
- Advanced Topics
- Continued Learning

## 3

### Q&A/WORKSHEET

# WHAT IS A COMPUTER?



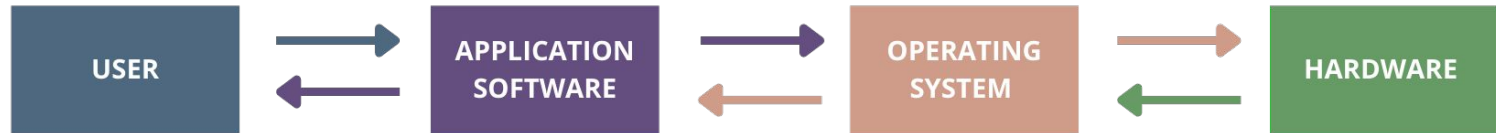
## **HARDWARE**

Physical components of device



## **SOFTWARE**

Set of instructions you write used by your hardware to execute action



# OPERATING SYSTEMS

- **Windows, MacOS, Linux**
- Most important software on a computer
  - Coordinates hardware and software
- Manages memory, storage, CPU, GPU
- **Command line**: window into your operating system
  - **Bash** is the language you will use on Mac and Linux terminals primarily

```
(base) georgie:~ georgienahass$ pwd
/Users/georgienahass
(base) georgie:~ georgienahass$ ls -l
total 217136
-rw-r--r--  1 georgienahass  staff   637920 Dec 30  2018 6flt_autopsf.log
-rw-r--r--  1 georgienahass  staff   641530 Dec 30  2018 6flt_autopsf.pdb
-rw-r--r--  1 georgienahass  staff  1909561 Dec 30  2018 6flt_autopsf.psf
-rw-r--r--  1 georgienahass  staff   636740 Dec 30  2018 6flt_autopsf_format
ted.pdb
drwxr-xr-x  4 georgienahass  staff      128 Apr 22  2021 AppData
drwxr-xr-x  9 georgienahass  staff     288 Oct 26 12:43 Applications
drwx----- 22 georgienahass  staff    704 Nov  3 10:26 Box Sync
-rw-r--r--  1 georgienahass  staff   2430 Nov 26  2018 Brazilin.pdbqt
-rw-r--r--  1 georgienahass  staff   2428 Dec  5  2018 Brazilin_flexible.p
dbqt
-rw-r--r--@  1 georgienahass  staff    5694 Jul 13  2018 C:\\Users\\georgien
ahass\\Desktop\\ChangeThisName.xlsx
drwxr-xr-x 11 georgienahass  staff     352 Oct  6 00:20 CADDworkflows
-rw-r--r--@  1 georgienahass  staff     489 Jul 10  2018 CD Script.R
-rw-r--r--@  1 georgienahass  staff     494 Jan  9  2018 CD ThT Fluorescence
```



