

# Introduction to Computational Thinking and Python Programming

**Instructor:** Sarom Leang, PhD (Teacher/Professor)

**Assistant:** Romin Katre

**Innovation Hall 203**



# Pronouns

- Instructor: Sarom Leang, Ph.D. (Instructor/Teacher)
- Assistant: Romin Katre



# Schedule

- 10:00 AM – 10:15 AM (Homeroom)
- 10:15 AM – 11:35 AM (G1)
- 11:40 AM – 12:35 PM (Lunch)
- 12:40 PM – 02:00 PM (G2)



# 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**



# 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.)

## Exploratory Topics

- Session #1 – October 23, 2023
  - Entrance Survey
  - How Computers Work
- Session #2 – December 2, 2023
  - Parallel Computing
- Session #3 – February 10, 2024
  - Generative Artificial Intelligence
- Session #4 – March 23, 2024
  - Quantum Computing
- Session #5 – April 20, 2024
  - Future of Computing
  - Exit survey

## Topics

- Algorithms and Problem Solving
- Debugging and Troubleshooting
- Loops
- Algorithms and Syntax
- Variables and Conditionals
- Variable Arithmetic
- Conditionals (If/Else)
- Compound Conditionals



# Introductions

**Choose one:**

- Everyone has a story. What is yours?

or

- Answer the following questions:
  - Name (Pronouns)
  - Grade level
  - County and school
  - Do you have any experience in computer programming? If yes, elaborate.
  - What do you hope to get out of this course?



# Sarom Leang, PhD (Instructor/Teacher)

- 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.**



# Entrance Survey (G1)

- Visit the following URL and answer the survey as best you can:
  - G1 – <http://bit.ly/2023G1Entrance>



# Entrance Survey (G2)

- Visit the following URL and answer the survey as best you can:
  - G2 – <http://bit.ly/2023G2Entrance>



