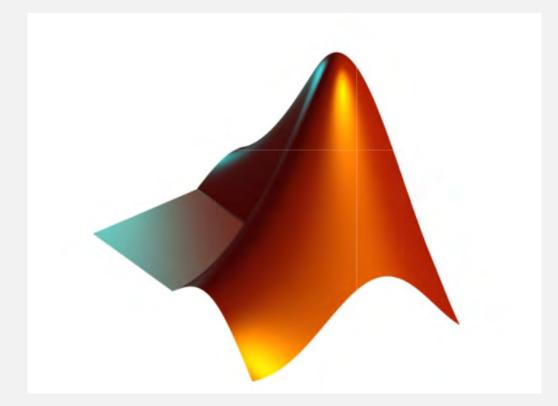
## MAKE WITH MATLAB

TTU Library Makerspace Workshop how to use MATLAB for your calculations and 3D magic



2025

■ Who am I?

## Sean W Scully

### Lead Administrator - TTU Libraries - Emerging Technology

Rhino3D, TinkerCAD, AutoCAD Inventor, Fusion360, Blender, Solidworks MakeCode, Python, Scratch, C++, C, MATLAB, Arduino, p5.js, JavaScript, Assembly, Verilog, Xilinx

GSB, General Studies – Math/Engineering/Renewable Energy, TTU MFA, Studio Art – Metals/Jewelry/Enameling, Kent State Univ BFA, Studio Art – Metalsmithing/Jewelry Design, TTU AA, Fine Arts, South Plains College

linkedin.com/in/seanwscully

Find me on the First Friday Art Trail, ffat.org, CASP Work Studio H





### **Emerging Technology Department**

- Makerspace: Main Library, 2<sup>nd</sup> floor, room 210
- VR Lab: Main Library, 2<sup>nd</sup> floor, room 201A

make@ttu.edu

https://www.depts.ttu.edu/library/make/





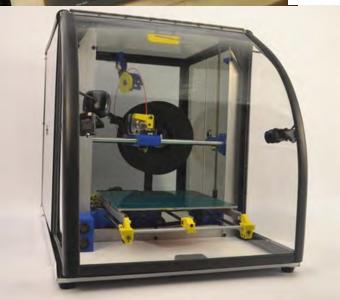




Cricut | Maker



- Glowforge Lasercutter
- Makyu Formbox
- Matter&Form 3D Scanner
- PolyPrinters 229 & 508
- Ultimaker 3, S7
- Sewing machines



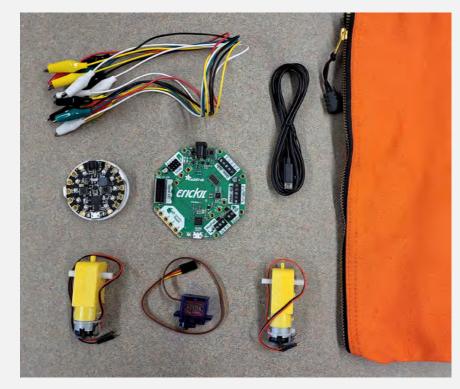






### TTU Library's Makerspace *Electro* and *Robo* Kits





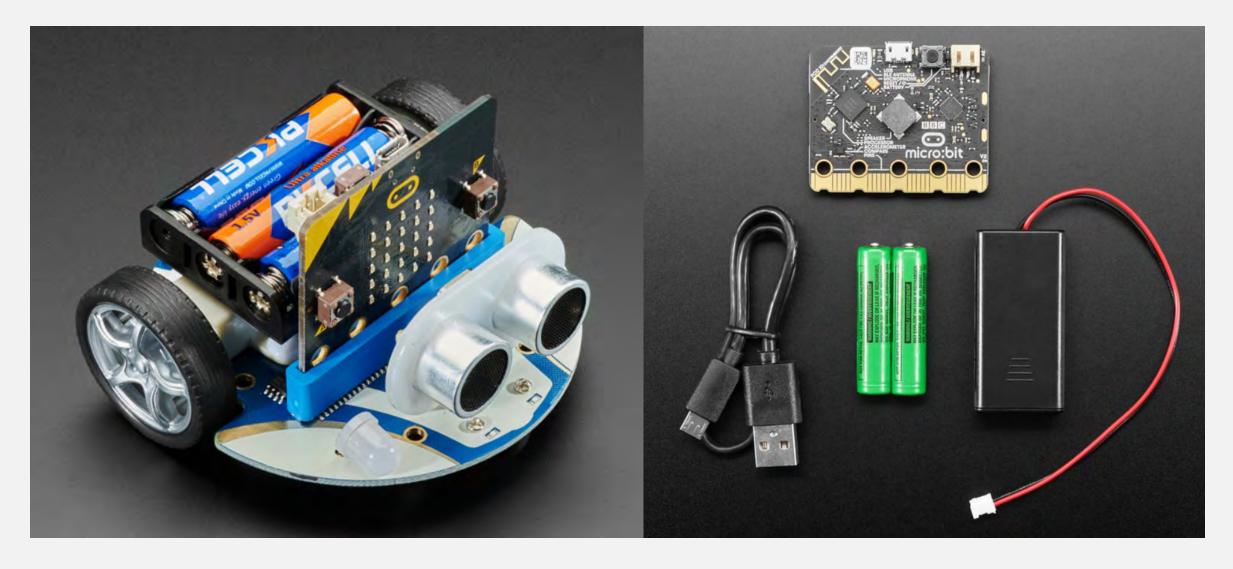
### Robo Kits (15)

- Adafruit's Circuit Playground Express (CPX)
- Adafruit's Crickit robotic control board
- geared motors (2), micro servo