# MEMORY

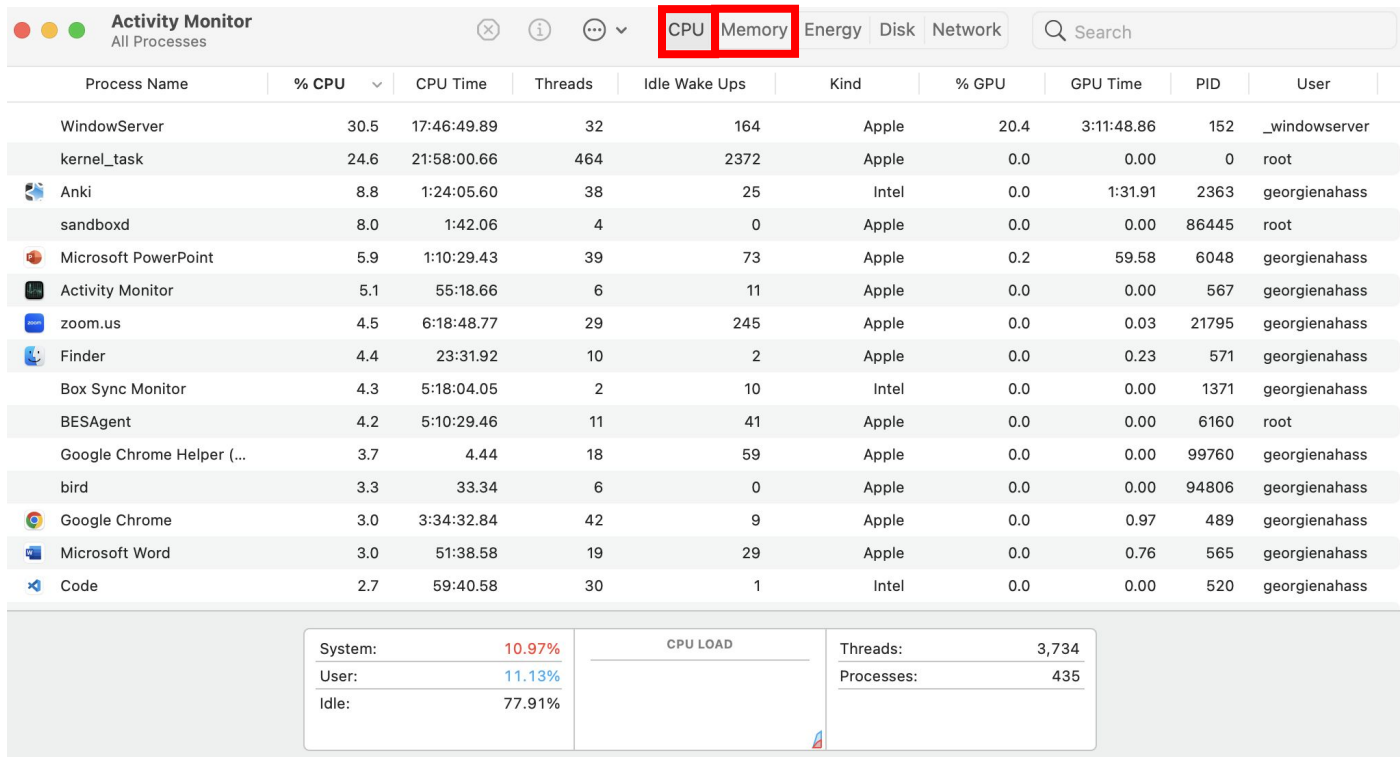
- **Memory vs. Storage**

- Memory = short term data (RAM, chrome tabs, variable storage in code)
- Storage = long term data (excel, word, etc)

- **CPU vs. GPU**

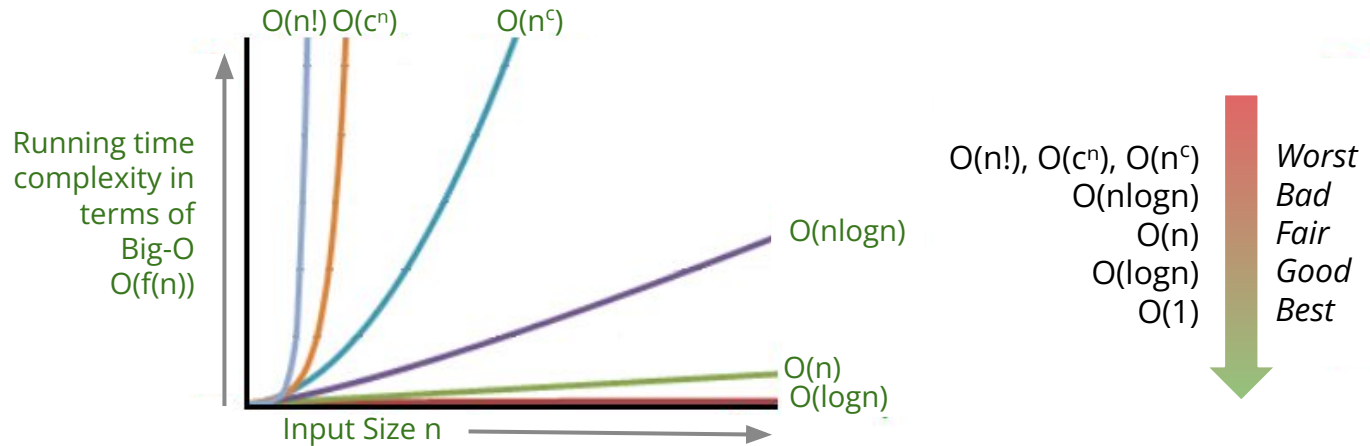
- CPU = Computer Processing Unit (slower, more versatile – *use this when in doubt*)
- GPU = Graphics Processor Unit (faster, less versatile)
- Know how much your computer has (and how to manage it!)