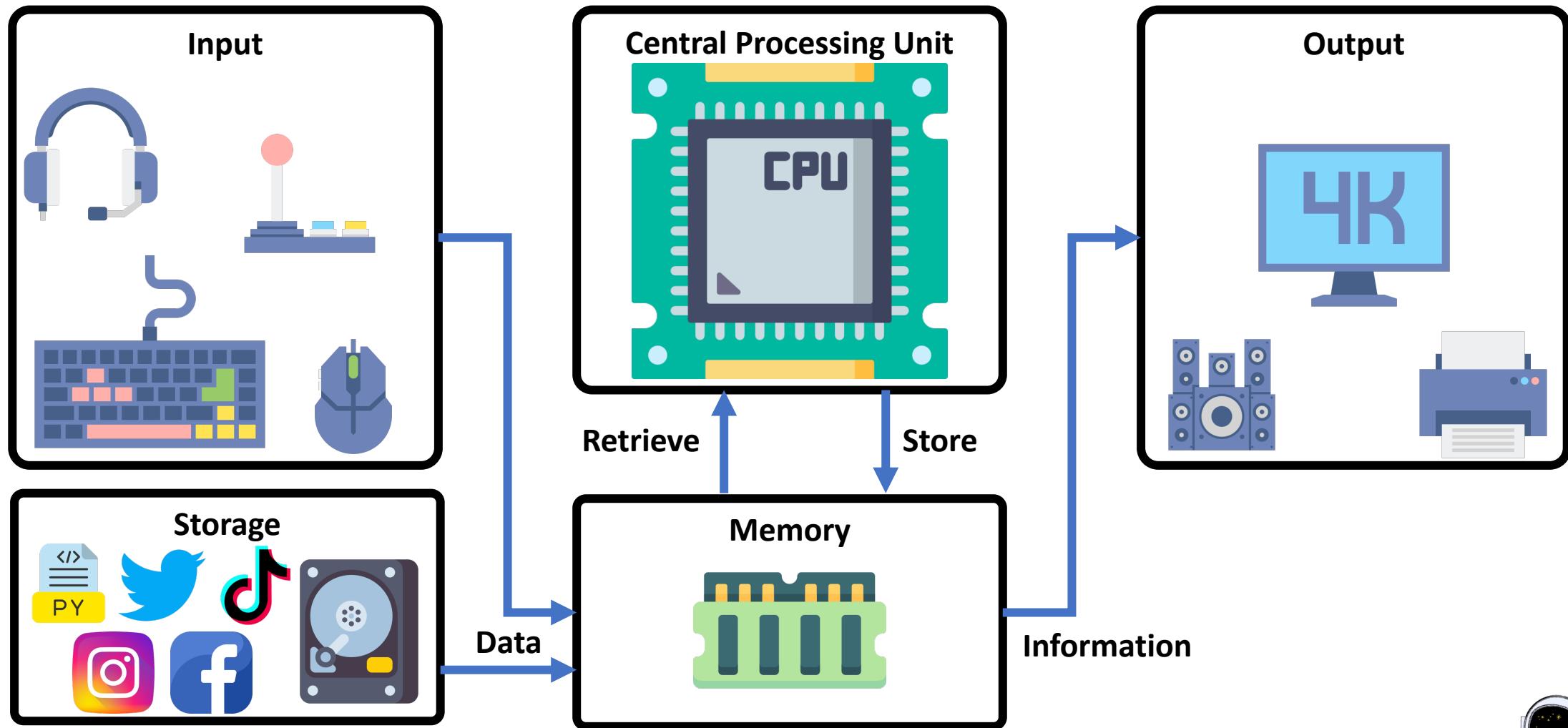
# Entrance Survey

- Visit the following URL and answer the survey as best you can:
  - G2 – <http://bit.ly/2023G2Entrance>