**ElectroSoldering Kits (5)** 



### TTU Library's Makerspace CuteBot and Micro:Bit v2 Kits



Images of our CuteBot kit and Micro:Bit v2 kit



### TTU Library's Makerspace *Pi-400* and *Pi-ZeroW* Kits



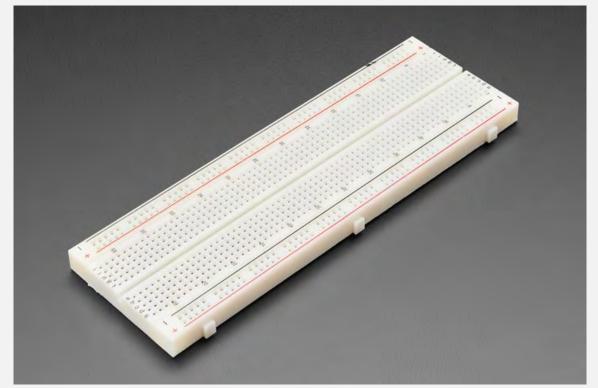


6 kits of each is available: recommend supplying your own microSD card (minimum size: 8Gb)



### TTU Library's Makerspace *Pi – Interface* Kits





6 kits of each is available, one for every Pi-400

- Pi T-Cobbler Plus
  - GPIO Breakout Pi A+, B+, Pi 2/3/4, Zero
- Full Sized Premium Breadboard
  - 830 Tie Points



### TTU Library's Makerspace iFixit Kits























6 kits of each is available, one for every Pi-400

- all kinds of screwdriver tips, 64 total
- larger kit has spudgers and plastic pryers

## what you can make in the Makerspace

- anything...except:
  - NO weapons please
  - N0 trademarked objects

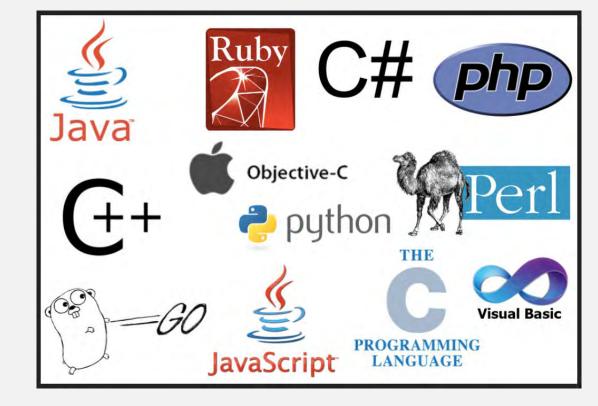


- we reserve the right to refuse objects that we suspect may violate the Student Code of Conduct
  - <a href="https://tinyurl.com/ttustudentcode">https://tinyurl.com/ttustudentcode</a>
- questions: make@ttu.edu



### intro to code

what is coding?



why are there so many computer languages?

what is Python?



