WiFi: Region One Guest PW: Webb1848

Early Childhood STEAM Educator Academies

WS 110238 – Day 1

Coding and Computational Thinking

REGION ONE ESC
STUDENTS FIRST

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Objectives

- Answer the question "why should we teach computer science?"
- Gain an understanding of computational thinking
- Learn why we should introduce coding to prereaders
- Experience various strategies to teach fundamental Computer Science to young children

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Agenda

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Day 1

- What is Computer Science?
- What is computational thinking?
- Developing computational thinking in prereaders

Day 2

- Teaching Computer Science fundamentals to prereaders through play
- Using electronic technology
  - Code.org and Hour of Code
  - Ozobot EVO
  - Tynker Junior

Icebreaker

Draw the Picture

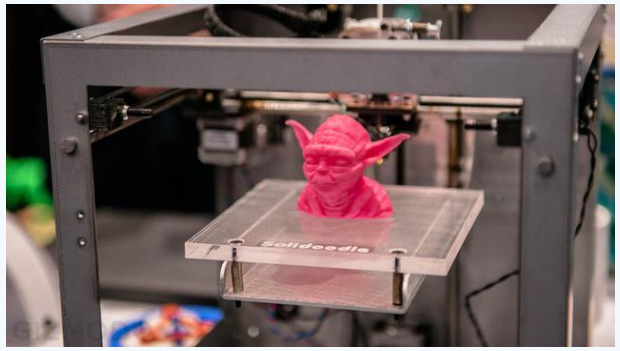
- Each of you will receive a picture
- You will have 10 minutes to write down instructions on how to reproduce the picture using only basic shapes (i.e. triangle, square, circle, etc.) [the programmer]
- Do not give away what the picture is
- You will be trading your instructions with someone else at your table who will try to reproduce your picture based on your written instructions [the computer]

Discuss with a Shoulder Partner…

- How do you use technology on a daily basis? Give some examples from today!
- What do you think technology will look like 30 years from now?

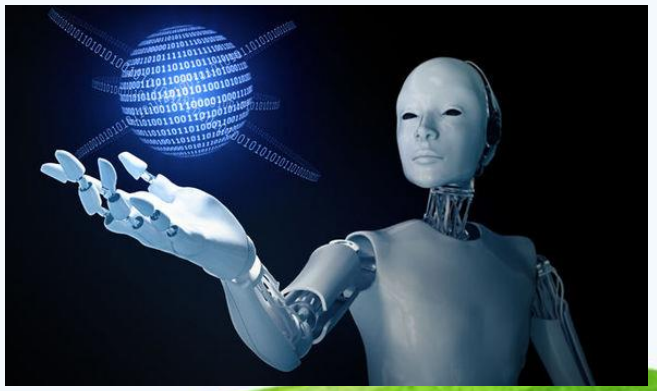
Self-driving trucks…

3D Printing…



Gut probes…

AI…



https://futurism.com/images/things-to-come-a-timeline-of-future-technology-infographic

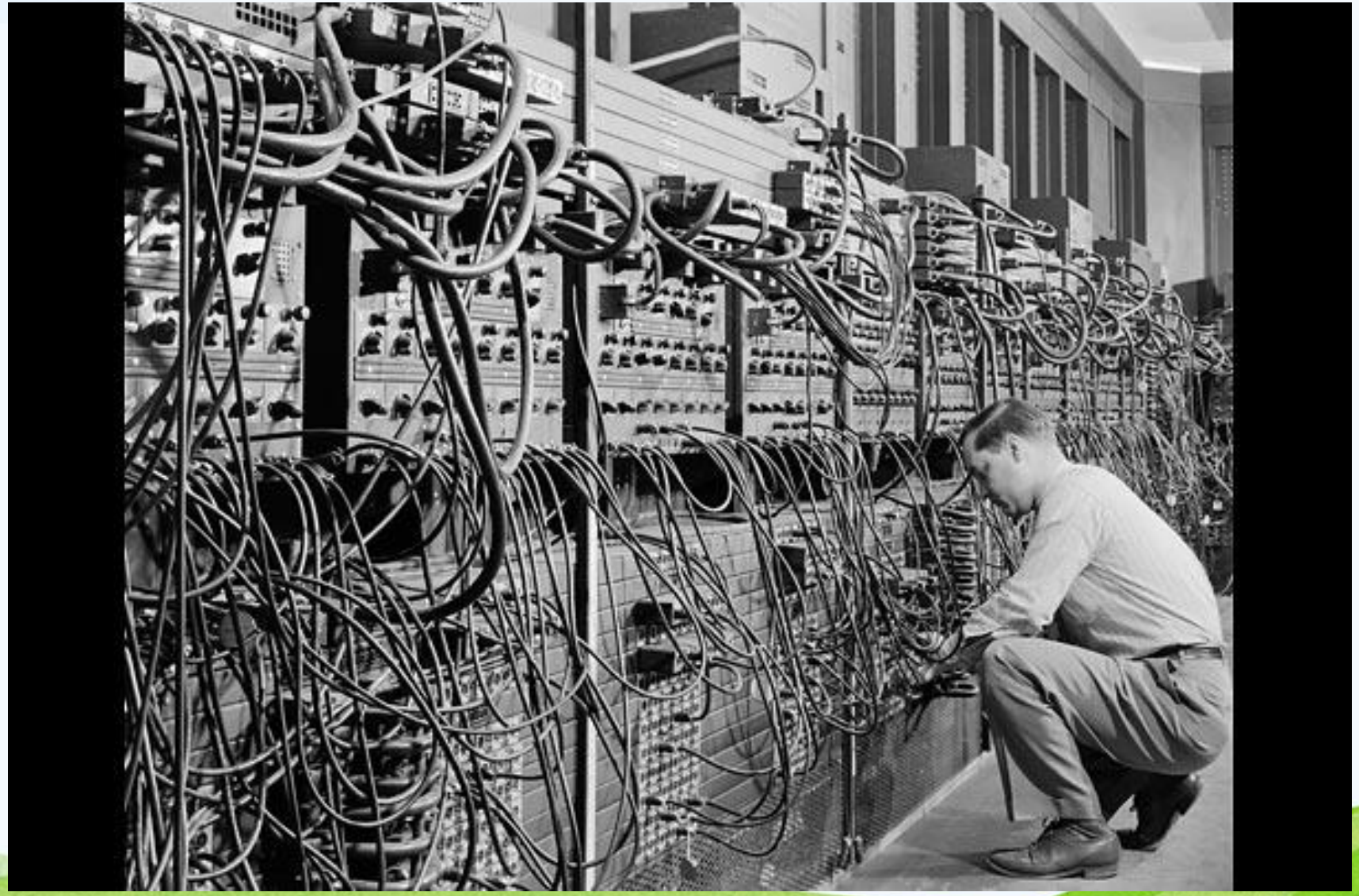
What is Computer Science?

- Computer Science is the study of computers and computational systems. Computer scientists deal mostly with software and software systems including their theory, design, development, and application.

Principal areas of study within CS:

- Artificial intelligence
- Computer systems and networks
- Security
- Database systems
- Human computer interaction
- Vision and graphics
- Numerical analysis
- Programming languages
- Software engineering
- Bioinformatics
- Theory of computing

The Computer- 1946



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The Computer - 2019

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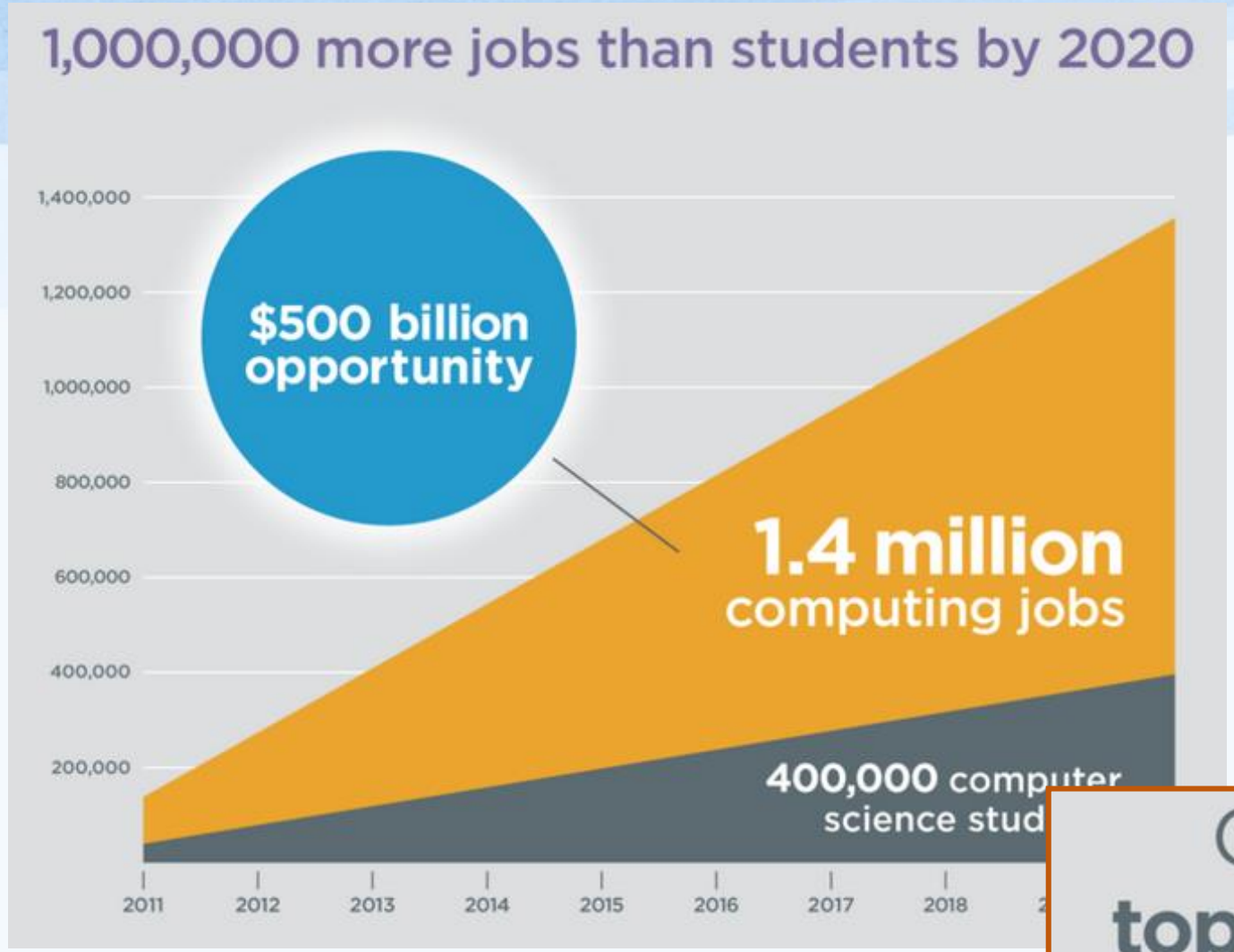