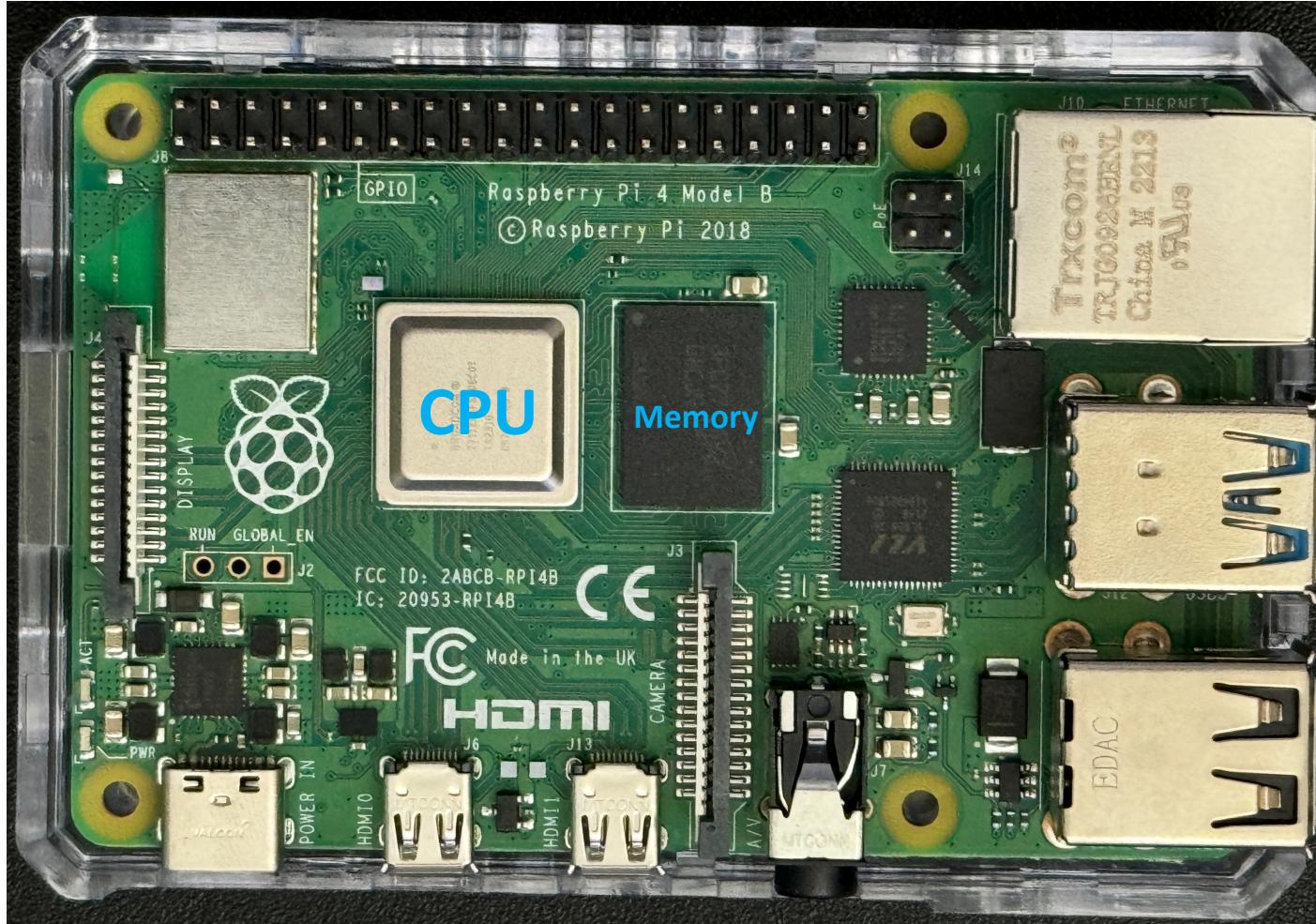


# Discussion – How Do Computers Work?

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# Discussion – How Do Computers Work?



Raspberry Pi

# Discussion – How Do Computers Work?

## Data

- collection of raw statistics or facts
- unorganized
- does not inherently have meaning
- does not offer a clear enough picture to make decisions

## Information

- offers context to those facts, statistics
- is organized
- has purpose due to analysis
- with context, information can help influence decisions

# Discussion – How Do Computers Work?

## Data

- Website traffic  
(hourly/daily/weekly/monthly)
- Spreadsheet with job earnings
- Student test scores
- Annual total rainfall, seawater levels, average temperatures

## Information

- Best time to release a new product/announcement
- Spending budget
- Adjust lesson plans
- Determine impact of climate change

# Discussion – What is a computer?

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program

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

# Example – Set of Instructions (For Humans)

- Left hand out and palm up
- Right hand out and palm 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



# Example – Set of Instructions (For Computers)

```
r=int(input("Enter upper limit: "))
for a in range(2,r+1):
    k=0
    for i in range(2,a//2+1):
        if(a%i==0):
            k=k+1
    if(k<=0):
        print(a)
```

# 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

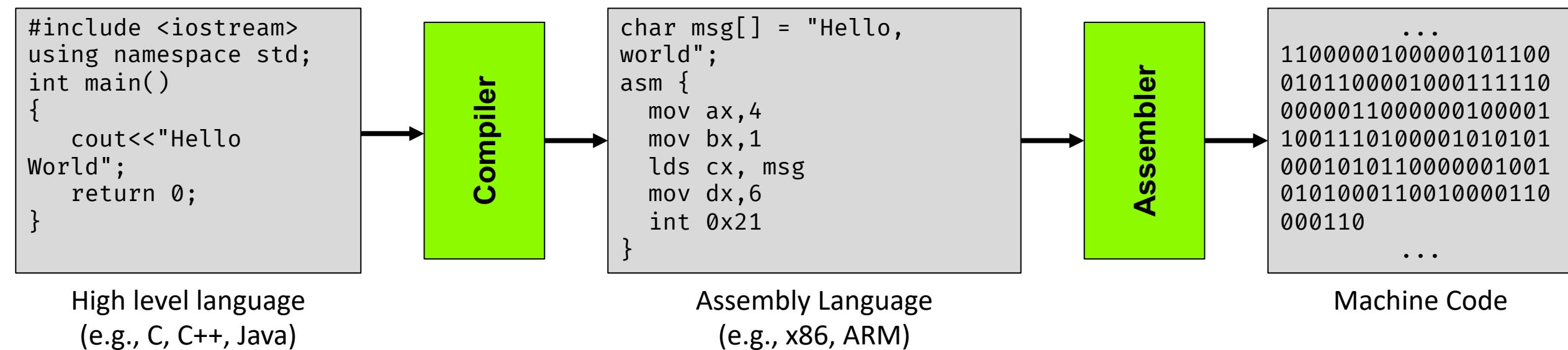


Discussion - What is the impact of computer programming (e.g., world, daily life)?