## what is coding?

### computer programming

directly asking the computer to do something in a language it understands

language => code

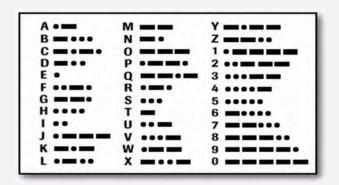
Speech => Text

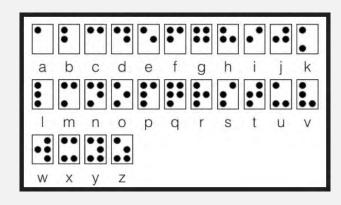
Text => Numbers

- text commands specific to computer's language

- hexadecimal or binary numbers, e.g. ASCII

Numbers => Machine Codes - "microcode" encoded on the silicon chips

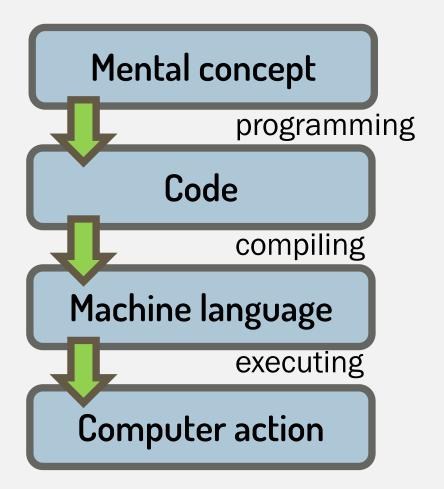


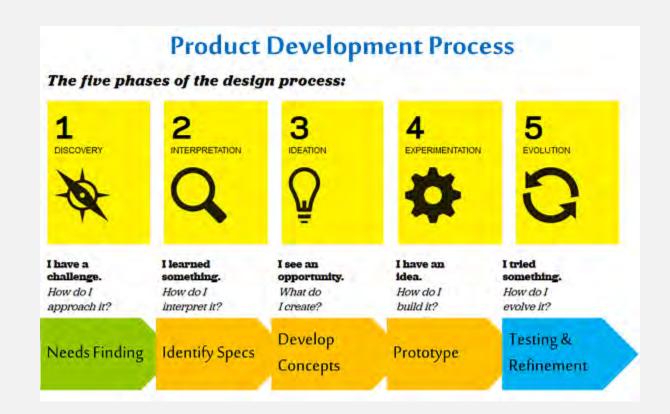


ASCII control characters				ASCII printable characters							Extended ASCII characters													
DEC	HEX	Si	mbolo ASCII	DEC	HEX	Simbolo	DEC	HEX	Simbolo	DEC	HEX	Simbolo	DEC	HEX	Simbolo	DEC	HEX	Simbolo	DEC	HEX	Simbolo	DEC	HEX	Simbol
00		NULL	(carácter nulo)	32		espacio	64		മ	96	-	*	128		Ç	160	=ON	á	192		L	224	- Opt	Ó
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02		STX	(inicio texto)	34			66		В	98		b	130		é	162	AZII	ó	194		-	226	830	Ó
63		ETX	(fin de texto)	35	oth		67		C	99	0.00	c	131		ā	163	6.00	0	195	Cim	-	227	- 71	Ò
04	00049	EOT	(fin transmisión)	36		5	68		D	100		d	132		ä	164		n.	196		-	228	TAIL	ŏ
05		ENQ	(enquiry)	37	7.30	%	69		E	101		e	133		à	165	1000	Ñ	197	100	+	229	6.50	Õ
06		ACK	(acknowledgement)	38		8	70		F	102		1	134		â	166			198		ä	230		μ
07		BEL	(timbre)	39	-IT		71		G	103	DO: TO	9	135	170	C	167	871		199		Ã	231	TID	b
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09		HT	(tab horizontal)	41	1.0379	)	73		1	105		1	137		e	169		100	201		p	233	11.1975	Ú
10		LF	(sate de inea)	42	ZAD		74		J	106		i	138	SAC	ė	170	-1001	7	202	CAC	7	234		Û
11		VT	(tab vertical)	43			75	18	K	107		k	139		- 1	171	20	1/2	203		-	235		Ü
12		FF	(form feed)	44			76	10	L	108		1	140	000	1	172	HC1	1/4	204			236		Ý
13		CR	(retorno de carro)	45		1.0	77	101	M	109	HON.	m	141	#Cn	1	173			205	COM	-	237		Ŷ
14	OKLY	50	(shift Out)	46		-	78	18	N	110		n	142		Ä	174			205		- 6	238		-
15		SI	(shift in)	47		1	79		0	111		0	143		A	175			207			239		
16	700	DLE	(data link escape)	48	2000	0	80		P	112		D	144	100	É	176	<b>FOR</b>	10	208		ð	240	LID	
17		DC1	(device control 1)	49	3.49	1	81		Q	113	Tee	q	145		80	177		82	209		Ð	241	1 1197	*
18		DC2	(device control 2)	50	1237	2	82		R	114	Tor		146		Æ	178		-	210		E	242	# 2n	1
19		DC3	(device control 3)	51	11/4	3	83		S	115	130		147		ő	179	-1	T	211	()3h	E	243	120	%
20	AME	DC4	(device control 4)	52	4.47	4	84		T	116	187	T.	148	100	ò	180	- 67	4	212	DATE	Ė	244	1.00	1
21	ABITE	NAK	(negative acknowle.)	53	1.00	5	85	100	U	117		u	149		ò	181	100	A	213		1	245	880	6
22		SYN	(synchronous idle)	54		6	86		V	118		v	150		ù	182		Ā	214		1	246		+
23	UTTE	ETB	(end of trans. block)	55		7	87		W	119		w	151		ù	183		A	215		I.	247		
24		CAN	(cancel)	56		8	88	200	X	120	Est	×	152	100	y	184	500	0	216		T.	248		



## coding overview





http://www.toves.org/books/java/ch01-overview/process.png

https://bioebootcamp.sites.stanford.edu/system/files/product developementprocess\_1.png



### essence of code

- any language understood by the computer
  - Commands vocabulary/keywords that initiate an action
    - run, print, for, while
  - Syntax order of words and uses of punctuation
    - print ("hello world")
  - Uses data as an "input" to produce an "output"
- most languages have similar keywords and syntax

fprintf ("A\n")	MATLAB	Output: A
print ("A")	Python	Output: A
cout <<"A";	C++	Output: A
print "(a10)", str	Fortran	Output: A





### why so many tongues?

### The History of Computer Tongues

https://www.thesoftwareguild.com/blog/history-of-programming-languages/

### Secret Life of Machines Series

• Word Processors - <a href="https://tinyurl.com/e8av8scx">https://tinyurl.com/e8av8scx</a>

### which language is most efficient

- depends on task/hardware
- depends on the programmer
  - https://www.researchgate.net/publication/320436353\_Energy\_efficiency\_across\_programming\_languages\_how\_do\_energy\_time\_and\_memory\_relate

### fun "Brief History of Computers"

<u>https://www.lesswrong.com/posts/vfRpzyGsikujm9ujj/a-brief-history-of-computers</u>

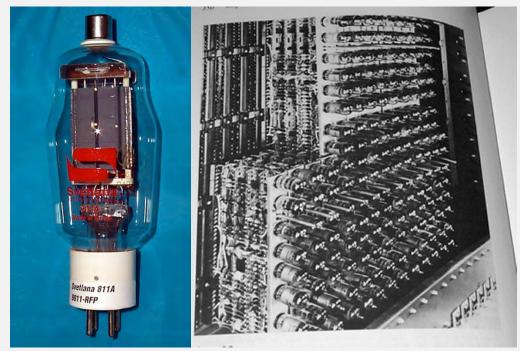




### Hardware differences - Structure, Purpose

FORTRAN - IBM 700 Series (1950-60s) - room-size, vacuum tubes



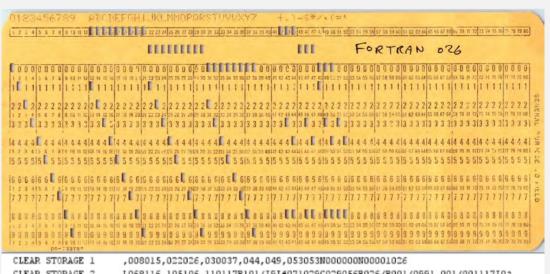




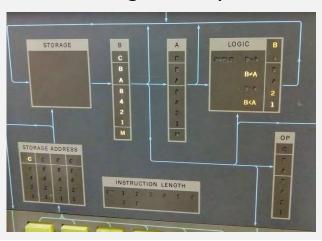


### Hardware differences – Structure, Purpose

FORTRAN - IBM 1401 Series (1960s) - room-size, used vacuum tubes, punch cards, magnetic tape reels