# ACTIVITY MONITOR/TASK MANAGER



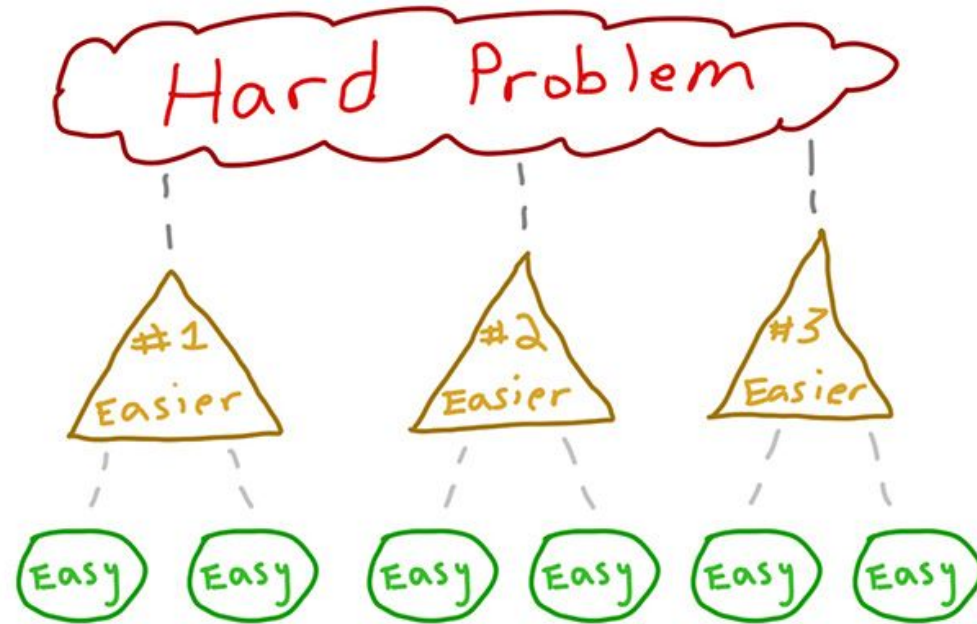
# BIG O NOTATION

- Metric for determining *algorithm efficiency*
- Difficulty of an algorithm (worst case scenario)





# THINKING LIKE A PROGRAMMER



TAKES PRACTICE!



# BEST PRACTICES

- Use ***packages*** and ***libraries!***
  - Pre built code and algorithms to help you solve problems! Embrace open source!
- Annotate, annotate, annotate!
- Practice, practice, practice!
- Name your variables something ***'human readable'***
- When in doubt, ***google*** it out
- Focus on ***understand***, not copy and paste
- Knowing theory is good, but ***NOT*** essential
- Learn through projects
  - Start small build up



# **JUPYTER NOTEBOOK WALKTHROUGH**



# NOW THAT YOU ARE A CODING BEAST...

- Research
  - Statistics
  - Database studies
  - *Everything you can do in things like GraphPad Prism, STATA, and SPSS, you can do in Python!*
- Clinical tools
  - Screen for tumors in brain MRIs
- Academic tools
  - Scheduler for volunteering shifts
- Personal use
  - Create a interface to keep track of workouts

# WHAT HAPPENS IF YOU GET STUCK?

- Copy and paste your error into **Google** and go from there
  - Important to learn the terminology so you can Google effectively
- **Stackoverflow.com**

I keep getting this error and don't understand why [on hold]



I can't figure out why I'm getting this error. I've tried everything. Any help would be greatly appreciated.