Sources: BLS, NSF, Bay Area Council Economic Institute

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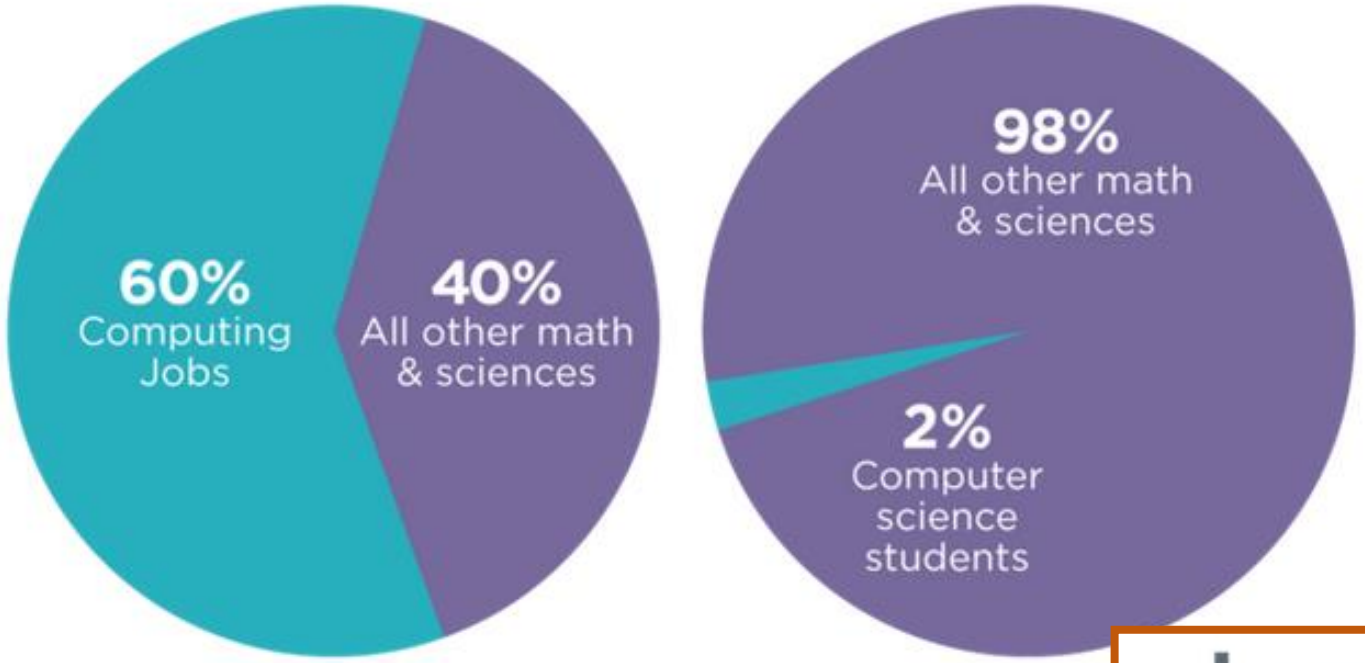
Computer science is a **top-paying college degree** and computer programming **jobs are growing at 2X the national average.**

The job/student gap in computer science



Sources: College Board, Bureau of Labor Statistics, National Science Foundation

Less than 2.4% of college students graduate with a degree in computer science. And the **numbers have dropped since** last decade.

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Fewer CS majors than 10 years ago (and a shrinking % are women)

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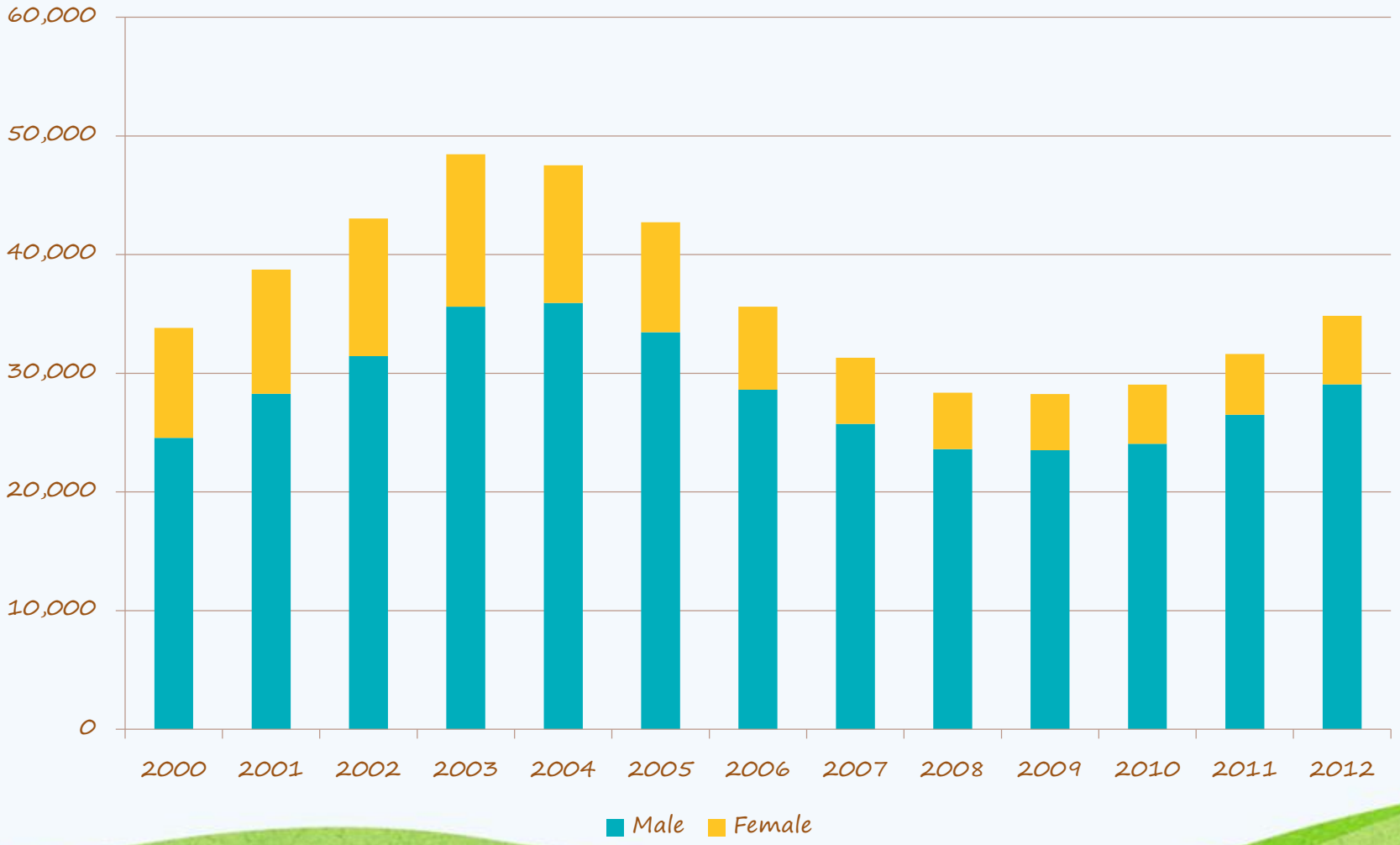

Sources: National Science Foundation

Breaking Stereotypes

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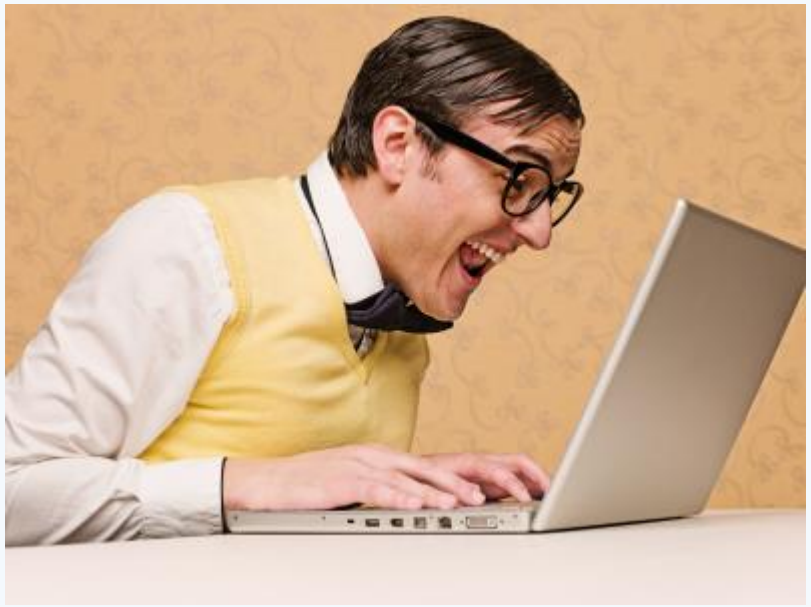