IRM 1403	A and H Print	Arrangment

PRINT ARRANGEMENT		DEFINED CHARACTER	CARD	BCD CODE	ARRANG		DEFINED CHARACTER	CARD	BCD CODE	
A	Н		CODE		A H			CODE		
		Blank		С	G	G	G	12-7	BA 42	
			12-3-8	BA8 21	H	Н	Н	12-8	BA8	
н	)	н	12-4-8	CBA84	1	1	1	12-9	CBA8	
		[ Left Bracket (Special Character)	12-5-8	BA84 1	-	-	! (Minus Zero)	11-0	8 8 2	
		< Less Than (Special Character)	12-6-8	BA842	J	J	J	11-1	CB	
		Group Mark	12-7-8	C8A8421	K	K	K	11-2	CB 2	
&	+	&	12	CBA	L	L	L	11-3	B 2	
5	5	5	11-3-8	CB 8 21	M	M	M	11-4	CB 4	
		•	11-4-8	B 84	N	N	N	11-5	8 4	
		Right Bracket (Special Character)	11-5-8	CB 84 1	0	0	0	11-6	B 42	
		; Semicolon (Special Character)	11-6-8	CB 842	P	P	P	11-7	CB 42	
		△ Delta (Mode Change)	11-7-8	B 8421	Q	Q	Q	11-8	CB B	
-		-	11	В	R	R	R	11-9	B 8	
/	/	/	0-1	CA I			* Record Mark	0-2-8	A 8 2	
,	,	,	0-3-8	C A8 21	S	S	S	0-2	CA 2	
%	(	%	0-4-8	A 8 4	T	T	T	0-3	A 2	
-		∨ Word Separator	0-5-8	C A84 1	U	U	U	0-4	C A 4	
-		\ (Special Character)	0-6-8	C A842	V	V	V	0-5	A 4	
-		* Tape Segment Mark	0-7-8	A 8 4 2 1	W	W	W	0-6	A 42	
+	+	& (Special Character)		A	X	X	X	0-7	C A 42	
	21	, ,	3-8	8 21	Y	Y	Y	0-8	C A8	
a		á	4-8	C 84	Z	Z	Z	0-9	A 8	
		: Colon (Special Character)	5-8	8 4 1	0	0	0	0	C 8 2	
		> Greater Than (Special Character)	6-8	8 4 2	1	1	1	1		
		√ Tape Mark	7-8	C 8421	2	2	2	2	2	
8.	&	? (Plus Zero)	12-0	CBA8 2	3	3	3	3	C 2	
A	A	A	12-1	BA 1	4	4	4	4	4	
В	В	В	12-2	BA 2 CBA 21	5	5	5	5	C 4	
C	C	C	12-3	CBA 21	6	6	6	6	C 42	
D	D	D	12-4	BA 4	7	7	7	7	42	
E	E	E	12-5	CBA 4 1	8	8	8	8	8	
F	F	F	12-6	CBA 42	9	9	9	9	C 8	



### Hardware differences – Structure, Purpose

BASIC - Commodore (a.k.a. C-64, 1980s) - table-top machines, used microchips





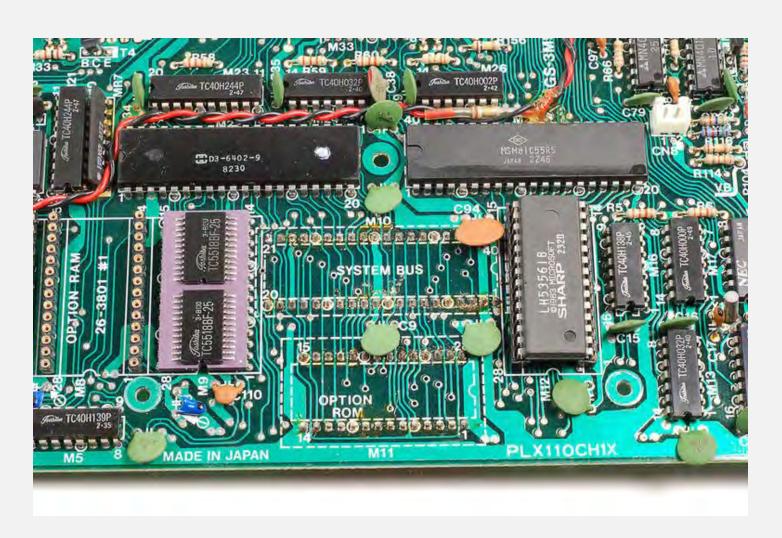


### Hardware differences – Structure, Purpose

BASIC - Tandy 100 (a.k.a. TRS-80, mid-1980s) - table-top or portable machines, used microchips



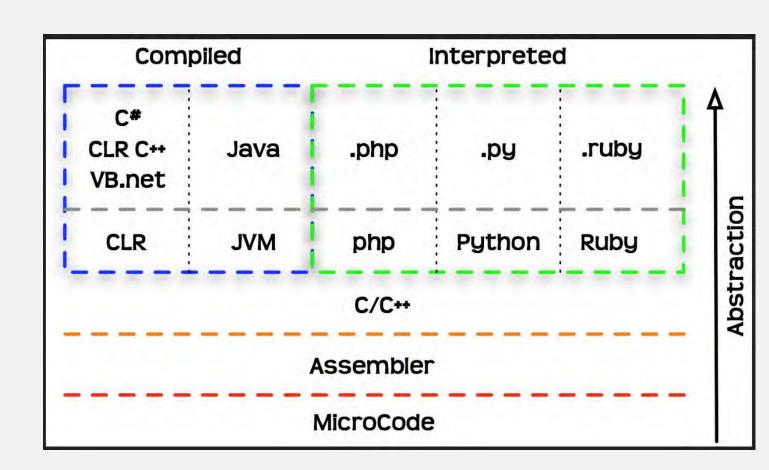






## "levels" of languages

- "levels" of abstraction
  - complex metaphors
- Compiled vs. Interpreted



Control, efficiency, or ease-of-use

#### F

### three traditional styles of language

#### Math-based

• Fortran oldest, least-intuitive, designed for to perform math (Formula Translation)

• MATLAB good for complexity, matrices

### Object-based

• Go (Golang) similar to C, but uses safety features like "garbage collection"

