

Introduction to Computational Thinking and Python Programming

Sarom Leang, Ph.D. (Instructor)

Jesse McClandish (Mentor)

October 29, 2022

Session 1





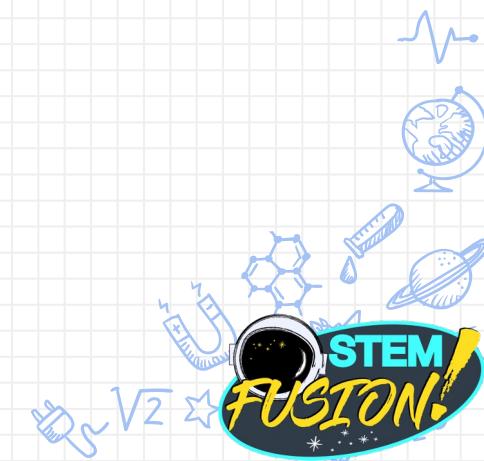
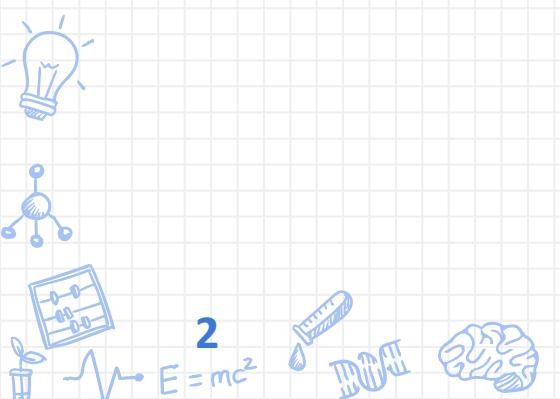
Names and Faces and Pronouns

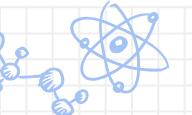
Sarom Leang, Ph.D. (Instructor)

- Professor
- Instructor
- Mr. Leang

Jesse McClandish (Mentor)

- Jesse





H₂O

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Schedule

10:00 AM – 10:25 AM Homeroom

10:25 AM – 11:45 AM G1 Block

11:45 AM – 12:35 PM Break/Lunch

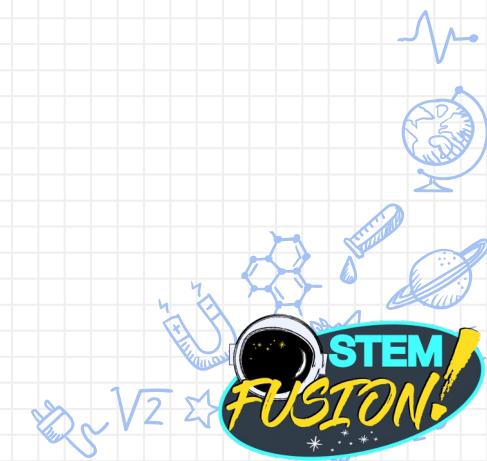
12:40 PM – 01:55 PM G2 Block

01:55 PM – 02:00 PM Dismissal



$$E=mc^2$$

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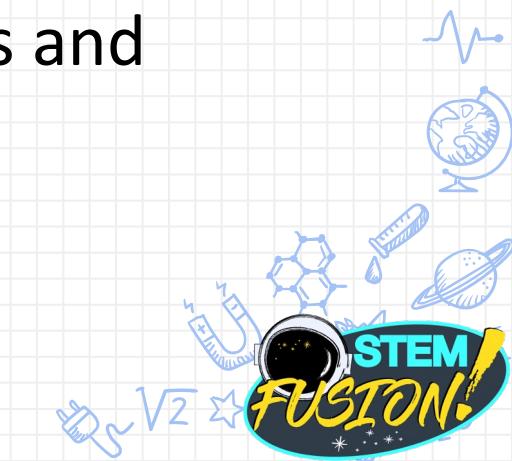


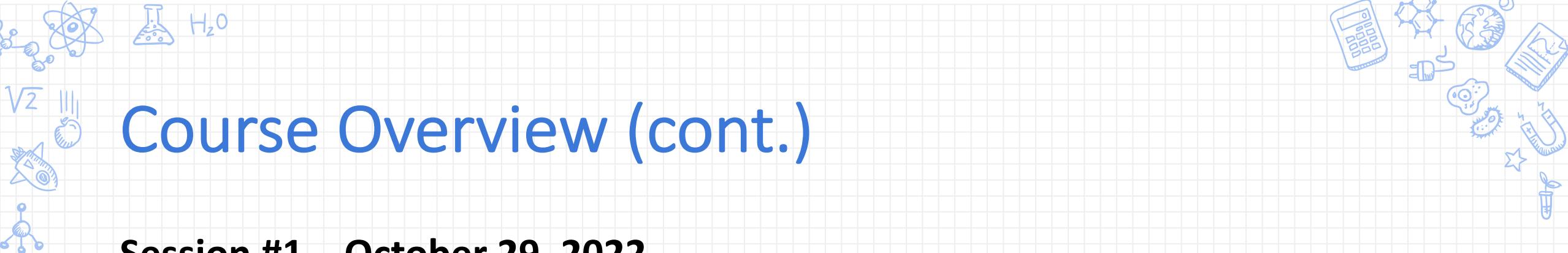
Course Overview

This course introduces the fundamental building blocks of computational thinking and computer programming using the Python language.