The Statistics

https://csedweek.org/promote/tx

Technology affects every field…

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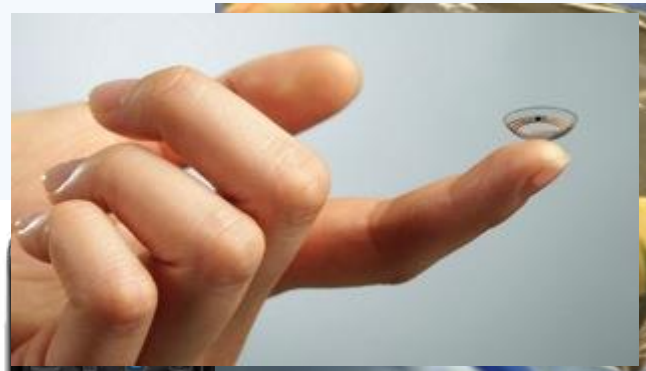
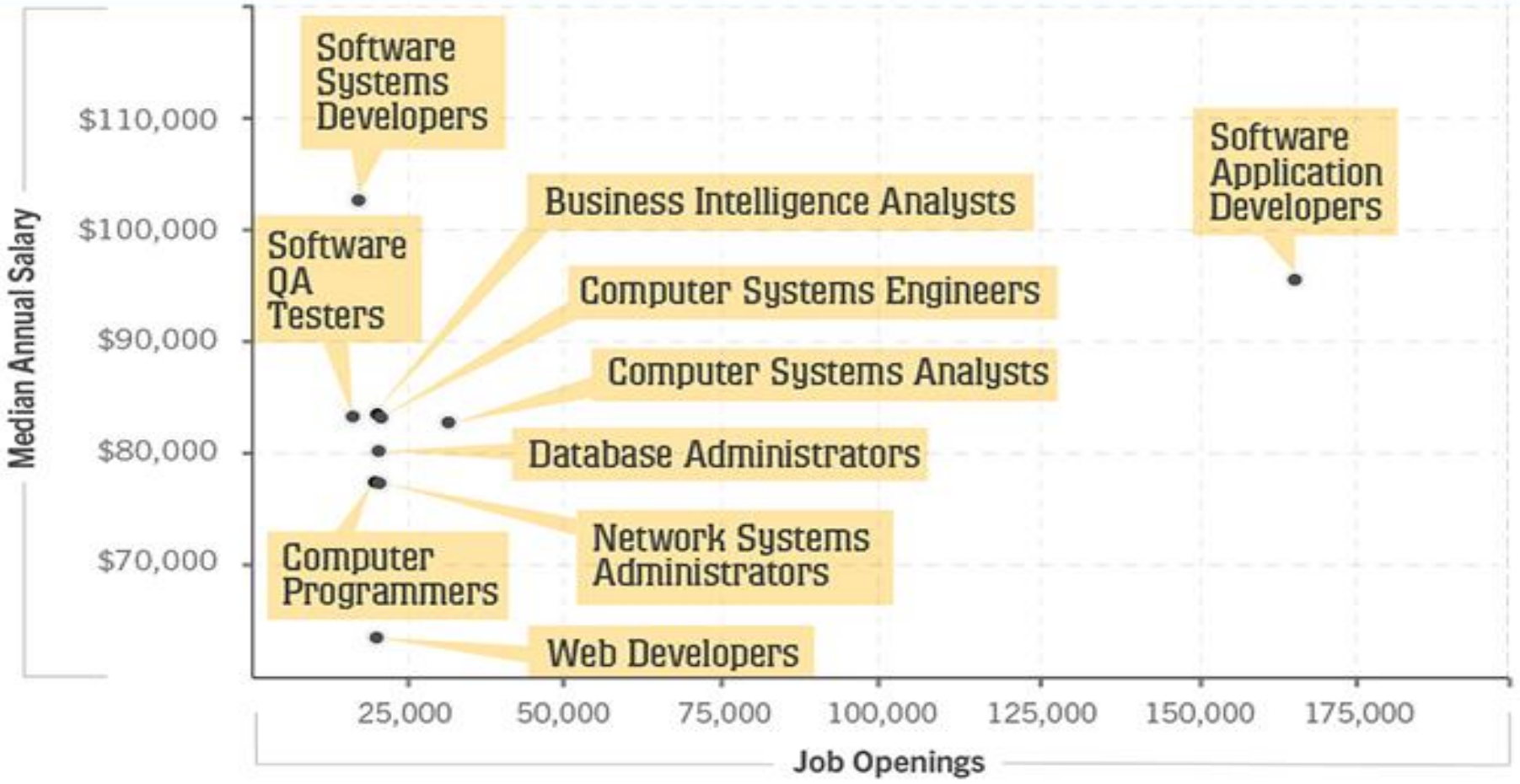


What Can You Do With a Computer Science Degree?



RASMUSSEN COLLEGE

Sources: Burning-Glass.com (analysis of 561,194 computer science degree job postings, Jul. 01, 2014 - Jun. 30, 2015)
U.S. Department of Labor (onetonline.com)

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What is coding?

- Coding, also known as programming, is "the process of developing and implementing various sets of instructions to enable a computer to do a certain task." (BusinessDictionary.com)

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Evolution of Coding


```
01101010011010100010110110010010101100101010101001010101
01111000101011110001101110111000101010010101001101010100
01010100010010010110101000101001011100011001010100100110
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00011010101011110101101111010010010001011010101010000010
00110101001101010001011011001001010110010101010100101010
101111100010101111000110111011100010101001010100110101010
```

Binary

Evolution of Coding

```
ASSUME CS:CODE,DS:DATA
DATA SEGMENT
LIST DW 2579H,0A500H,0C009H,0159H,0B900H
COUNT EQU 05H
DATA ENDS
CODE SEGMENT
START:      XOR BX,BX
            XOR DX,DX
            MOV AX,DATA
            MOV DS,AX
            MOV CL,COUNT
            MOV SI,OFFSET LIST
AGAIN:      MOV AX,[SI]
            SHL AX,01
            JC NEG
            INC BX
            JMP NEXT
NEG:        INC DX
NEXT:       ADD SI,02
            DEC CL
            JNZ AGAIN
            MOV AH,4CH
            INT 21H
            CODE ENDS
            END START
```

Assembly

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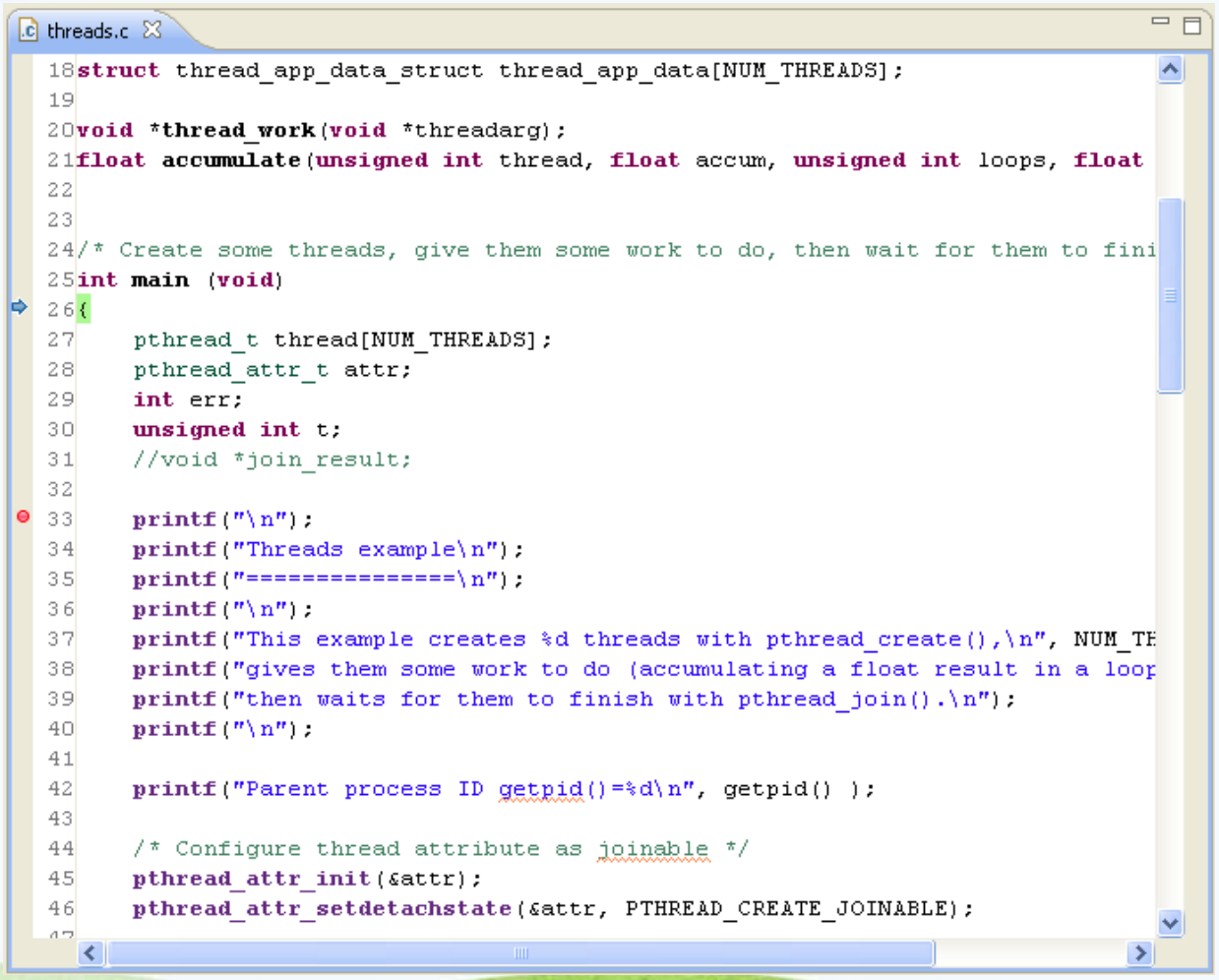
Evolution of Coding