• Python high-level language, being used for building games and hardware programming

• C++ general purpose with low-level memory manipulation, in the C family

• C# general purpose, used in Unity and robotics, in the C family

### Specialized – Web, Data

• COBOL business-centered language, recently object-oriented

• Javascript smaller version of Java, used for web widgets like TinkerCAD

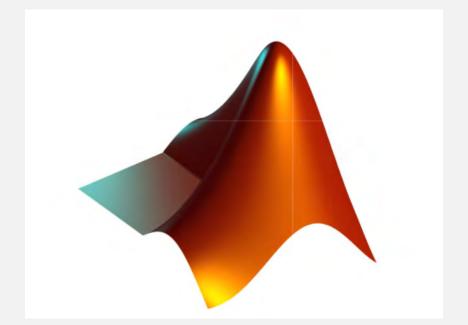
• HTML webpage coding usually in conjunction with XML, PHP and CSS

• Ruby on Rails webpage/app coding aimed at server-side platforms

SQL database management, used in loT applications (internet of things)

• Hadoop "big data" management language





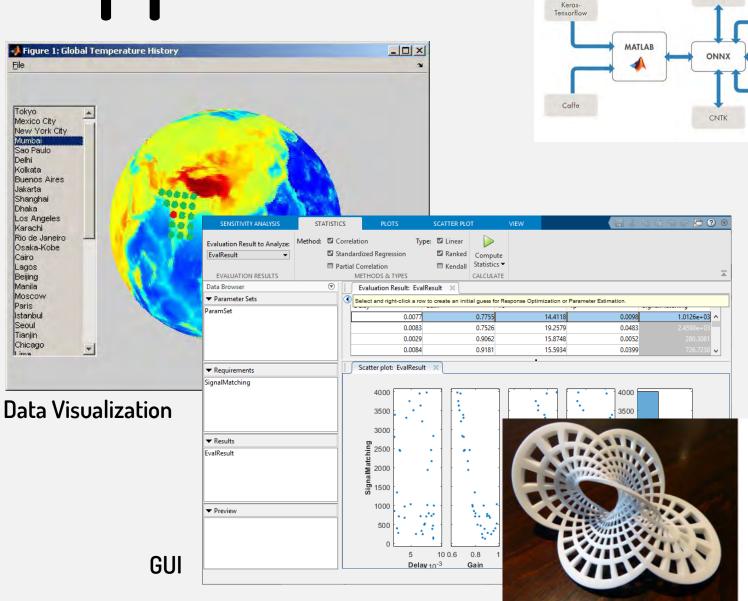
## what matlab can do

Data visualization, GUIs, Deep learning, 3D models for printing

using: loops, variables, matrices, add-ons, i/o

F

# applications







PyTorch

Deep learning

3D models for printing

#### F

# math-based language: MATLAB

- Common uses for MATLAB:
  - Math
    - Various processes from algebra and calculus to statistics
  - Matrices
    - Data in matrix-format can be processed
  - Plotting data
    - 2D graphs and charts, meshes (3D graphs)
  - Building an interface (GUI: graphic user interface)
    - Creating more intuitive methods of interaction to process the data

## IDE

## Integrated Development Environment

- what is it? an "all-inclusive resort" for your coding experience
  - Write/Edit
    - text editing
  - Compile/Run
    - translate into machine language and run your program
  - Troubleshoot/Debug
    - walk through your code line-by-line to make sure it will work
  - Integrations and plugins
    - add specific functionality for your project

## IDE - offline = power

offline - free, complex install, harness computer power, plug-in option

Create a MATLAB account: <a href="https://www.mathworks.com/mwaccount/register">https://www.mathworks.com/mwaccount/register</a>

Student/Educator accounts should be free and/or tied to your institution.

#### Install MATLAB

https://www.mathworks.com/downloads/web\_downloads

#### Installation Manual

https://www.mathworks.com/help/install/

### IDE - online = convenience

online - free, easy, limited processing power

AND/OR - Work with MATLAB online

https://www.mathworks.com/products/matlab-online/limitations.html https://matlab.mathworks.com/

## getting started - vocabulary

- Most common terms/extensions you might deal with are:
  - *IDE* 
    - Integrated Development Environment
    - Software application for editing source code, running/testing the code (compiling), and debugging (fixing errors)
  - .m
    - MATLAB-specific text file that can be executed
    - Can be modified by a text-editor outside of the MATLAB IDE
  - .mlx
    - MATLAB-specific file that easily displays inline outputs and exports well for presentation formats
    - Optimized for the "Live Editor" found in the MATLAB IDE
  - .txt
    - A standard text document with unformatted plain text
    - Ideal for storing information that will be universal to most systems
  - .CSV
    - MS Excel file format for comma-separated or tab-separated data points
    - Easily read by MATLAB when importing data for plots and graphs
  - .png
    - Simplest file format for picture files
    - Used by MATLAB when saving images of plots and graphs



## vocabulary

- Know this: "all writing is re-writing"
- REPL (read-evaluate-print loop) interactive language environment
- Function/Command print vs 'print' vs PRINT
- Constants fixed values
- Variables values that can change
  - Strings single or double quotation marks: >>> print('Howdy world')
    - Numbers
    - Letters
- Loops repeat this action "\_" many times
  - when forever loop, keep doing this when this is true
  - for repeat this "\_" many times, then move on
- if/elif/else
  - if if this is true, do this
  - elif otherwise, do this
  - else otherwise, do this and move on



La Trahison des images René Magritte, 1929

### F

## let's explore MATLAB

- Search in your Start menu for "MATLAB"
- Entering simple commands in the live code editor
- Searching for functions and help
- Start a new code file (.m) and "run" it
- Make a sample Excel file of data to import (.csv)
- Read file data and begin graphing

### MATLAB - interface

IDE – Integrated Development Environment

• IDE - User interface for utilizing and editing in the language.

- Basic text editor
  - All elements are separate: graphs, code, etc.