-2



Error:

```
SyntaxError: invalid syntax
```



Code:

```
print "SyntaxError: invalid syntax"
```

```
python
```

share edit flag



# CONTINUED LEARNING

***What we covered today is just the tip of the tip of the iceberg!***

- Just like in medicine, **learning in programming never ends**
  - [learnpython.org](https://learnpython.org)
  - [codecademy.com](https://www.codecademy.com)
  - Google Python Style Guide
- Learn **bash scripting** to get around your terminal and file system
- Other tools worth downloading:
  - Visual Studio Code or PyCharm
  - Git is a system that allows you to share code and collaborate with other people

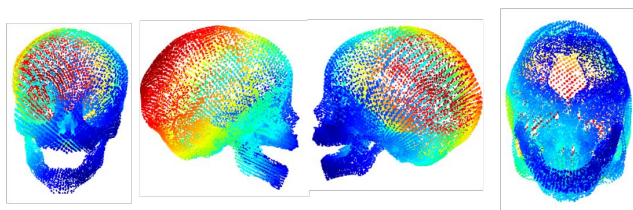


# SOME USEFUL LIBRARIES

- **Data Science and Statistics**
  - Pandas
  - SciPy
  - Numpy
  - Statsmodels
  - Matplotlib/Plotly/Seaborn
- **Software Development**
  - Tkinter/PyQT (user interfaces)
  - Django/Flask (application backends)
- **Biological Computation**
  - BioPython
- **Machine Learning**
  - OpenCV (also computer vision)
  - Scikit-learn
  - Tensorflow
  - Keras
  - PyTorch
- **Miscellaneous**
  - os
  - sys
  - re
  - datetime

*Whatever you want to do, there's probably a library to help you do it!*

# EXAMPLES OF RESEARCH PROJECTS



CT Normalizer

Theta Value: 1

Phi Value: 2

Theta Sig Figs: 0

Phi Sig Figs: 0

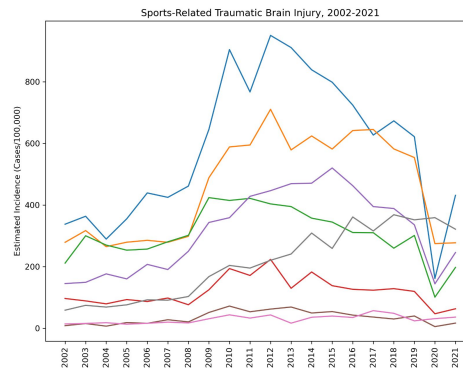
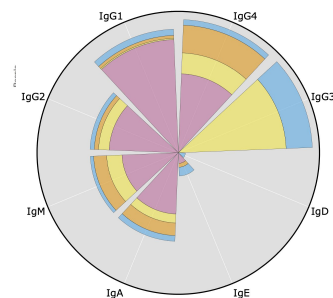
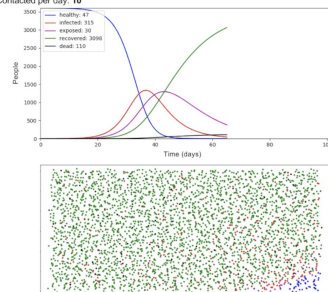
Density of Cloud: 100000

Change background color (D)

Run The CT Normalizer!

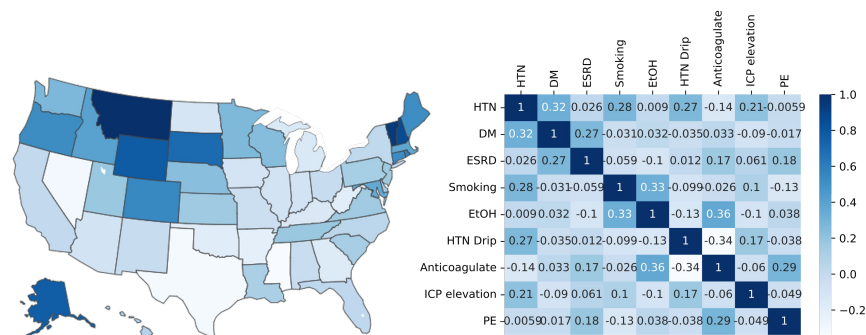
Celebrating 70 years  
CmKloftZ Center  
UIC  
Leadership in education