C++

Object Oriented Programming

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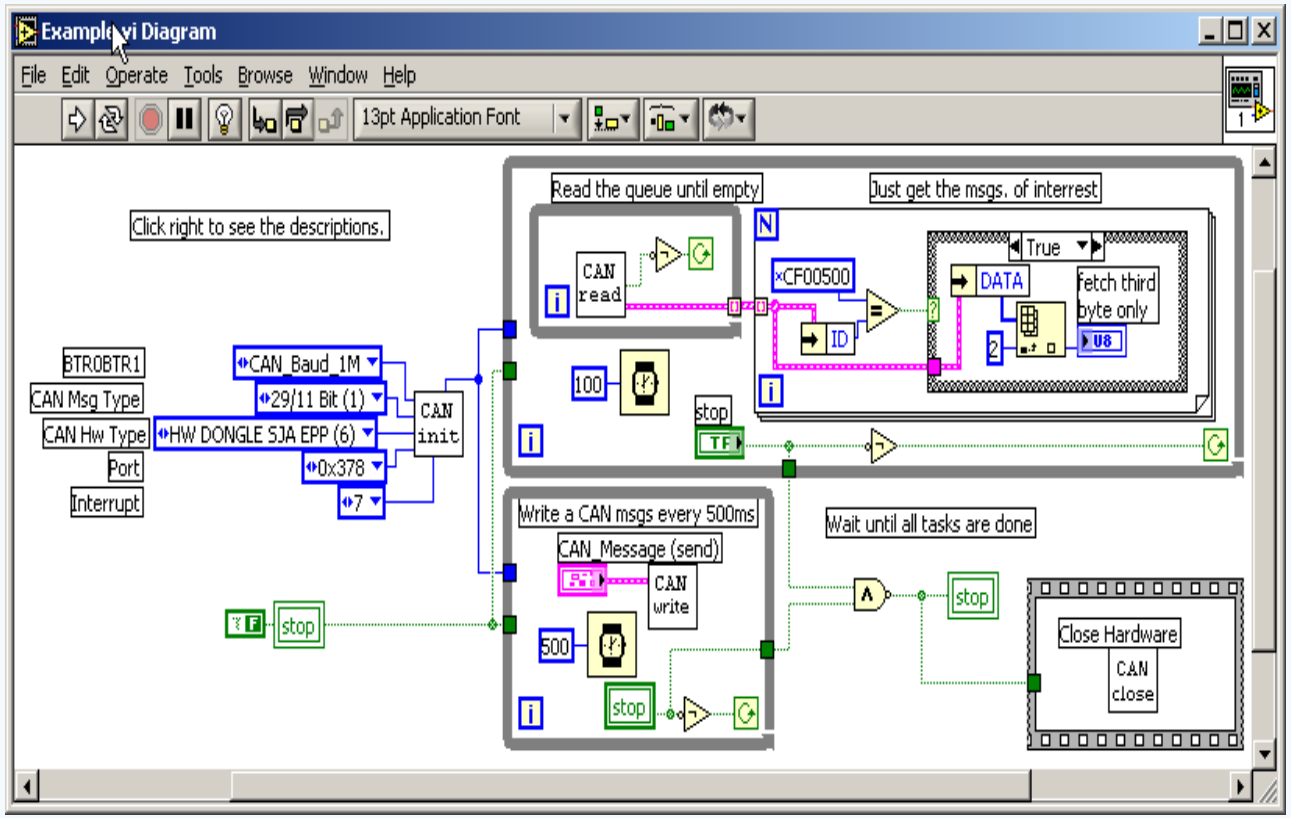
Evolution of Coding



LabView

Evolution of Coding

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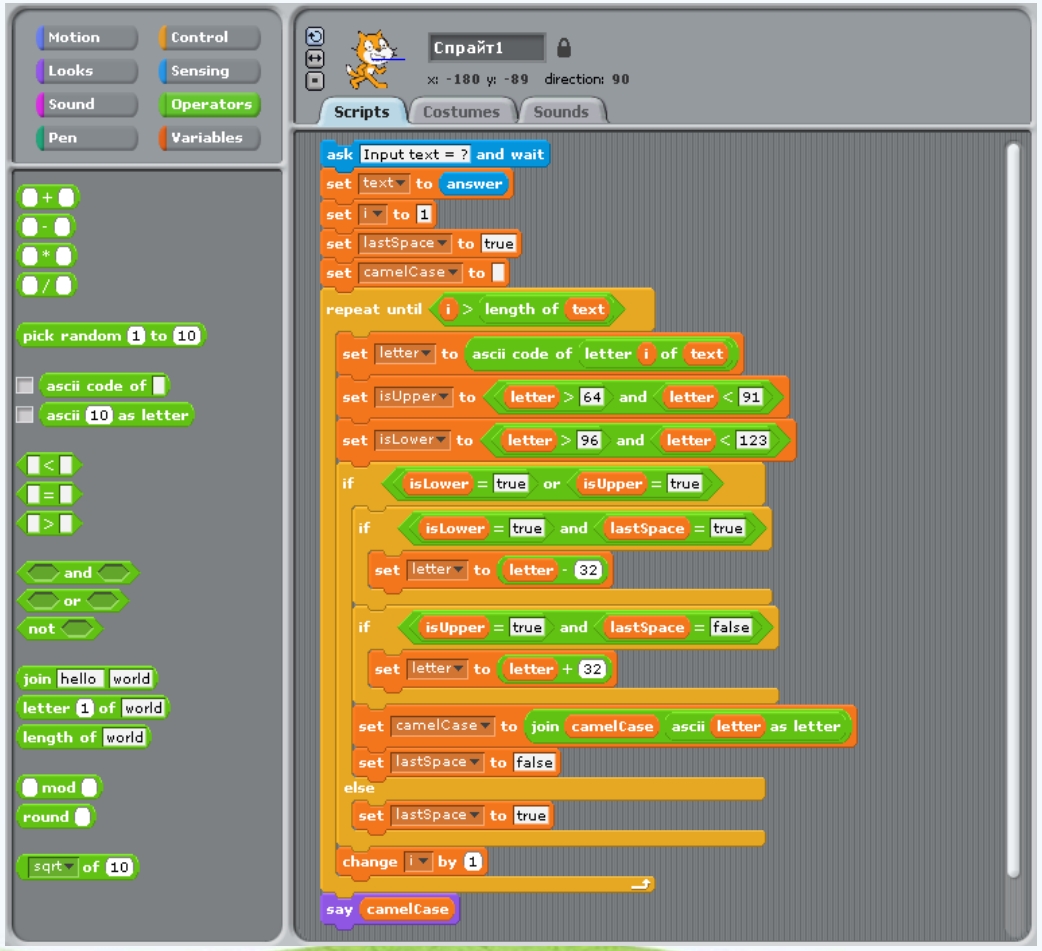

Scratch

Blockly Programming

Why code? (Reason #1)

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To graduate with a STEM endorsement following the Computer Science pathway.

- We are already living in a world dominated by software.
- The next generation's world will be even more online and digital.

Texas Education Agency Graduation Toolkit

Texas High School Diploma – *Steps*

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Distinguished Level of Achievement

26 Credits • Algebra II Required • Eligible for Top 10% Automatic Admissions to Texas Public Universities

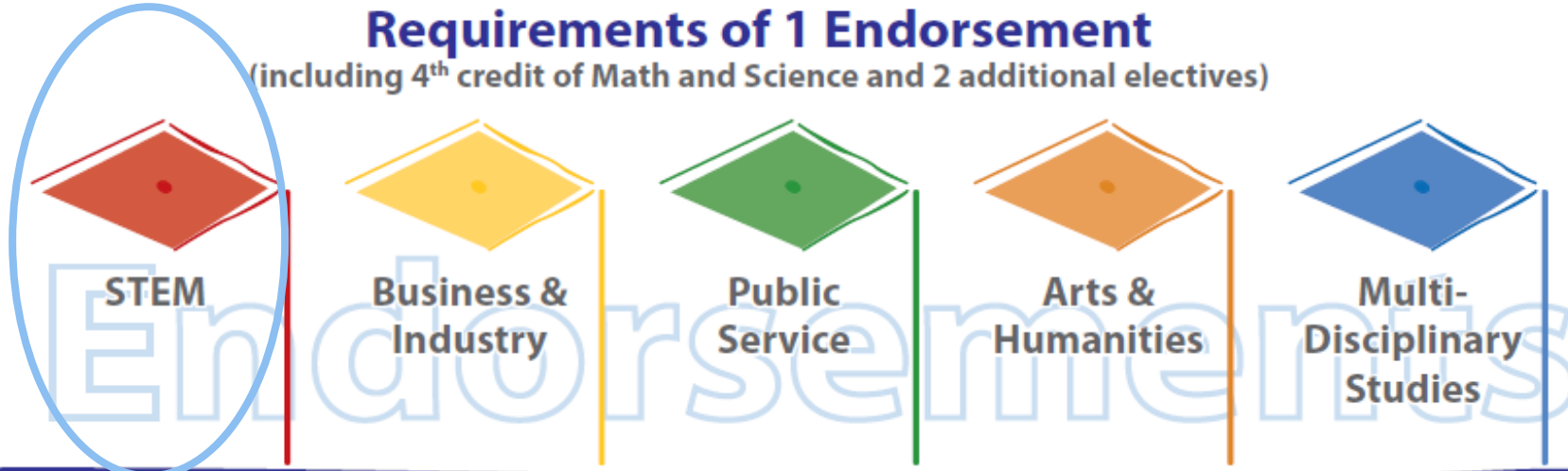
=

22 Credits for the Foundation High School Program

+

Requirements of 1 Endorsement

(including 4th credit of Math and Science and 2 additional electives)



Be sure to visit your school counselor to learn more about your options.
Students may earn more than one endorsement.

Texas Education Agency • Texas Higher Education Coordinating Board • Texas Workforce Commission

BR14-130-02

But the truth is…

There are not enough teachers to teach Computer Science courses in K-12.

- It's been shown that students' positive exposure to coding and CS correlates to majoring in CS in college.
- Our high schools fail to offer CS because there are not enough qualified CS teachers to meet demand.

SOURCE: Code.org

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Why code? (Reason #2)

To understand the networked world in which students are growing up in.

- We are already living in a world dominated by software
- The next generation's world will be even more online and digital

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Why code? (Reason #3)

To promote computational thinking.

- Combines mathematics, logic and algorithms to solve problems
- Teaches you how to tackle large problems by breaking them down into a sequence of smaller, more manageable problems
- Helps you go from specific solutions to general ones
- Helps you understand and master technology of all sorts and solve problems in almost any discipline

Why code? (Reason #4)

To develop skills in…

- Creativity
- Collaboration
- Communication
- Persistence
- Application of logic
- Attention to details
- Problem decomposition
- Problem solving
- Critical thinking
- Pattern recognition
- Abstraction
- Algorithmic thinking

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Why code? (Reason #5)

To learn a global language that is more common than any spoken language.