Upon successful completion of this course, students will be able to:

- Improve their problem solving skills
- Write, read, and execute Python code using basic data types and operators





Course Overview (cont.)

Session #1 – October 29, 2022

- Python programming environment, “Hello World”

Session #2 – December 3, 2022

- Python data types, typecasting, conditionals, and Booleans

Session #3 – March 4, 2023

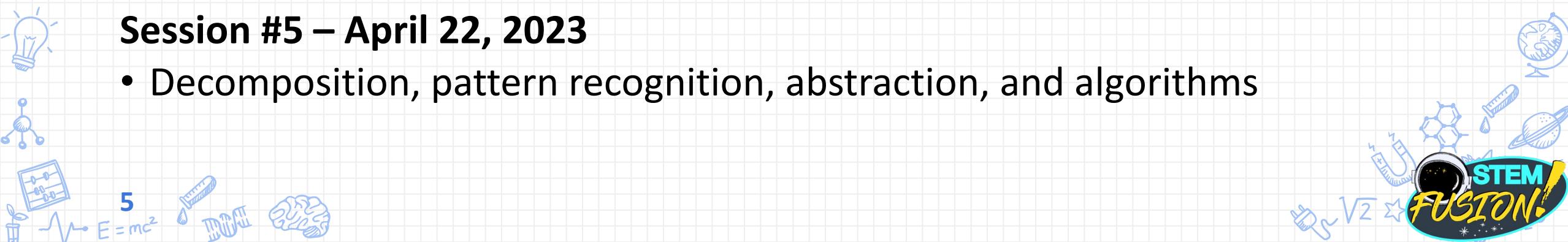
- Loops, {list, dictionary, set} comprehension, and functions

Session #4 – March 25, 2023

- Exception handling

Session #5 – April 22, 2023

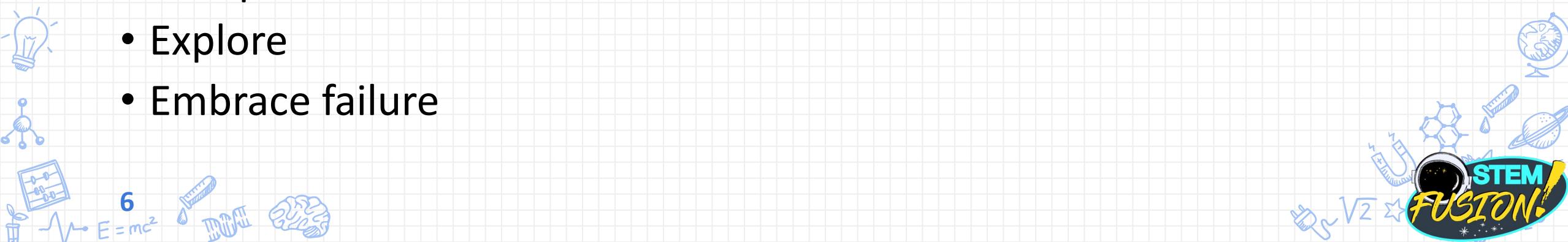
- Decomposition, pattern recognition, abstraction, and algorithms

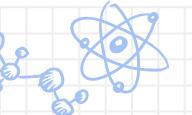




Student Expectations

- **NO FOOD**
- **NO DRINKS** (on the table)
- Be respectful to individuals and property
- Be open to learning
- Be open to not understanding
- Be patient with yourself
- Ask questions
- Explore
- Embrace failure





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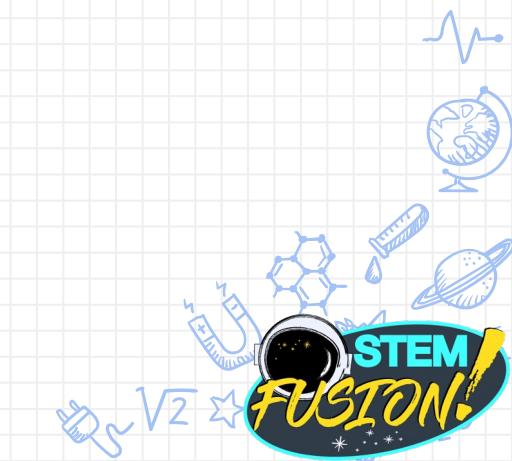
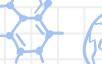


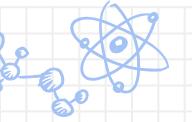
Resources

- Google
 - <https://www.google.com>
 - Refine web searches
 - <https://support.google.com/websearch/answer/2466433>
- Stack Overflow
 - <https://stackoverflow.com>



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Introductions



Choose one:

- Everyone has a story. What is yours?