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- 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



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





Welcome to the world of

# OZARIA



# Your journey begins...





# Today's Journey

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**Warm-Up:** Algorithms & Sequences



**Learn how to use Ozaria**

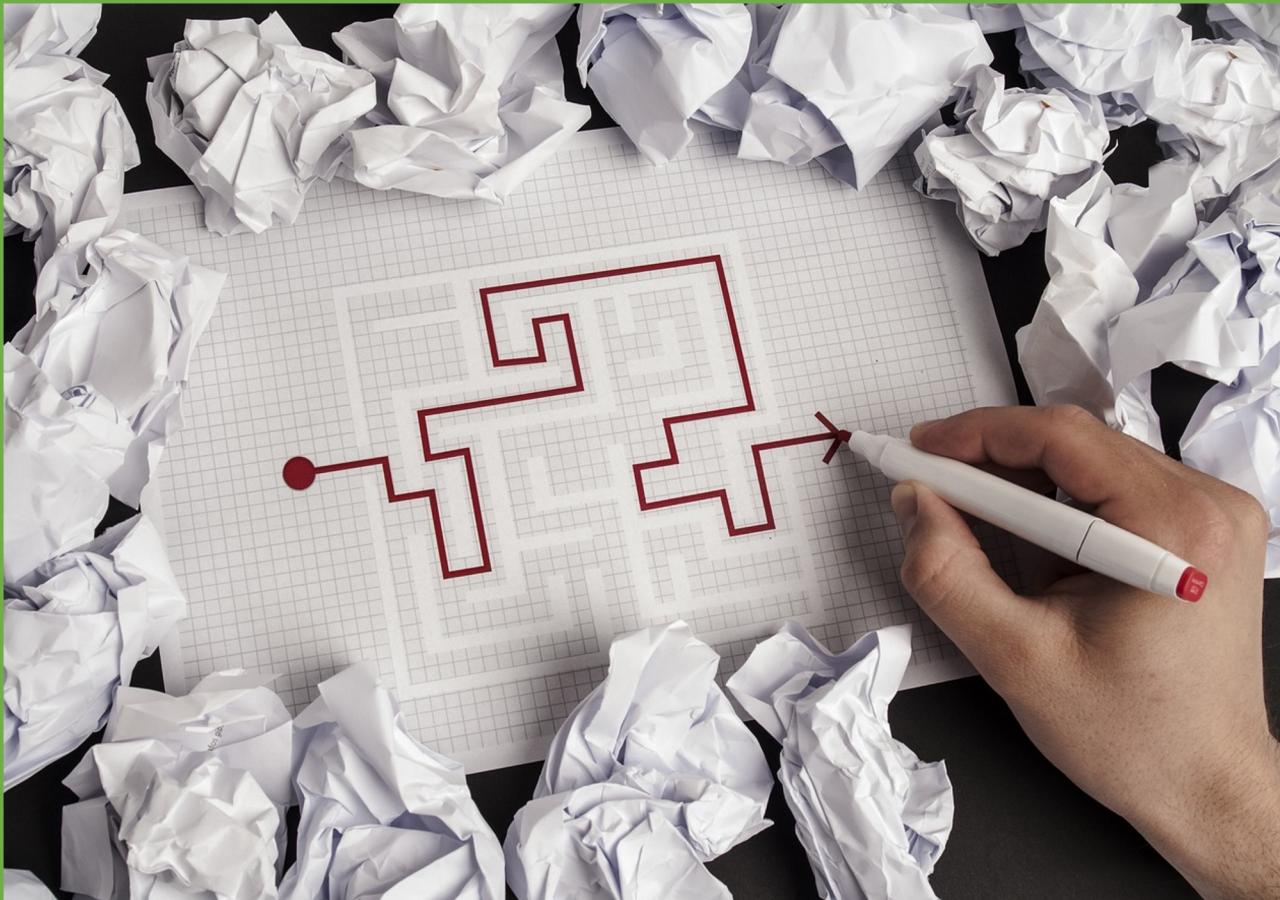


**Play Ozaria:** Get to the Spirit Lands



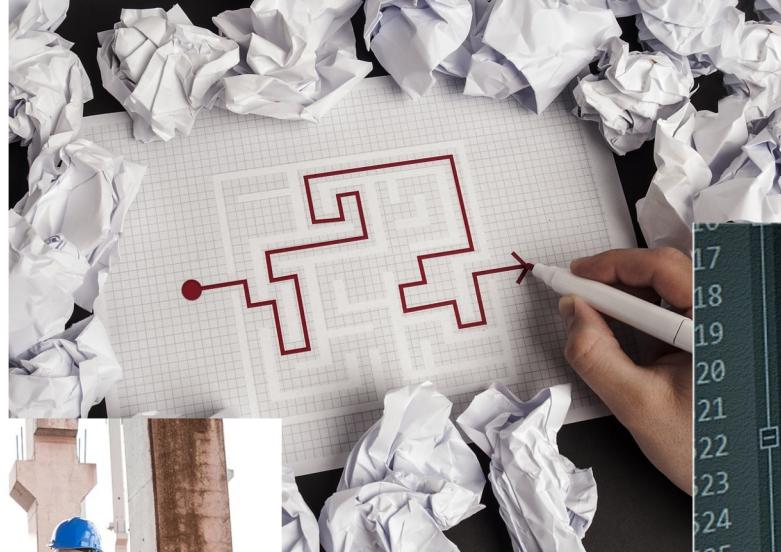
**Optional Extension:** Design a Map

# Algorithms & Sequences



# Algorithms

a sequence of instructions that can be used to solve a problem or set of problems



```
string sInput;
int iLength, iN;
double dblTemp;
bool again = true;

while (again) {
    iN = -1;
    again = false;
    getline(cin, sInput);
    system("cls");
    stringstream(sInput) >> dblTemp;
    iLength = sInput.length();
    if (iLength < 4) {
        again = true;
        continue;
    } else if (sInput[iLength - 3] != '.') {
        again = true;