- The study of language in which you learn a system of signs, symbols and rules to communicate improves thinking by challenging the brain to recognize, negotiate meaning and master different language patterns
- Memorizing rules and vocabulary strengthens mental muscles and improves overall memory
- Learning a language increases perception

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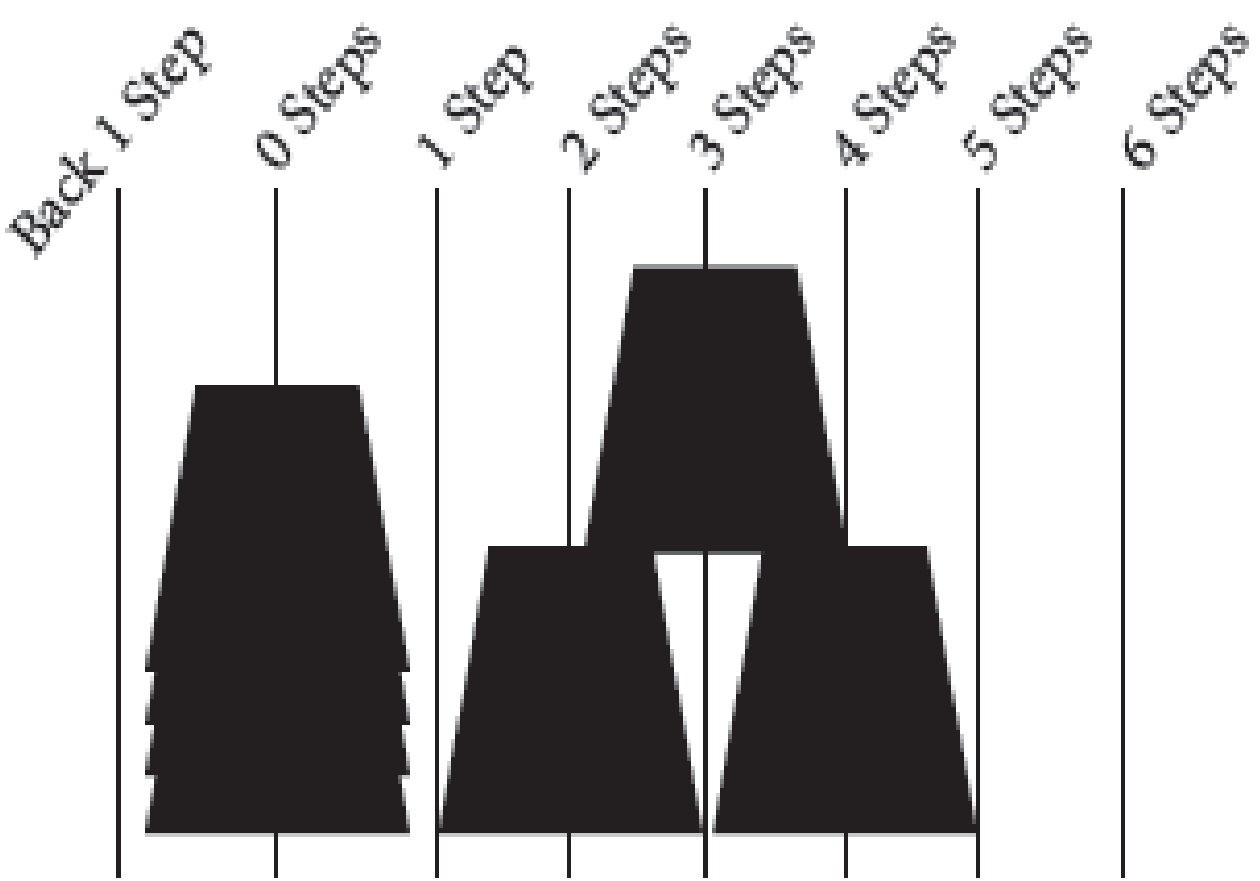
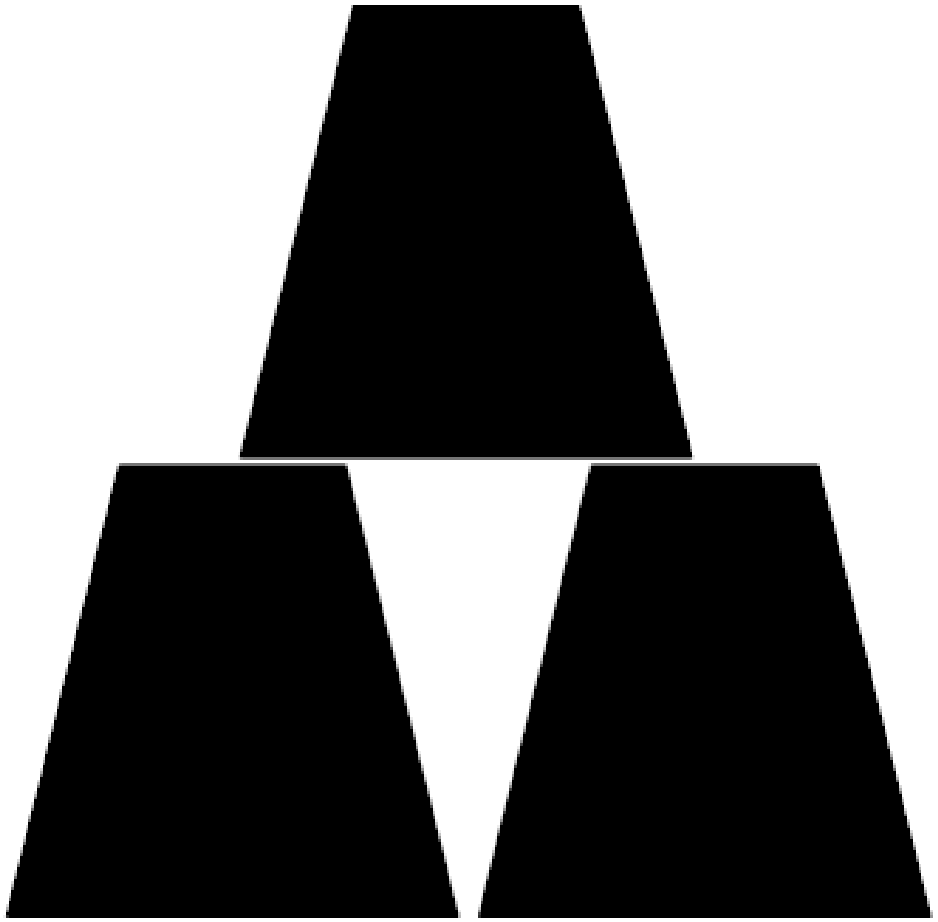
"Unplugged" Activity

Robot Friends



Move robot arm up	Move robot arm down
Rotate cup 90°	Make a "BEEP" sound
Grab cup	Release cup
Move 1/2 cup width forward	Move 1/2 cup width backward

Challenge #1



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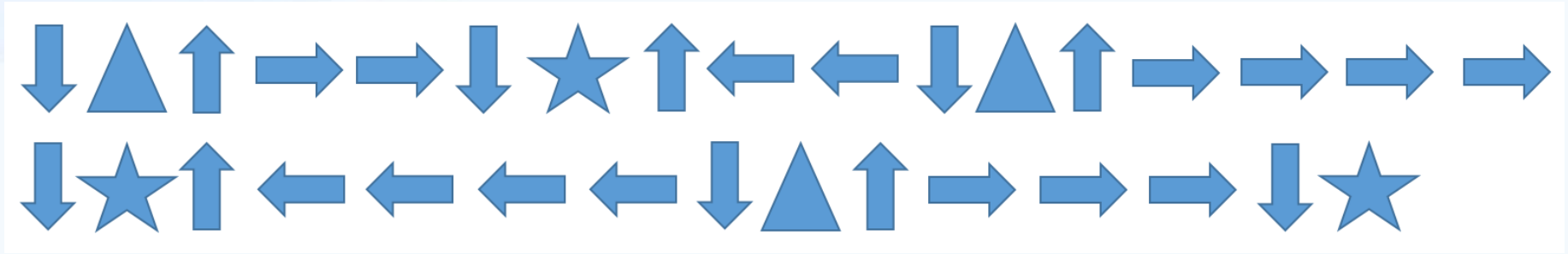
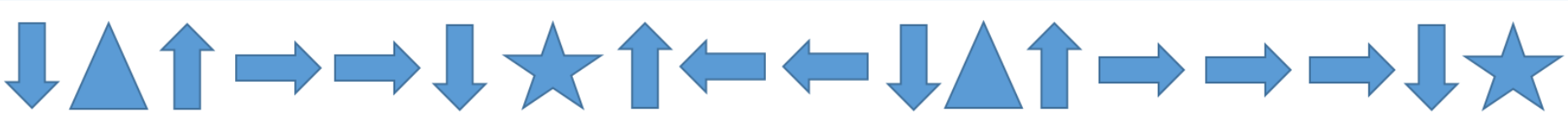
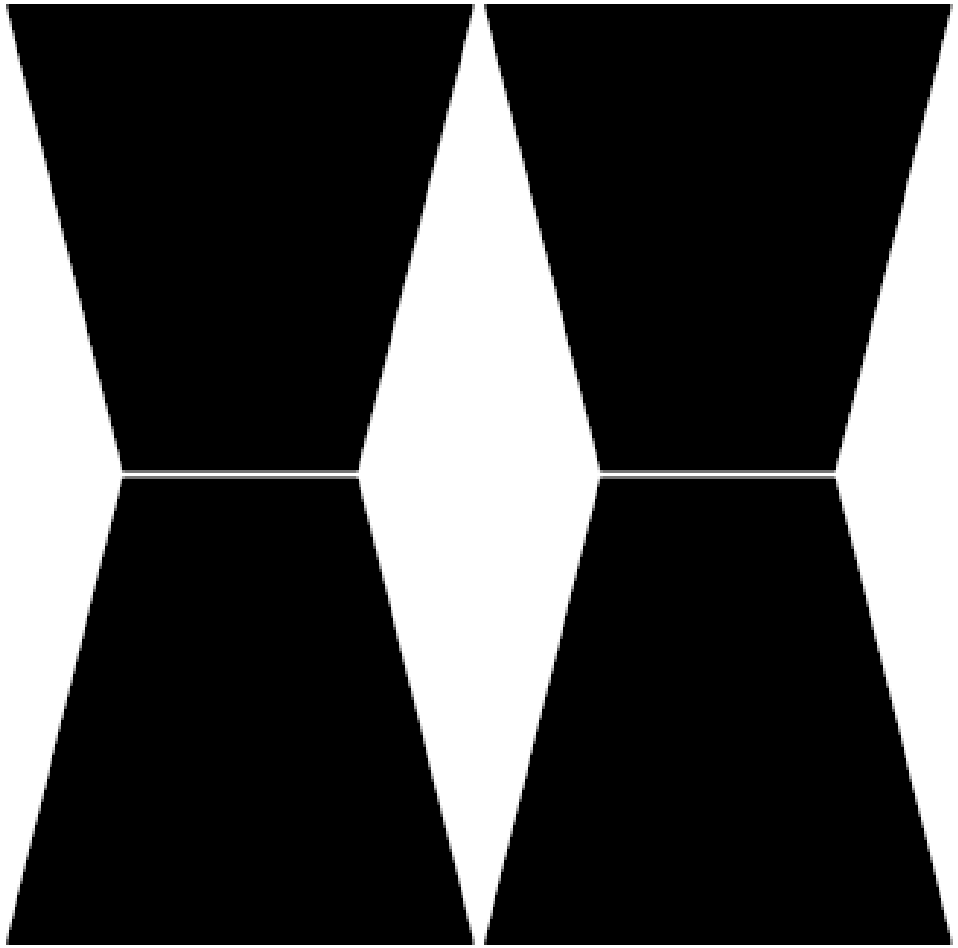