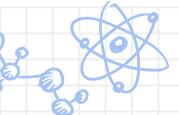
or

- Answer the following questions:
 - Name/Pronouns
 - Grade level and school
 - What did you choose to attend STEM Fusion!?
 - Why did you choose this course for STEM Fusion!?
 - Do you have any experience in computer programming?
 - What do you hope to get out of this course?



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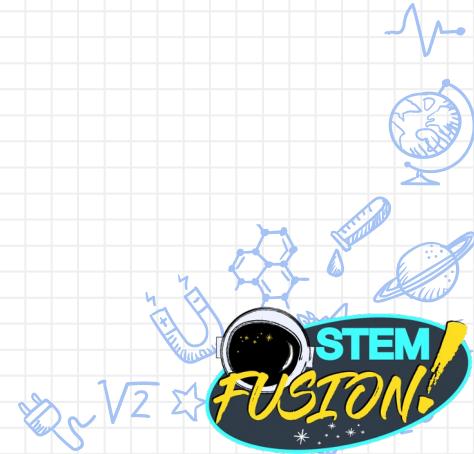
My Story

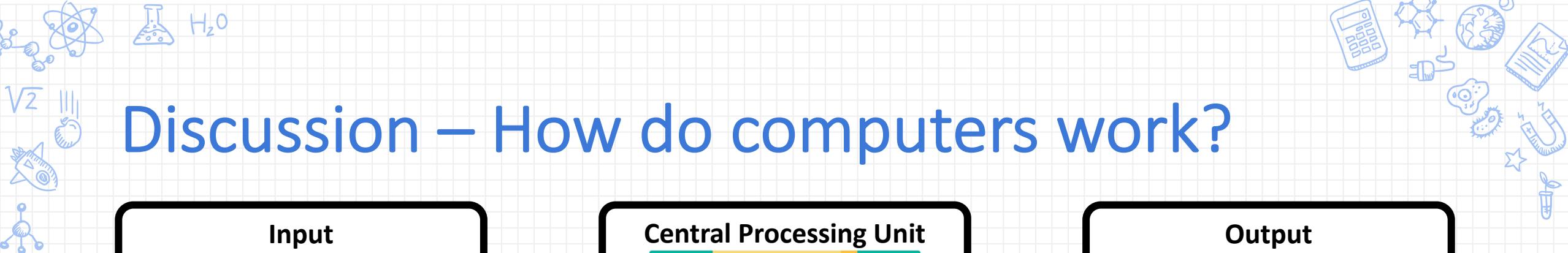
- 1982 Coming to America!
Khmer Rouge Genocide
- 1998 EIP Class 7 Scholar
Wakefield High School
- 2004 B.S. Chemistry (Honors, High Distinction), Minor CS
George Mason University
- 2011 Ph.D. Physical Chemistry / Postdoctoral Researcher
Iowa State University
- 2014 Assistant Research Scientist
The Ames Laboratory, Department of Energy
- 2018 Senior Computational Scientist/Senior Software Engineer
EP Analytics, Inc.