- Live Editor
  - All outputs and graphs can be inline and exported as a pdf, LaTeX, word file, etc.

## MATLAB – walkthrough topics

- Help! "lookfor"
- Variables
- Formatting output
- Array/Matrices
- Diary recording activities in the Command window into a file
- File creation/deletion, i/o
- Commenting %, %{, %}
- Simple data manipulation (.\*, .+)
- Graphs! (2D, 3D, Labeling)



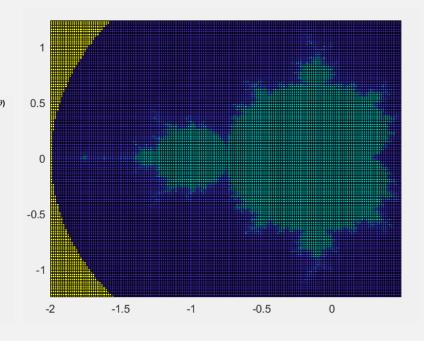
## today's spiffy code

```
%{
% 2D graph of function
x=0:.1:4:
y=-2:.1:1;
[X,Y]=meshgrid(x,y);
Z=sin(X).*cos(Y);
contour(x,y,Z);
mesh(X,Y,Z);
% 3D graph of function
%}
%{
% Vertical 3D spiral
t=0:.1:5*pi;
r=exp(t/10);
x=r.*cos(t);
y=r.*sin(t);
z=t:
plot3(x,y,z);
%}
```

```
%{
% 2D Mandelbrot set plot
[X,Y]=meshgrid(-2:.015:.5,-1.25:.015:1.25);
C=X+j*Y;
                                                                  figure
W=100*ones(size(C));
Z=zeros(size(C));
for n=1:50,
                                                                  axis equal
  Z=Z.*Z+C:
                                                                  set(gca, 'xdir', 'reverse', 'ydir', 'reverse')
  h=find(abs(Z)<2):
  if ~isempty(h),
     W(h)=n*ones(size(h)):
  else
     break
  end:
end:
                                 x = \cos(\theta)^2 \sin(\theta) \cos(\phi), y = \cos(\theta)^2 \sin(\theta) \sin(\phi), z = \cos(\theta)^2 \cos(\theta)
clear CZ
pcolor(X,Y,W)
                                              -0.5
```

-0.2

```
% "ezmesh" for graphing 3D radiation intensity for 'U(theta)=cos(theta)^2'
fx = inline('cos(theta)^2*sin(theta)*cos(phi)');
fy = inline('cos(theta)^2*sin(theta)*sin(phi)');
fz = inline('cos(theta)^2*cos(theta)')
ezmesh(fx,fy,fz,[0 2*pi 0 pi],100)
colormap([0 0 0])
```



## today's spiffy code - sources

#### Example 1. Quadratic Equation with loops and conditional functions-

- Chapra, Steven C. <u>Applied Numerical Methods with MATLAB for Engineers and Scientists</u> (2005). Print.
- Pages 47-49
- https://ttu-primo.hosted.exlibrisgroup.com/permalink/f/1nr4jhr/01TTU\_ALMA21141188370002611

#### Example 2. Mandelbrot set with "meshgrid"-

- Cavallo, Alberto., Roberto. Setola, and Francesco. Vasca. <u>Using MATLAB, Simulink, and Control System Toolbox : A Practical Approach</u> (1996). Print.
- Pages 79-83
- <a href="https://ttu-primo.hosted.exlibrisgroup.com/permalink/f/f2u3nh/01TTU\_ALMA21141319770002611">https://ttu-primo.hosted.exlibrisgroup.com/permalink/f/f2u3nh/01TTU\_ALMA21141319770002611</a>

#### Example 3. "ezmesh" for 3D graphing of radiation intensity-

- Gross, Frank B. <u>Smart Antennas for Wireless Communications</u>: <u>With MATLAB</u> (2005). Print.
- Pages 45-46
- https://ttu-primo.hosted.exlibrisgroup.com/permalink/f/1boli6j/01TTU\_ALMA21180212890002611



## Sample code - file i/o

#### Composed by combining deepai.org/chat and MATLAB's documentation

- Generate random number data set in different file formats
- Modify and output a comparison

```
% Generate random data
data = randi([0, 100], 10, 5);
data1 = randi([0, 255], 100, 500);
```

% Write data to .txt file - not recommended, use "writematrix" instead dlmwrite('random\_data.txt', data)

% Write data to .txt file using 'writematrix' writematrix(data, 'random\_data.txt')

% Write data to .csv file writematrix(data, 'random\_data.csv')

% Write data to .png file imagesc(data1) saveas(gcf,'random\_data.png')

% Write data to excel file writematrix(data, 'random\_data.xlsx', 'Sheet', 1) data\_txt = load('random\_data.txt');
% Scalar multiplication
new\_data\_txt = data\_txt .\* 5;
% Dot product
dot\_prod\_txt = dot(data\_txt(:,1), data\_txt(:,2));
% Triangle matrix
L\_txt = tril(data\_txt);
% Identity matrix
L\_txt = eye(size(data\_txt));

% Load .txt file

% Plot original file
subplot(221)
imagesc(data\_txt)
title('Original - txt file')
colorbar
% Plot result file
subplot(222)
imagesc(new\_data\_txt)
title('Scalar Multiplication - txt file')
colorbar

% Load .csv file data\_csv = readmatrix('random\_data.csv'); % Scalar multiplication new\_data\_csv = data\_csv .\* 10; % Dot product dot\_prod\_csv = dot(data\_csv(:,1), data\_csv(:,2)); % Triangle matrix L\_csv = tril(data\_csv); % Identity matrix l\_csv = eye(size(data\_csv));