Or, if you are thinking out of the box…



Challenge #2



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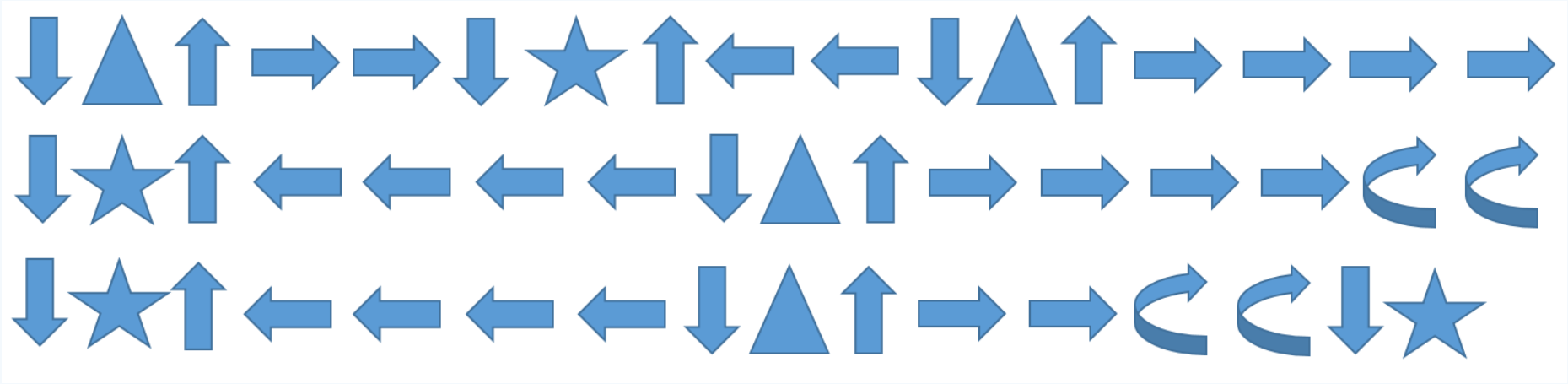
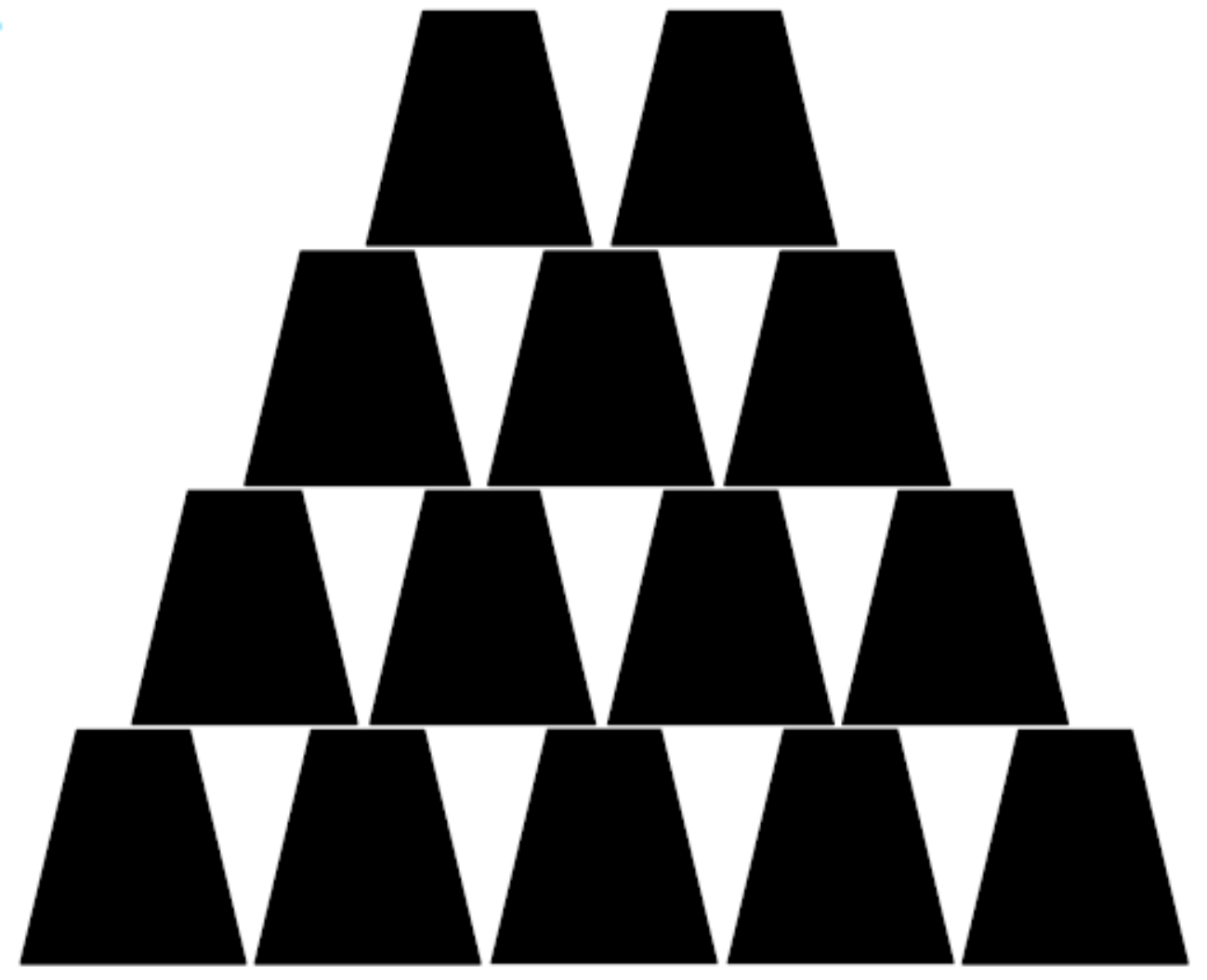


Challenge #3



Move robot arm up	Move robot arm down
Rotate cup 90°	Make a "BEEP" sound
Grab cup	Release cup
Move 1/2 cup width forward	Move 1/2 cup width backward

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Think algebraically!

HINT:
Equations and Functions

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Let  ! And let  ?

! 2→ ? 2← ! 4→ ? 4← ! 6→ ? 6← !

8→ ? 8← ! 10→ ? 10← ! 3→ ? 3← !

5→ ? 5← …

Vocabulary

- ALGORITHM – A series of instructions on how to accomplish a task
- CODING – Transforming actions into a symbolic language
- DEBUGGING – Finding and fixing the issues in code
- FUNCTION – A piece of code that can be called over and over
- PARAMETERS – Extra bits of information that you can pass into a function to customize it

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PLAY CARGO BOT!

Skip to a harder level to challenge yourself!

Computational Thinking

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Have you seen the crazy handshakes that NBA players do?

https://youtu.be/8yievz9G_6Y

Run this code with a shoulder partner...

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Make your own special handshake!