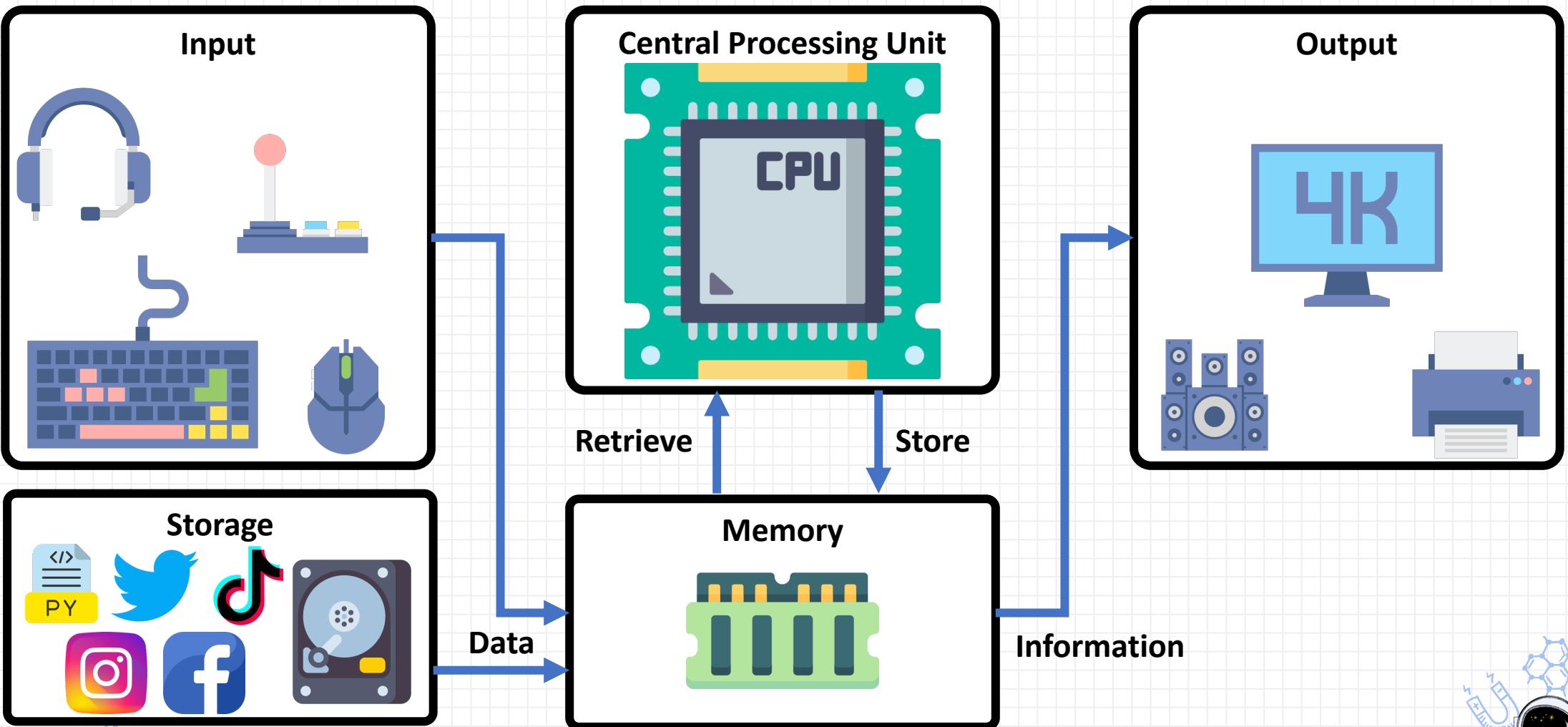
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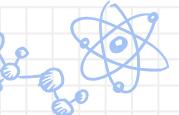
$$E = mc^2$$





Discussion – How do computers work?





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Discussion – What is a computer?

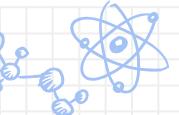


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V²

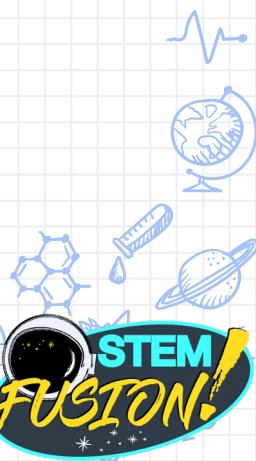


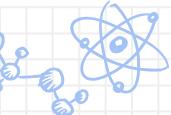
Discussion – What is a computer?

- An electronic device that **stores, retrieves, and processes** data.



$$12 \quad E = mc^2$$





$$\sqrt{2}$$

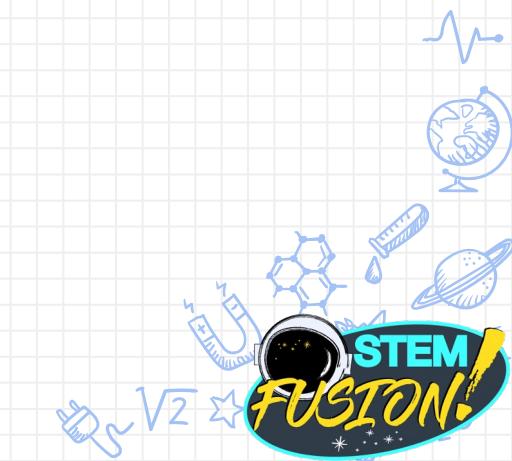


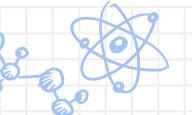
Discussion – What is a computer?

- An electronic device that **stores, retrieves, and processes** data.
- A **programmable** electronic device that **stores, retrieves, and processes** data.



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**STEM FUSION!**



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Discussion – What is computer programming?