        continue;
    } while (++iN < iLength) {
        if (isdigit(sInput[iN])) {
            continue;
        } else if (iN == (iLength - 3)) {
            again = true;
        }
    }
}
```

# Problem Solving with Decomposition

You can solve a complex problem by breaking it down into a sequence of subgoals & steps



**What are the subgoals & steps for baking a cake?**

**Subgoal 1: Make the cake layers**

- Measure & combine ingredients
- Make the batter
- Put batter into pans
- Bake the cake layers

**Subgoal 2: Make the filling/frosting**

- What are the steps?

**Subgoal 3: Build the cake**

What are the steps?



# Concept Check: Subgoals & Sequences

Write down a sequence of subgoals & steps to help the hero get to the exit stairs.



**Subgoal 1: ??**

- Move right
- Move right
- ???

**Subgoal 2: ??**

- Move up
- Move right

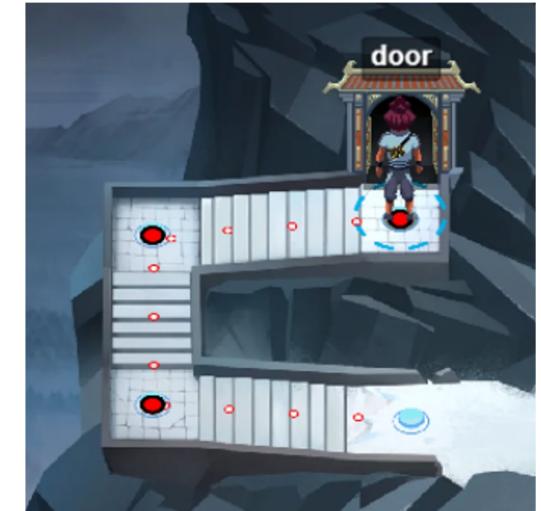
# Input & Output

Code is a type of language we use to communicate with computers.

**Input**



We **input** the code . . .