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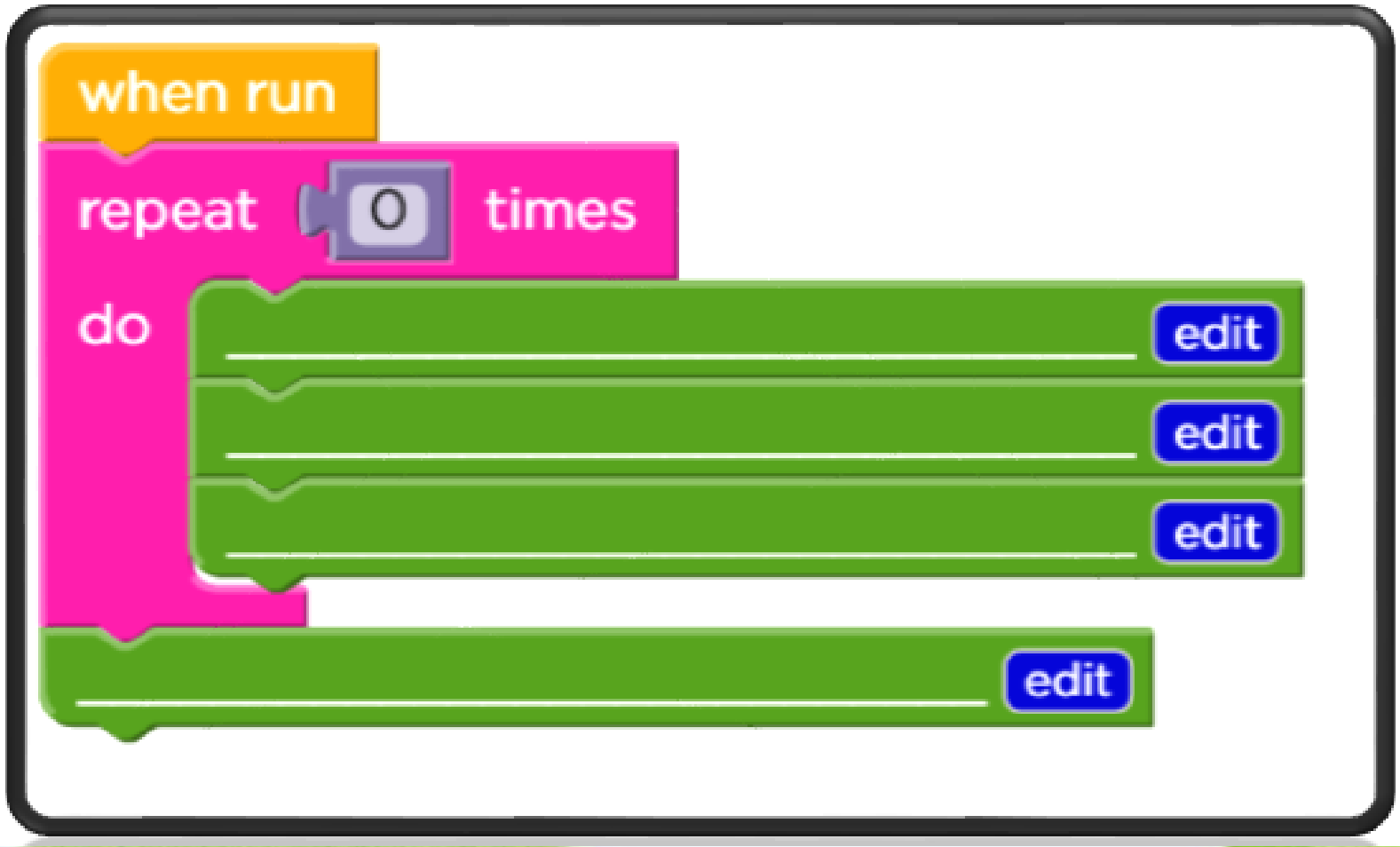

Discuss with a Shoulder Partner…

- What is your process for solving really BIG problems?
- What are some really BIG problems in the world that could use some solving?
- Are you confident that the students of today will be able to solve these BIG problems?

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A Computational Thinking Exercise

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ADD the numbers 1 to 200 in your head in 10 seconds

$$1 + 2 + 3 + \ldots + 198 + 199 + 200$$

But computational thinking (CT) helps you to do this:

$$1 + 2 + 3 + \ldots + 198 + 199 + 200$$

201 201 201

$$201 \times 100 = 20100$$

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Computational Thinking is…

- …the thought processes involved in formulating a problem and expressing its solution(s) in such a way that a computer—human or machine—can effectively carry out.

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Why CODING?

www.fastcompany.com
3.31.16

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These Will Be The Top Jobs In 2025 (And The Skills You'll Need To Get Them)

#1 - TECHNOLOGY AND COMPUTATIONAL THINKING

It's no surprise that tech skills will be in demand. However, Fidler says that "computational thinking"—the ability to manage the massive amounts of data we process individually each day, spot patterns, and make sense out of all of it—will be valued. "As the total amount of information coming at you increases and increases, the ability to manage that in a way that you're not overwhelmed, is pretty key," he says.

Related jobs: Software developer jobs will grow 18.8% between now and 2024, according to the BLS, while **computer systems analyst** jobs will increase 20.9% by 2024. **Market research analyst and marketing specialist jobs**, which also require those analytical skills, will increase 18.6%.

#2 CAREGIVING, #3 SOCIAL INTELLIGENCE AND NEW MEDIA LITERACY, #4 LIFE LONG LEARNING, AND #5 ADAPTABILITY AND BUSINESS ACUMEN

https://careersportal.ie/careerplanning/story.php?ID=2501203022

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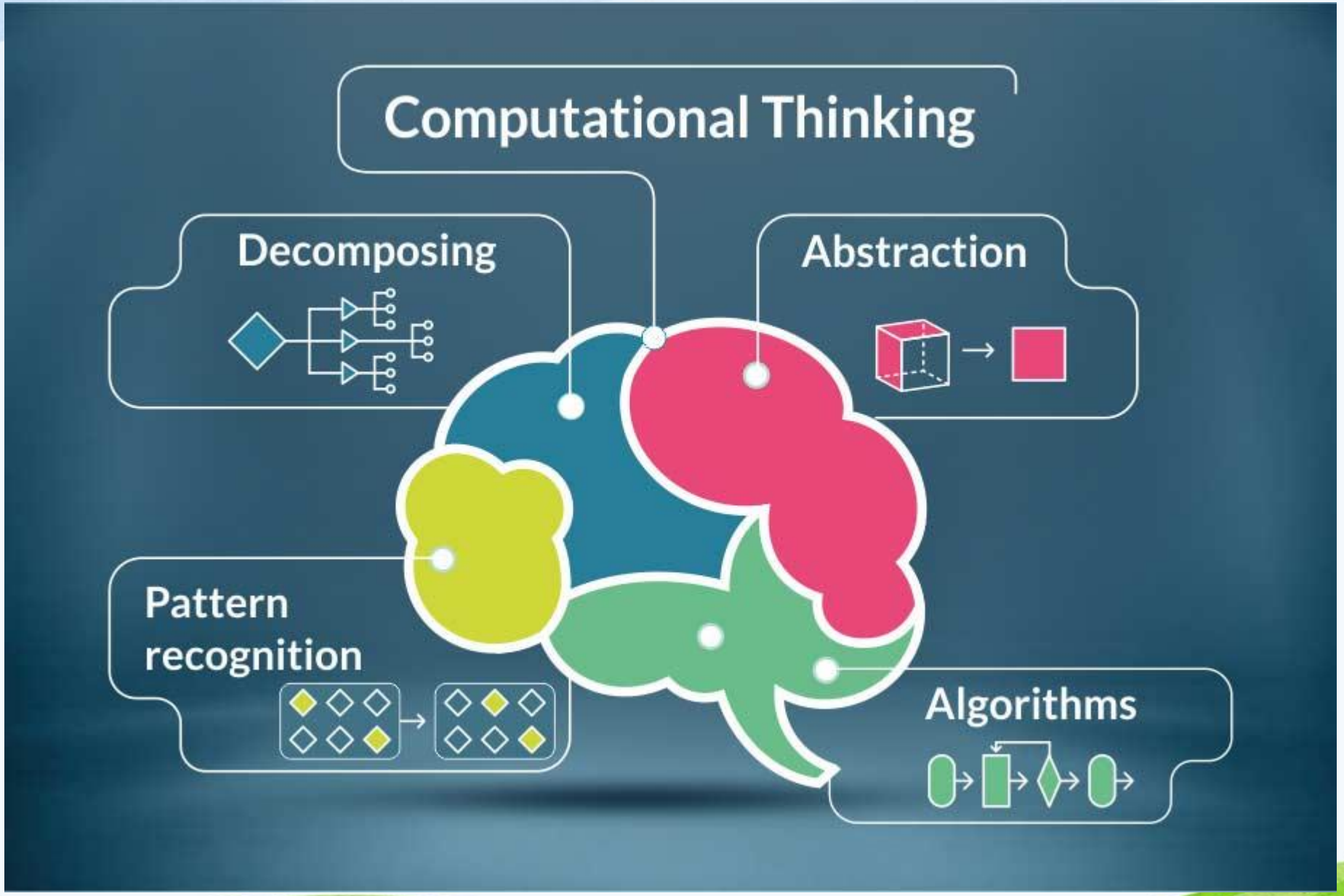

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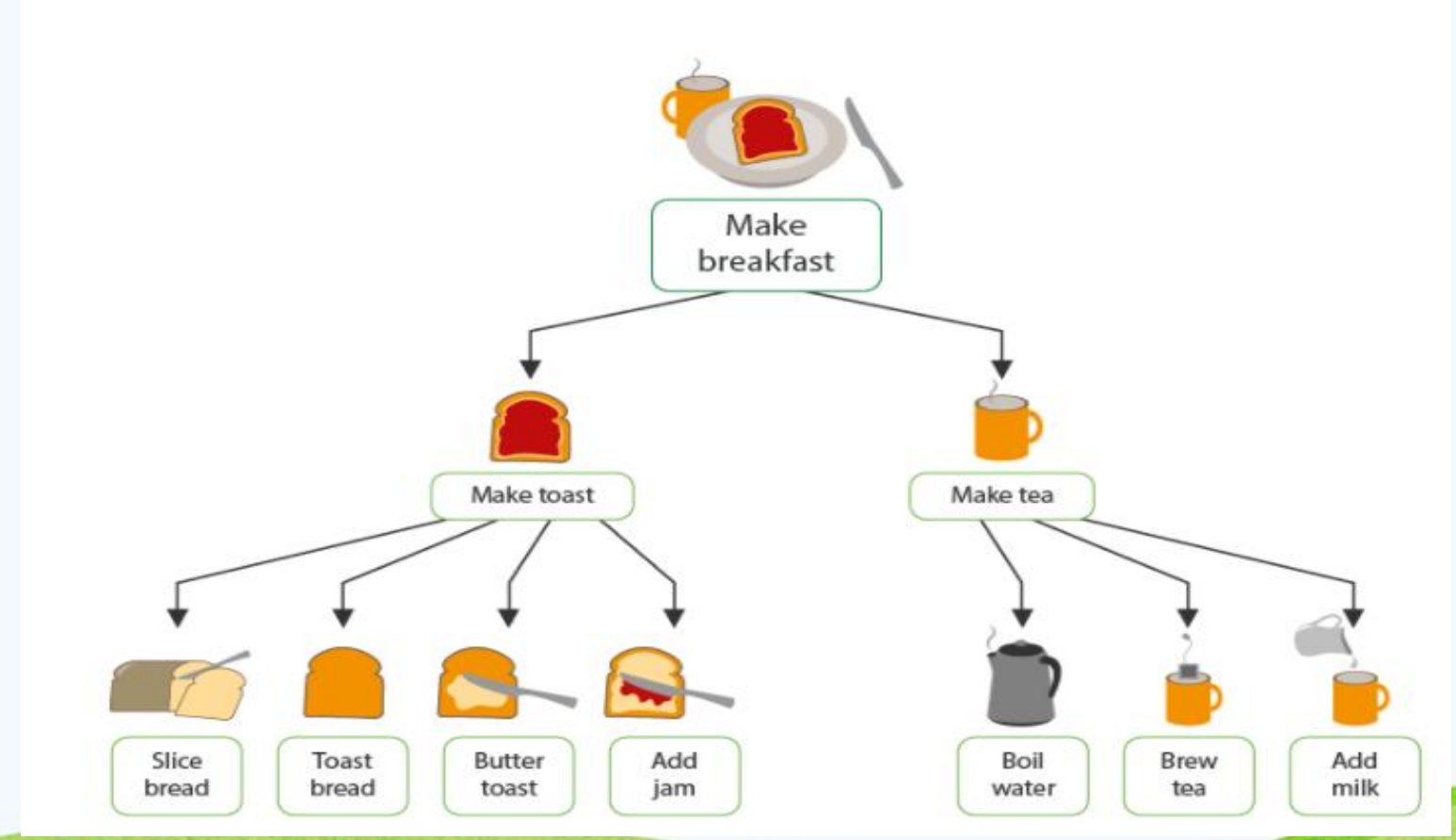
Decomposition

- Breaking a problem down into smaller pieces.