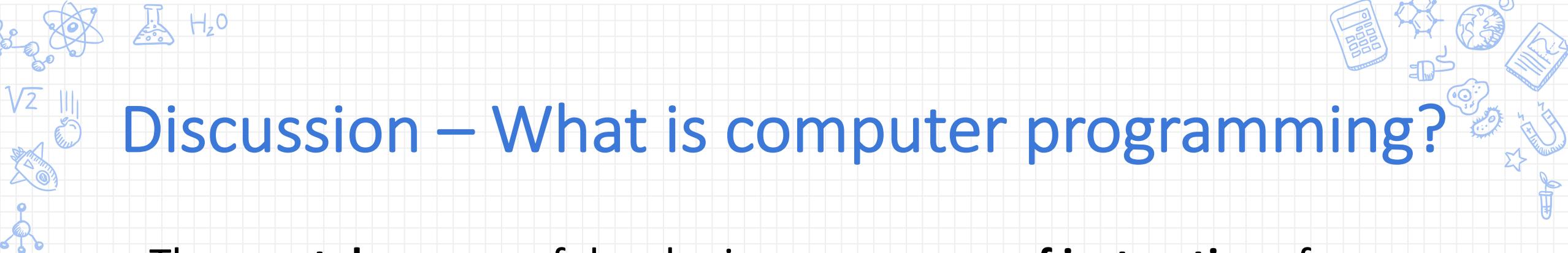
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$$E=mc^2$$



STEM
FUSION!

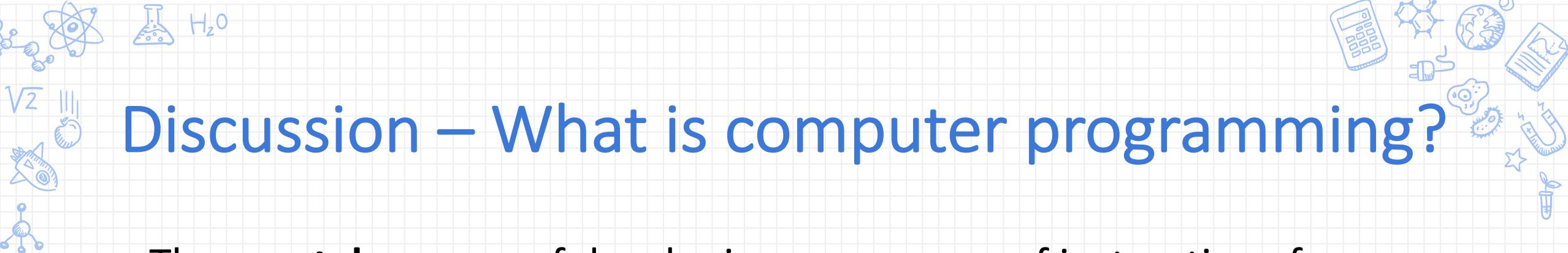




Discussion – What is computer programming?

- The **mental process** of developing a **sequence of instructions** for a computer.
 - Design and planning





Discussion – What is computer programming?

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 - **What is the physical process called?**

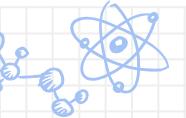




Discussion – What is computer programming?

- The **mental process** of developing a sequence of instructions for a computer.
 - Design and planning
- **What is the physical process called?**
 - Coding





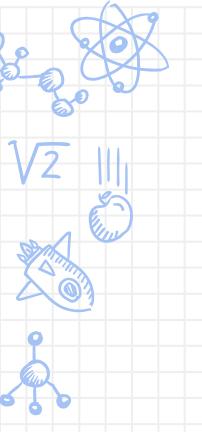
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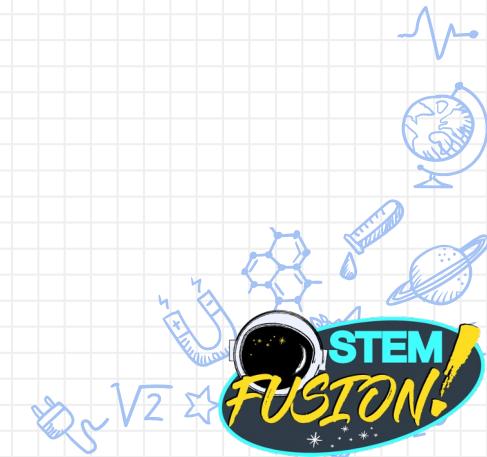
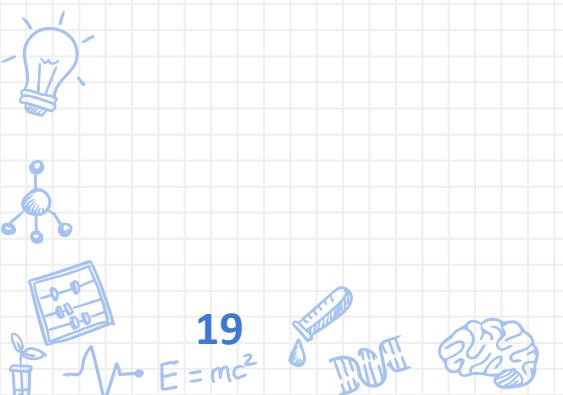
Example – Sequence of Instructions