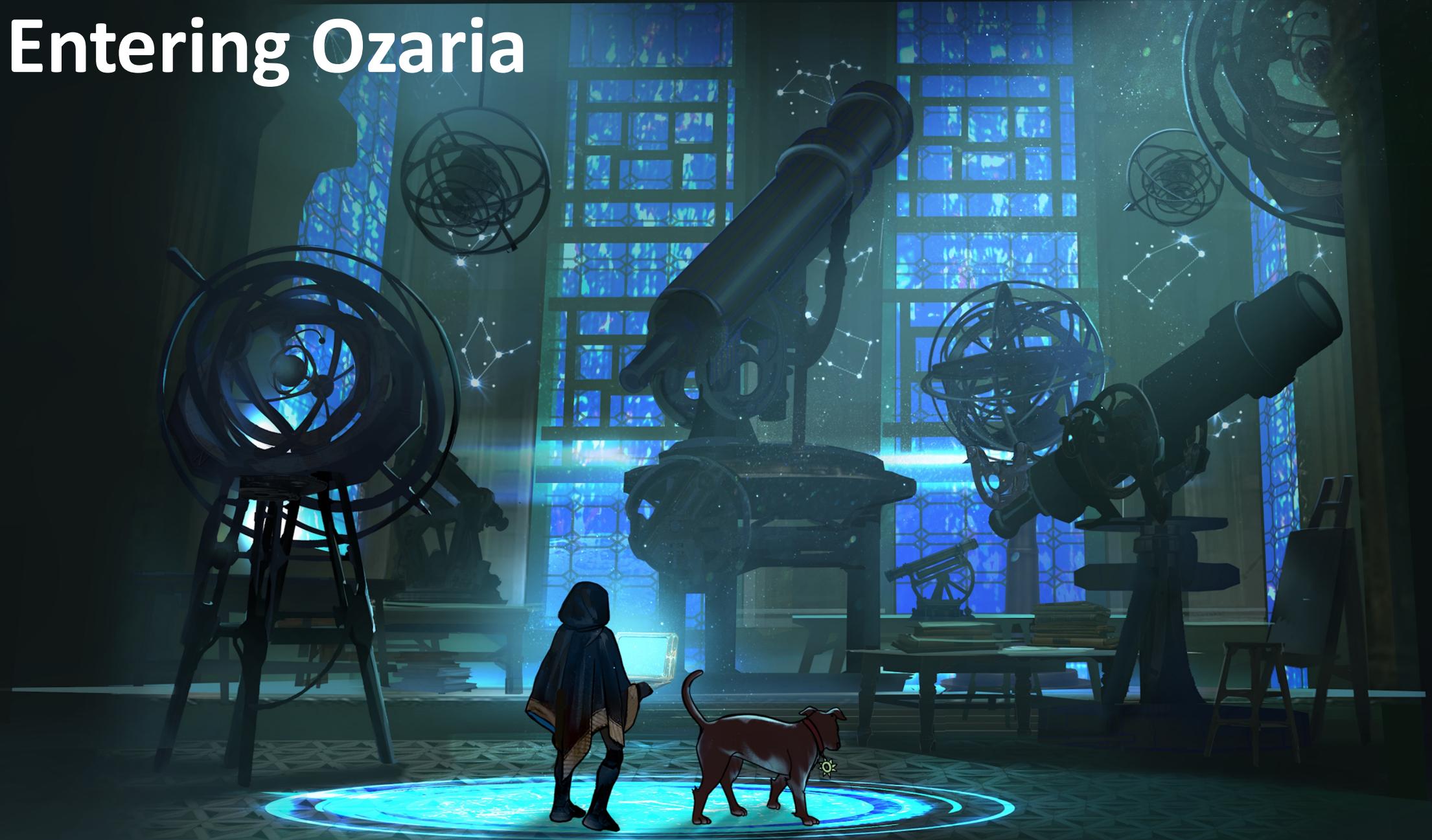


**Output**

. . . and **outputs** actions and/or results based on that code.

the computer processes or reads the code...

# Entering Ozaria



# Navigating Ozaria



Change **account settings**, **customize** your hero, or go back to your **dashboard**

Use the **map** to navigate to different parts of the game. **Mouse over a stop** to see the **name** of the level.