% Plot original file subplot(223) imagesc(data\_csv) title('Original - csv file') colorbar % Plot result file subplot(224) imagesc(new\_data\_csv) title('Scalar Multiplication - csv file') colorbar % Load .png file as grayscale
data\_png = imread('random\_data.png');
data\_png = rgb2gray(data\_png);
% Scalar multiplication
new\_data\_png = data\_png .\* 2;
% Dot product - bad code error
%dot\_prod\_png = dot(data\_png(:,1), data\_png(:,2));
% Triangle matrix
L\_png = tril(double(data\_png));
% Identity matrix
l\_png = eye(size(data\_png));

% Plot original file figure subplot(221) imshow(data\_png) title('Original - png file') colorbar % Plot result file subplot(222) imshow(new\_data\_png) title('Scalar Multiplication - png file') colorbar

% Load .xlsx file
data\_xlsx = readmatrix('random\_data.xlsx', 'Sheet', 1);
% Scalar multiplication
new\_data\_xlsx = data\_xlsx .\* 3;
% Dot product
dot\_prod\_xlsx = dot(data\_xlsx(:,1), data\_xlsx(:,2));
% Triangle matrix
L\_xlsx = tril(data\_xlsx);
% Identity matrix
L\_xlsx = eye(size(data\_xlsx));

% Plot original file subplot(223) imagesc(data\_xlsx) title('Original - xlsx file') colorbar % Plot result file subplot(224) imagesc(new\_data\_xlsx) title('Scalar Multiplication - xlsx file') colorbar

### webinars - MATLAB

### Webinars and Online Resources

Website hub for MATLAB: documentation, videos, examples, answers, downloads, etc. <a href="https://www.mathworks.com/support.html">https://www.mathworks.com/support.html</a>

### Sample Webinars hosted by MATLAB

Explore a full tour that touches on a recent version of MATLAB (webinar: 5/30/2019) <a href="https://www.mathworks.com/videos/what\_s-new-in-matlab-1509980095981.html">https://www.mathworks.com/videos/what\_s-new-in-matlab-1509980095981.html</a>

Sensor Fusion and Tracking for Automated Driving (webinar: 6/25/2019)

https://www.mathworks.com/videos/sensor-fusion-and-tracking-for-automated-driving-1562165146757.html

Data Science with MATLAB (webinar: 6/27/2019)

https://www.mathworks.com/videos/data-science-with-matlab-1562616258299.html

#### **Image Processing**

https://www.mathworks.com/help/images/

## app-specific texts - MATLAB

#### Problem-based textbooks

MATLAB Recipes: A Problem-Solution Approach, Paluszek, Michael; Thomas, Stephanie; 2021

https://ttu-primo.hosted.exlibrisgroup.com/permalink/f/1j33bpi/TN\_cdi\_safari\_books\_9781484261248

Practical MATLAB: With Modeling, Simulation, and Processing Projects, Turk, Irfan; 2019

https://ttu-primo.hosted.exlibrisgroup.com/permalink/f/1j33bpi/TN\_cdi\_askewsholts\_vlebooks\_9781484252819

#### MATLAB and Simulink

Beginning MATLAB and Simulink: From Novice to Professional, Eshkabilov, Sulaymon; 2019

https://ttu-primo.hosted.exlibrisgroup.com/permalink/f/1j33bpi/TN\_cdi\_askewsholts\_vlebooks\_9781484250617

#### MATLAB and R

R and MATLAB, Hiebeler, David E; 2015

https://ttu-primo.hosted.exlibrisgroup.com/permalink/f/1j33bpi/TN\_cdi\_askewsholts\_vlebooks\_9781466568396

#### MATLAB and Machine Learning

MATLAB Machine Learning Recipes: A Problem-Solution Approach, Paluszek, Michael; Thomas, Stephanie; 2019

https://ttu-primo.hosted.exlibrisgroup.com/permalink/f/1j33bpi/TN\_cdi\_askewsholts\_vlebooks\_9781484239162

### resources - MATLAB

#### Forums/Listicles:

- https://stackoverflow.com
- <a href="https://www.tutorialspoint.com/matlab">https://www.tutorialspoint.com/matlab</a>
- <a href="https://medium.com/quick-code/top-tutorials-to-learn-matlab-for-beginners-d19549ecb7b7">https://medium.com/quick-code/top-tutorials-to-learn-matlab-for-beginners-d19549ecb7b7</a>
- <a href="https://www.analyticsvidhya.com/resources-learn-matlab-programming/">https://www.analyticsvidhya.com/resources-learn-matlab-programming/</a>

#### Various Application Walkthroughs

https://getreuer.info/posts/index.html

#### Youtube Channels/Video Tutorial/Course series:

- https://www.mathworks.com/learn/tutorials/matlab-onramp.html
- https://www.youtube.com/user/MATLAB
- https://blogs.mathworks.com/videos/
- https://www.youtube.com/watch?v=qGiKv3-02vw
- https://www.youtube.com/watch?v=6iN56l7dEMY&list=PLcKDPP0F93EvvBrgR852MU13zvS2ih
   <u>TpR</u>
- https://www.youtube.com/watch?v=B-SAMofba-o

### more resources - MATLAB

### Youtube Channels/Video Tutorial/Course series (contin):

- https://www.youtube.com/watch?v=fjSGtiPb-YY
- Simulink
  - https://www.youtube.com/watch?v=i0mqgewj5Xl
- Robotics
  - https://www.youtube.com/watch?v=BwNw\_-KXjbM
- Analysis
  - https://www.youtube.com/watch?v=ehh7pnbTnYo
- GUI (Graphic User Interface)
  - https://www.youtube.com/watch?v=Ta1uhGEJFBE