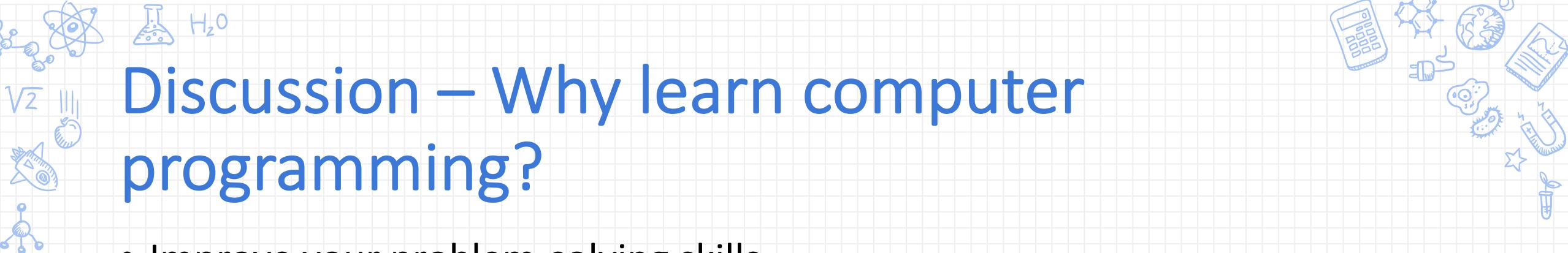
- Left hand out and up
- Right hand out and up
- Flip left hand
- Flip right hand
- Left hand to right shoulder
- Right hand to left shoulder
- Left hand to back of head
- Right hand to back of head
- Left hand to right hip
- Right hand to left hip
- Left hand on left bottom
- Right hand on right bottom
- Wiggle
- Wiggle
- Jump





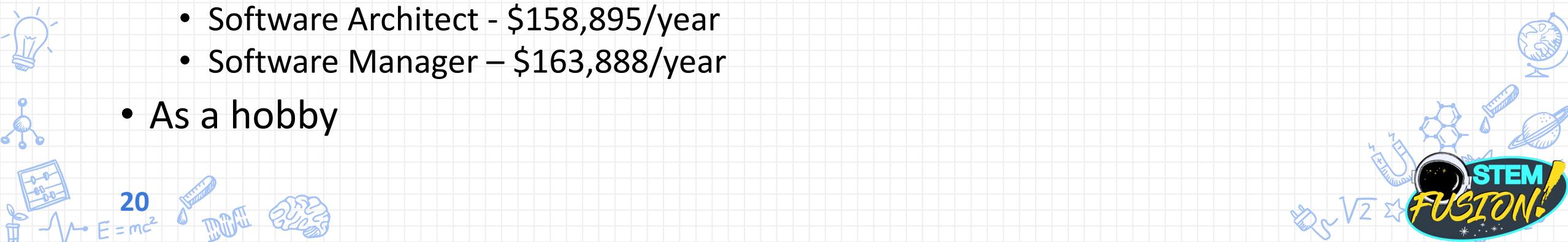
Discussion – Why learn computer programming?





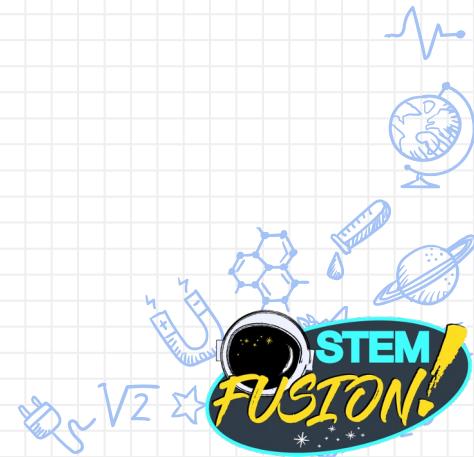
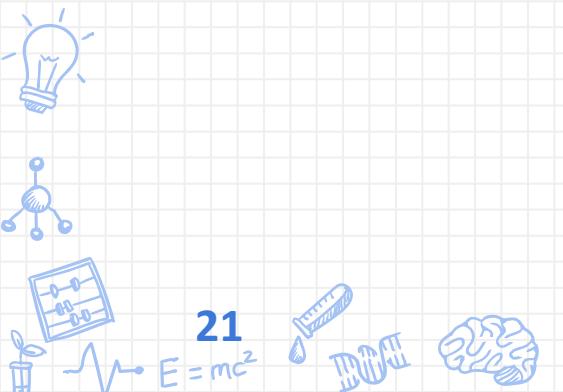
Discussion – Why learn computer programming?