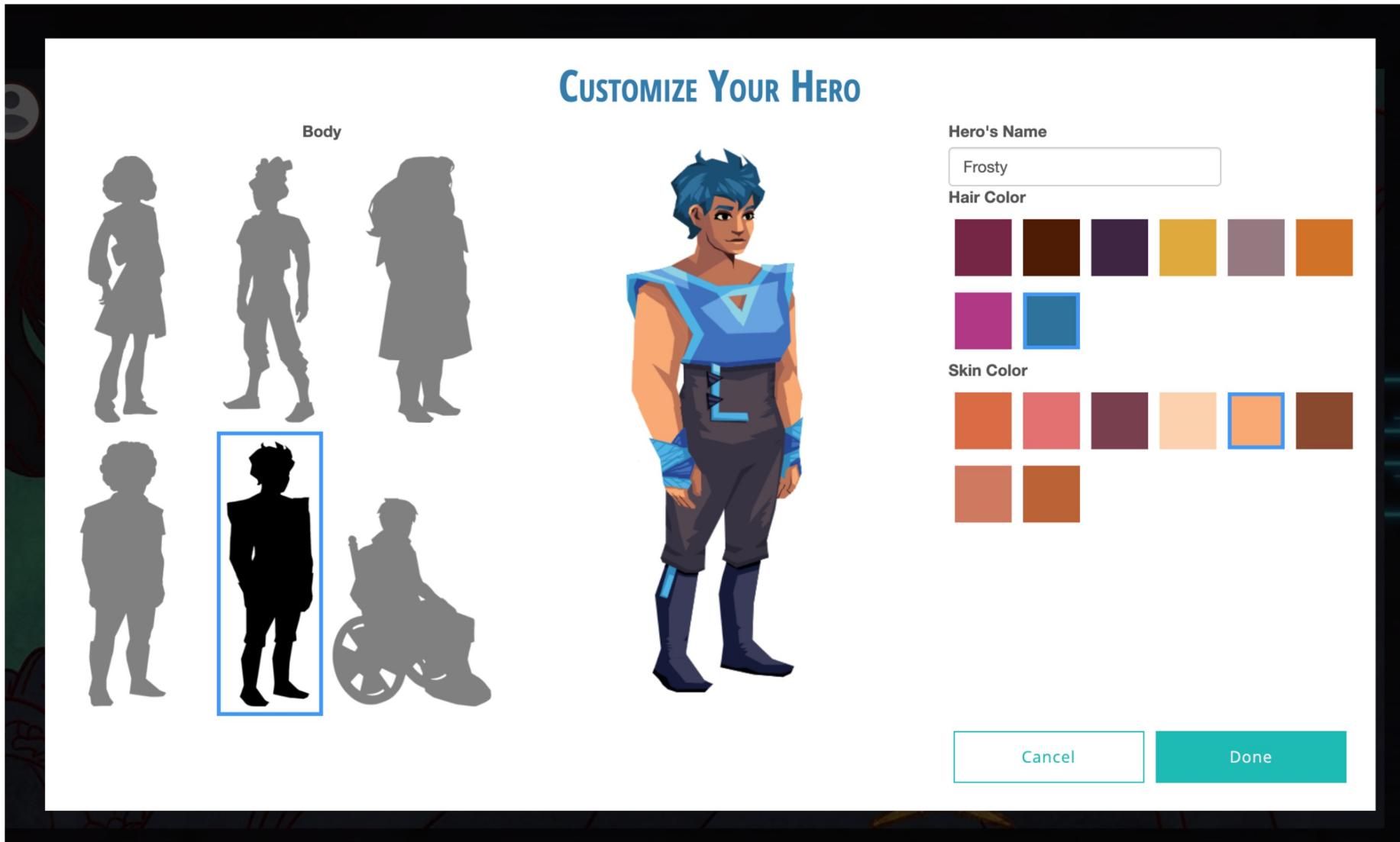
To save space, cinematics and concept checks are organized into **intros**.