Average # People Contacted per day: 10



	AC (n=7075)	Non-AC (n=7075)	P-Value
<b>Demographics</b>			
Age (years)	72.80 ± 11.21	72.82 ± 11.20	<0.001*
Sex (female)	2388 (33.75%)	2393 (33.82%)	0.929
White	5912 (83.56%)	6024 (85.14%)	0.010*
Black	641 (7.65%)	628 (7.46%)	0.579
Asian	203 (2.87%)	181 (2.56%)	0.255
Native American	26 (0.37%)	20 (0.28%)	0.376
Pacific Islander	24 (0.34%)	7 (0.10%)	0.002*
Hispanic	367 (5.19%)	318 (4.49%)	0.005
<b>In-Hospital Complications</b>			
CLASS1	12 (0.17%)	7 (0.10%)	0.251
Deep Vein Thrombosis	231 (3.27%)	158 (2.23%)	<0.001*
Alcohol Withdrawal	57 (0.81%)	76 (1.07%)	0.098
Cardiac Arrest	130 (1.84%)	117 (1.65%)	0.404
CAUTI	101 (1.43%)	62 (0.88%)	0.002*
Pulmonary Embolism	46 (0.65%)	40 (0.57%)	0.516
Extremity CS	2 (0.03%)	3 (0.04%)	0.555
Intubation	151 (7.79%)	386 (5.56%)	<0.001*
Kidney Failure	98 (1.39%)	87 (1.23%)	0.416
Myocardial Infarction	76 (1.07%)	32 (0.45%)	<0.001*
Respiratory Failure	54 (0.76%)	61 (0.86%)	0.512
Unplanned Reoperation	295 (4.17%)	239 (3.38%)	0.013*
Sepsis	84 (1.19%)	48 (0.68%)	0.002*
Stroke	192 (2.71%)	145 (2.05%)	0.010*
Pressure Ulcer	120 (1.70%)	105 (1.48%)	0.313
Unplanned ICU Admission	538 (7.60%)	367 (5.17%)	<0.001*
VAP	151 (2.13%)	154 (2.18%)	0.690
<b>Miscellaneous</b>			
VTE Prophylaxis	3675 (51.63%)	3528 (49.87%)	0.080*
Ventilator Duration (days)	8.32 ± 5.65	8.69 ± 5.50	<0.001*
Length of Stay (days)	15.40 ± 8.25	15.40 ± 7.70	0.984
In-Hospital Death	1882 (23.77%)	1145 (16.18%)	<0.001*

\* = significant  
AC = anti-coagulant, CAUTI = catheter-associated urinary tract infection, CLASS1 = central-line associated bloodstream infection, CS = compartment syndrome, VAP = ventilator-associated pneumonia, VTE = venous thromboembolism



	HTN	DM	ESRD	Smoking	EtOH	HTN Drip	Anticoagulate	ICP elevation	PE
HTN	1	0.32	0.026	0.28	0.009	0.27	-0.14	0.21	-0.0059
DM	-0.32	1	0.27	-0.0310	0.032	-0.0350	0.033	-0.09	-0.017
ESRD	-0.026	0.27	1	-0.059	-0.1	0.012	0.17	0.061	0.18
Smoking	-0.28	-0.0310	0.059	1	0.33	-0.0990	0.026	0.1	-0.13
EtOH	-0.009	0.032	-0.1	0.33	1	-0.13	0.36	-0.1	0.038
HTN Drip	-0.27	-0.0350	0.012	-0.099	-0.13	1	-0.34	0.17	-0.038
Anticoagulate	-0.14	0.033	0.17	-0.026	0.36	-0.34	1	-0.06	0.29
ICP elevation	-0.21	-0.09	0.061	0.1	-0.1	0.17	-0.06	1	0.049
PE	-0.0059	0.017	0.18	-0.13	0.038	-0.038	0.29	-0.049	1





# POTENTIAL FUTURE SESSIONS

- **We want to keep the party going!**
- Potential sessions include:
  - Data analysis for research workshop
  - Leetcode/algorithms workshop
  - Intro to scripting
  - Intro to machine learning and computer vision
  - Whatever you guys want to learn! (i.e., fill out the feedback form)



*PLEASE FILL OUT  
POST-WORKSHOP  
SURVEY!*



**THANK YOU!**

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