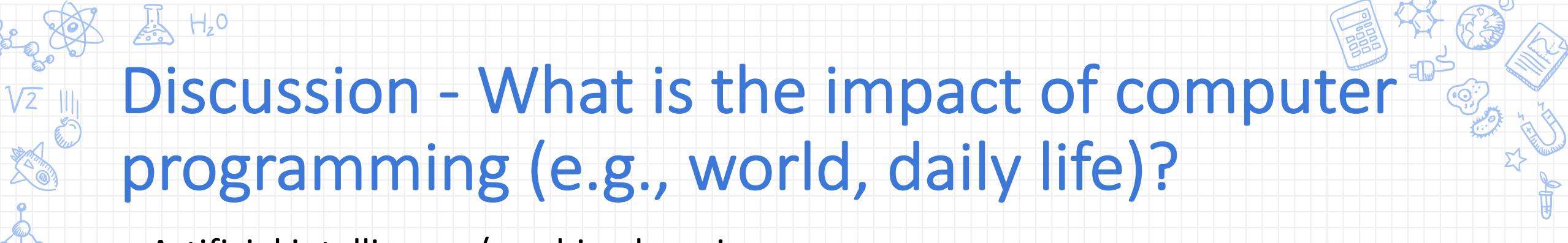
- Improve your problem-solving skills
- Process large amounts of data (finance, manufacturing, healthcare, science)
- Create/design a web site/application/game
- To better understand computer programs/technology
- As a career (Glassdoor salary search for Washington D.C. area)
 - Software Developer - \$109,099/year
 - Data Scientist - \$118,542/year
 - Software Architect - \$158,895/year
 - Software Manager – \$163,888/year
- As a hobby





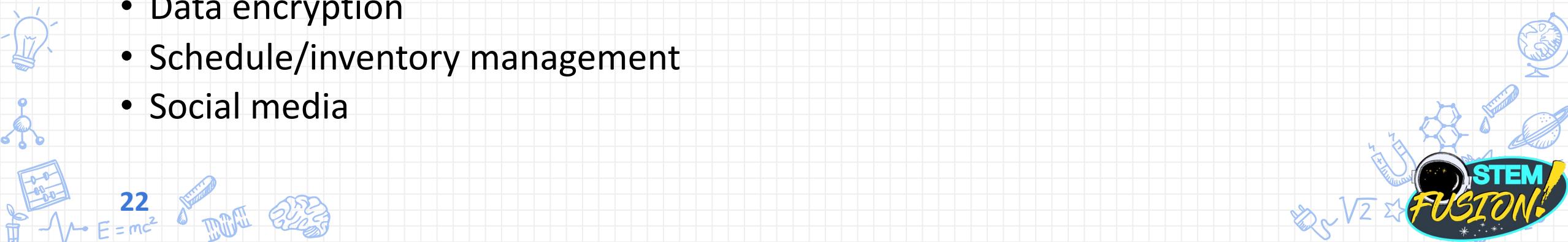
Discussion - What is the impact of computer programming (e.g., world, daily life)?