#### AI + MATLAB

https://www.mathworks.com/solutions/artificial-intelligence.html

### Not Free (TTU may have free access to "udemy"):

- https://www.udemy.com/topic/matlab/
- https://hackr.io/tutorials/learn-matlab

## forum-style resources - MATLAB

### Mathworks blog:

https://blogs.mathworks.com/community/

#### Mathworks' MATLAB Central - Answers:

https://www.mathworks.com/matlabcentral/answers/index

### Discord app - MATLAB server (free for desktop/mobile platforms):

https://discord.gg/bBMbNCT

#### Reddit (as reliable as reddit can be):

https://www.reddit.com/r/matlab/

### WholsHostingThis (MATLAB blog entry):

https://www.whoishostingthis.com/resources/math-languages/

### events - MATLAB

"MATLAB & Simulink Academic Events and Resources" Newsletter

Opt-in and opt-out by modifying your Communication Preferences in your MathWorks Profile

https://www.mathworks.com/company/events.html

MATLAB EXPO, November 13-14, 2024 – online proceedings MATLAB EXPO, May 10-11, 2023 – online proceedings

https://www.matlabexpo.com/

https://www.matlabexpo.com/online/2024.html

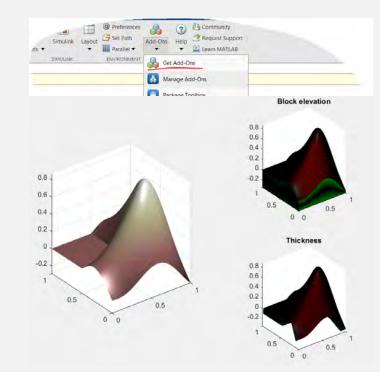
https://www.matlabexpo.com/online/2023.html

https://eventsonline.mathworks.com/series/matlab-expo-2021/overview



## 3D printing your data

- MATLAB script to create 3D-printable objects from 2D functions <a href="https://web.mst.edu/~dawesr/assets/3d\_printing\_tutorial.pdf">https://web.mst.edu/~dawesr/assets/3d\_printing\_tutorial.pdf</a>
- 3D mesh plot and exporting it into an STL file (3D printable file) <a href="https://community.wolfram.com/groups/-/m/t/139463">https://community.wolfram.com/groups/-/m/t/139463</a>



surf2solid add-on

- Anamorphic 3D Printing using MATLAB
   https://blogs.mathworks.com/community/2013/07/09/anamorphic-3d-printing/
- "surf2solid" function is now an add-on for MATLAB (as of R2013a)
   thicken with offset
   block a surface with a flat base
   https://www.mathworks.com/matlabcentral/fileexchange/42876-surf2solid-make-a-solid-volume-from-a-surface-for-3d-printing

## moving forward

- The Staff and Student Assistants in the Makerspace are here to help!
- There are O'Reilly video and text tutorials available to help learn the more advanced software (Python, MATLAB, Arduino, etc.) through Library

Databases: Search for "oreilly":

O'Reilly for Higher Education

Online access [2]

• Click "Online access" @

https://ttu-primo.hosted.exlibrisgroup.com/permalink/f/19r5ufk/01TTU\_ALMA61293358880002611

#### **Additional Resources:**

- <a href="https://www.youtube.com/watch?v=jTS5ZmrrzMs">https://www.youtube.com/watch?v=jTS5ZmrrzMs</a>
- <a href="https://www.mathworks.com/academia/educators.html?s\_tid=hp\_teach\_educator">https://www.mathworks.com/academia/educators.html?s\_tid=hp\_teach\_educator</a>

#### LabView/MATLAB:

- https://www.mathworks.com/products/connections/product\_detail/labview.html
- <a href="https://zone.ni.com/reference/en-XX/help/371361R-01/lvhowto/creating\_a\_matlab\_script/">https://zone.ni.com/reference/en-XX/help/371361R-01/lvhowto/creating\_a\_matlab\_script/</a>

## projects galore

project-sharing websites (some require membership)

https://learn.adafruit.com/

https://adafruit-playground.com

https://projecthub.arduino.cc/

https://www.hackster.io/

https://www.instructables.com/

https://hackaday.io/

https://make.co/

https://github.com/adafruit/circuitpython-weekly-newsletter-archive

https://magpi.raspberrypi.com/issues/128/

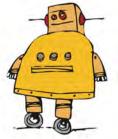
### Support/Forums/Discord

- MATLAB discord server
  - <a href="https://discord.com/invite/matlab">https://discord.com/invite/matlab</a>









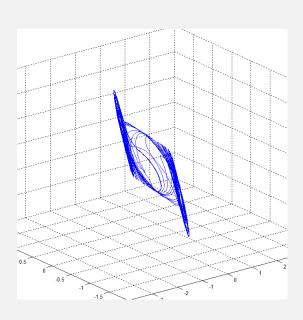


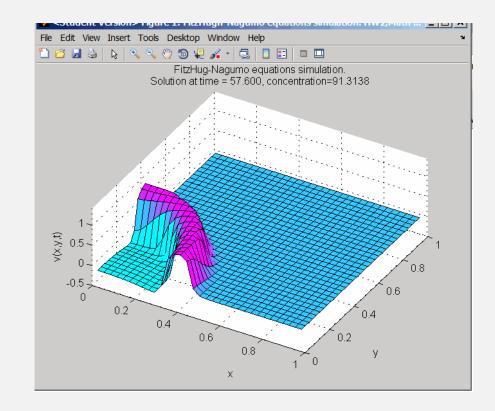


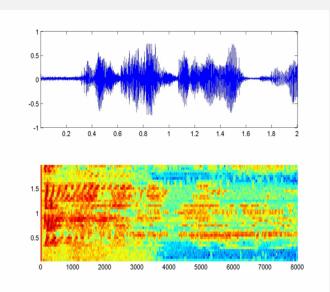
## thank you!

please share your projects and progress!
'Make with MATLAB' with Instructor Sean Scully review this workshop here:

https://ttu.libwizard.com/f/workshop-eval-24-25\_emerging\_tech









#### F

## thank you!

please share your projects and progress!

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https://ttu.libwizard.com/f/workshop-eval-24-25\_emerging\_tech

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Workshops - <a href="https://guides.library.ttu.edu/make">https://guides.library.ttu.edu/make</a>