→ Returns to **Map**

→ **Maximizes** your Browser

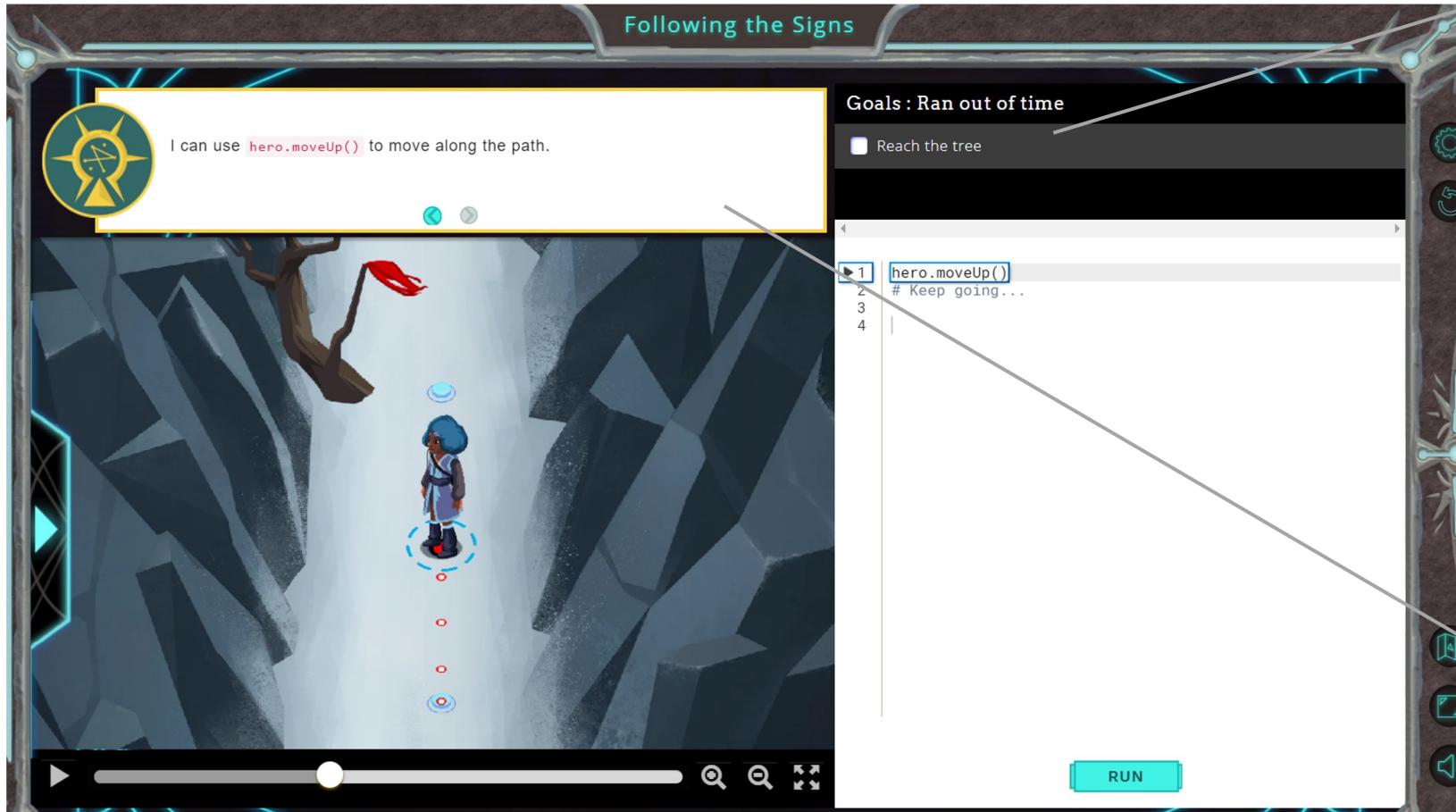
→ Turn the **Volume** On/Off

# Customize Your Hero



# Navigating Ozaria

## Practice Level: Following the Signs



**Goals** keep track of what you need to do to **complete the level**

Customize your **coding experience**

**Restart** the level

Use arrows to navigate the tutorial messages. They provide important **hints & instruction**.

# Navigating Ozaria

The screenshot shows the Ozaria game interface. On the left is a 3D scene of a character in a snowy, rocky environment. A yellow callout box contains the text: "I can use `hero.moveUp()` to move along the path." On the right is a code editor window titled "Following the Signs". The code editor shows the following script:

```
▶1 hero.moveUp()  
2 # Keep going...
```

Below the code editor are buttons for "RUN" and "STOP". To the right of the code editor are several icons: a gear, a circular arrow, a map, a square, and a speaker. Arrows from the text annotations point to these elements.

**The Code Bank gives you more info about the different commands you can use in your code.**

**Write your code here**

**Run your program to see what happens**

**Go backwards and forwards in your program. You can also zoom in and out.**



# Concept Check: How to Use Ozaria

Following the Signs

I can use `hero.moveUp()` to move along the path.

Goals : Ran out of time

Reach the tree

hero.moveUp()  
# Keep going...

RUN

3

4

5

6

8

7

# Independent Practice



# Logging into Ozaria (G1)

1. Go to: <https://www.ozaria.com>
2. Click “Sign Up”
3. Enter in your **class code**
4. **Create an account** or login with your Google account
5. Make sure to **write down your user name!**
6. Click **Continue** to start playing

Students, request a Class Code from your Teacher to create an Account!

Enter Class Code:

XXXXXXXXXXXXXXXXXXXX

Create Student Account

## Intro to CS (Python)

Teacher: Charlotte Cheng

Prologue: Sky Mountain [view map](#)

[view my classmates' projects](#)

Continue

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# Logging into Ozaria (G2)

1. Go to: <https://www.ozaria.com>
2. Click “Sign Up”
3. Enter in your **class code**
4. **Create an account** or login with your Google account
5. Make sure to **write down your user name!**
6. Click **Continue** to start playing

Students, request a Class Code from your Teacher to create an Account!

Enter Class Code:

XXXXXXXXXXXXXXXXXXXX

Create Student Account

## Intro to CS (Python)

Teacher: Charlotte Cheng

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Continue

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