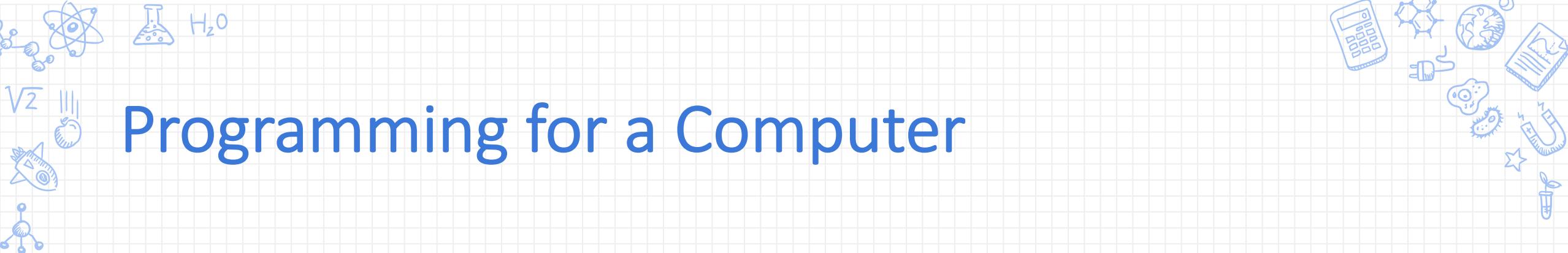




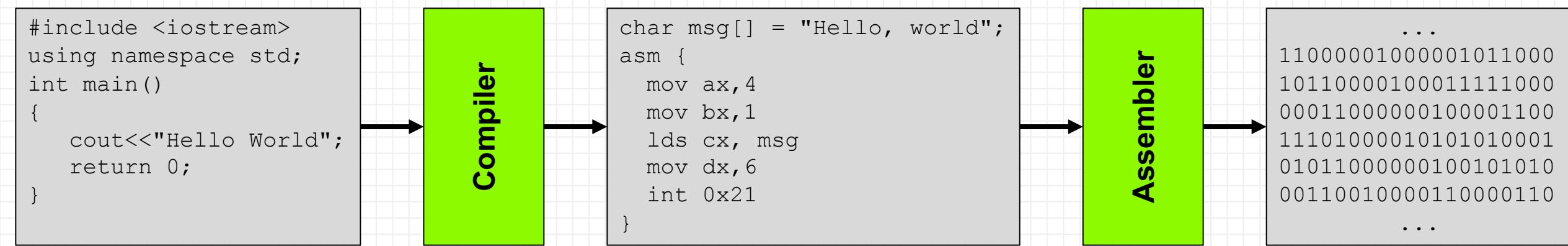
Discussion - What is the impact of computer programming (e.g., world, daily life)?

- Artificial intelligence/machine learning
- Robotics/automation
- Cybersecurity/threats
- Websites/E-commerce
- Payment processing/transactions
- Mobile Apps
- Weather modeling
- Global positioning system (GPS)
- Data encryption
- Schedule/inventory management
- Social media





Programming for a Computer

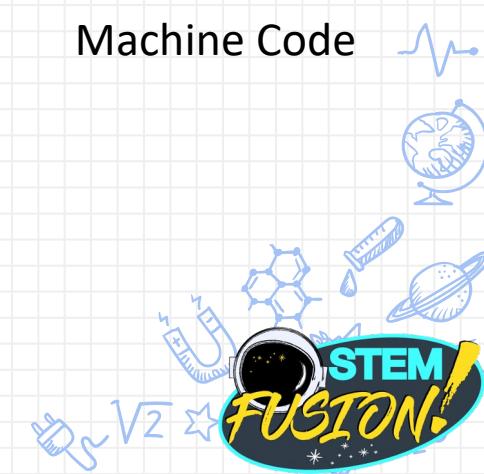
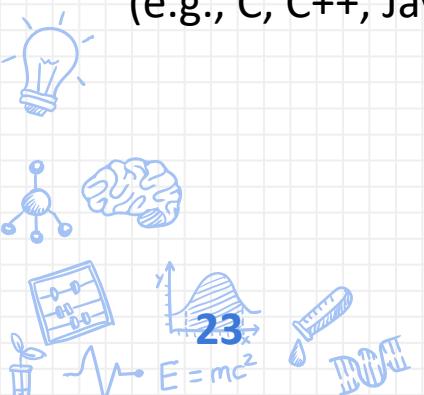


High level language
(e.g., C, C++, Java)

Assembly Language
(e.g., x86, ARM)

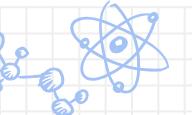
Machine Code

Note: Python uses an interpreter to convert Python code to Python bytecode (line-by-line).



Python

- An interpreted high-level programming language released in 1991.
- Can be used for web development, software development, mathematics, and system scripting.
- Works on different platforms (Windows, Mac, Linux, etc.).
- Simple syntax similar to the English language.
 - Syntax – arrangement of words/phrases to create something understandable



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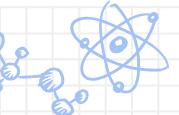
Programming Environment

- A text editor
 - Sublime <https://www.sublimetext.com>
- A Python interpreter
 - Python 3.11.0 <https://www.python.org>



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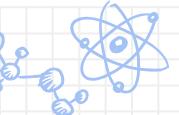


First Programming Exercise: Hello World

- Open up a blank document in the ATOM editor
- Type: **print("Hello World!")**
- Save the file as hello.py into your Documents folder
- Open up the command prompt
 - 1. Test if python is working: type **python** and hit enter
 - 2. If you get an error then: type
set PATH=%PATH%;C:\Python310
and hit enter
 - 3. Repeat step 1
- Execute your script:
 - Switch into the directory containing hello.py
 - **cd Documents**
 - Call the python program to interpret and execute your code
 - **python hello.py**



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hello.py

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



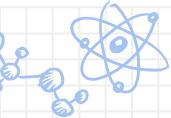
$$E=mc^2$$

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DOE





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Survey

- G1 - <https://forms.gle/3mqPuzfKsyg4PGWT8>
- G2 - <https://forms.gle/K7F5ofM1VUXVzzZq8>



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