Pattern Recognition

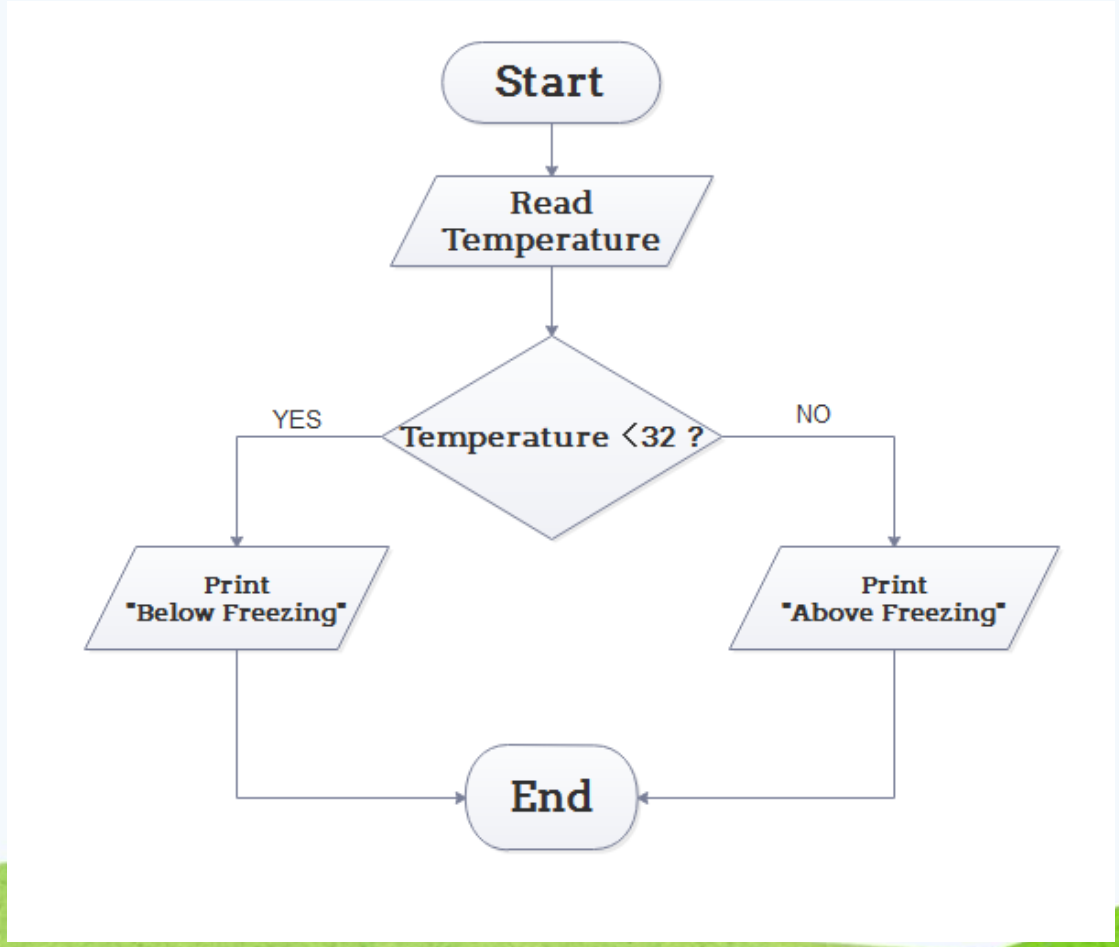
- Finding similarities between things.

Abstraction

- Pulling out specific differences to make one solution work for multiple problems.

Algorithms

- A list of steps that you can follow to finish a task.



The Computational Thinker: Concepts & Approaches

Concepts

- **Logic** — predicting & analysing
- **Algorithms** — making steps & rules
- **Decomposition** — breaking down into parts
- **Patterns** — spotting & using similarities
- **Abstraction** — removing unnecessary detail
- **Evaluation** — making judgement

Approaches

- **Tinkering** — experimenting & playing
- **Creating** — designing & making
- **Debugging** — finding & fixing errors
- **Persevering** — keeping going
- **Collaborating** — working together

Barefoot Computing
COMPUTING AT SCHOOL
EDUCATE · ENGAGE · ENCOURAGE

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www.barefootcas.org.uk

Barefoot would like to acknowledge the work of Julia Briggs and the eLIM team at Somerset County Council for their contribution to this poster.

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ISTE Standards

https://www.iste.org/explore/articleDetail?articleid=152

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Computational Thinking Activity

Building Your Monster

Building Your Monster

We have been selected to help identify some monsters found on the planet Zuron. We need to describe these things based on descriptions that we already have of certain eye-witness accounts. There are quite a few monsters to describe, and it may seem challenging, but I'm going to give you some tools to help you out.

TASK: Draw your own unique monster using the various parts you are provided by tracing them. When you are done, give your monster a name.

Building Your Monster

Step 1 - Decompose

We're not just talking about zombies here. Instead, we're talking about breaking a big, bad problem down into something much more simple. Often, big problems are just lots of little problems stuck together.

TASK: We have cataloged 3 variety of monster. Now, you need to catalog all of the monsters at your table. Start by comparing your monster with your table-mates and make a list of features to identify.

Building Your Monster

Step 2 – Patterns

Sometimes, when a problem has lots of little pieces, you will notice that the pieces have something in common. If they don't, then they may at least have some striking similarities to some pieces of another problem that has been solved before. If you can spot these patterns, understanding your pieces gets much easier.

TASK: What are some things that all of the monsters have? What are things that are similar between monsters of certain groups?

Building Your Monster

Step 3 – Abstraction

Once you recognize a pattern, you can "abstract out" (ignore) the details that make things different and use the general framework to find a solution that works for more than one problem.

TASK: Create a list of all the different features that the monsters with the details abstracted out of the sentence

Building Your Monster

Step 4 – Algorithms

When your solution is complete, you can write it up in a way that allows it to be processed step by step, so that the results are easy to achieve.

TASK: Arrange your steps into a list that other groups can use to recreate a monster. Write your algorithm on the side of your monster.

Example:
Draw WACKUS eyes.

Building Your Monster

VOCABULARY:

Computational Thinking—A method of problem-solving that helps computer scientists prepare problems for digital solutions

Abstraction—Removing details from a solution so that it can work for many problems

Algorithm—A list of steps that allow you to complete a task

Decompose—To break a hard problem up into smaller, easier ones

Pattern—A theme that is repeated many times

Program—Instructions that can be understood and followed by a machine

Teaching coding and CT to prereaders…

- To immerse children in versatile activities that align with standards in multiple areas:
  - MATH
  - PROBLEM SOLVING
  - COMMUNICATION
  - LITERACY

https://youtu.be/5nCzs4xg1OQ

8 Reasons Why Every Child Should Learn to Code

1. To learn to problem solve
2. To give kids a challenge and help them develop resilience
3. To teach children how to think
4. To expand their creativity
5. Because it is the future
6. There is lack of skills in the software industry
7. To help children learn to have fun with math
8. To learn while having fun

https://teachyourkidscode.com/why-coding-is-important-to-learn/

Committees:

- Location and Time
- Guests / Invitations
- Decorations
- Food
- Games
- Music
- Theme
- Safety
- Other Entertainment

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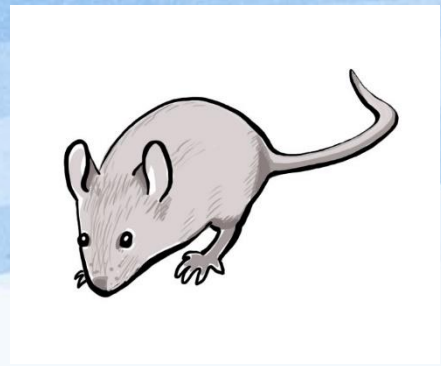
Computational Thinking Decomposition Activity

Let's Plan an End-of-the-Year Educator Party!



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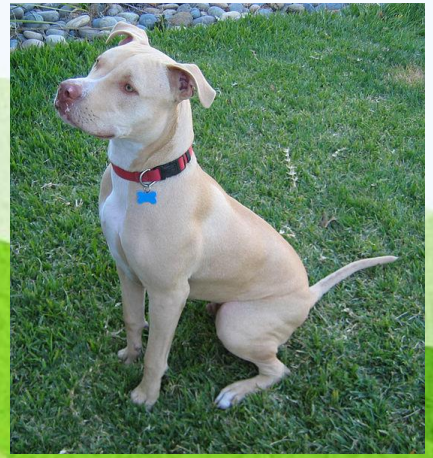
Computational Thinking Pattern Recognition Activity

Everybody Wants to be a Cat!



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Computational Thinking Abstraction Activity

Sorting

What categories can you sort the puzzle pieces into?

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Computational Thinking Abstraction Activity

The Book With No Pictures by BJ Novak,
https://youtu.be/MxfZwgLzHbY

Other books:
In My Heart: The Book of Feelings
This Is Not A Book
Ask Me
The Curious Guide to Things That Aren't

Computational Thinking Algorithms Activity

PB & J Activity

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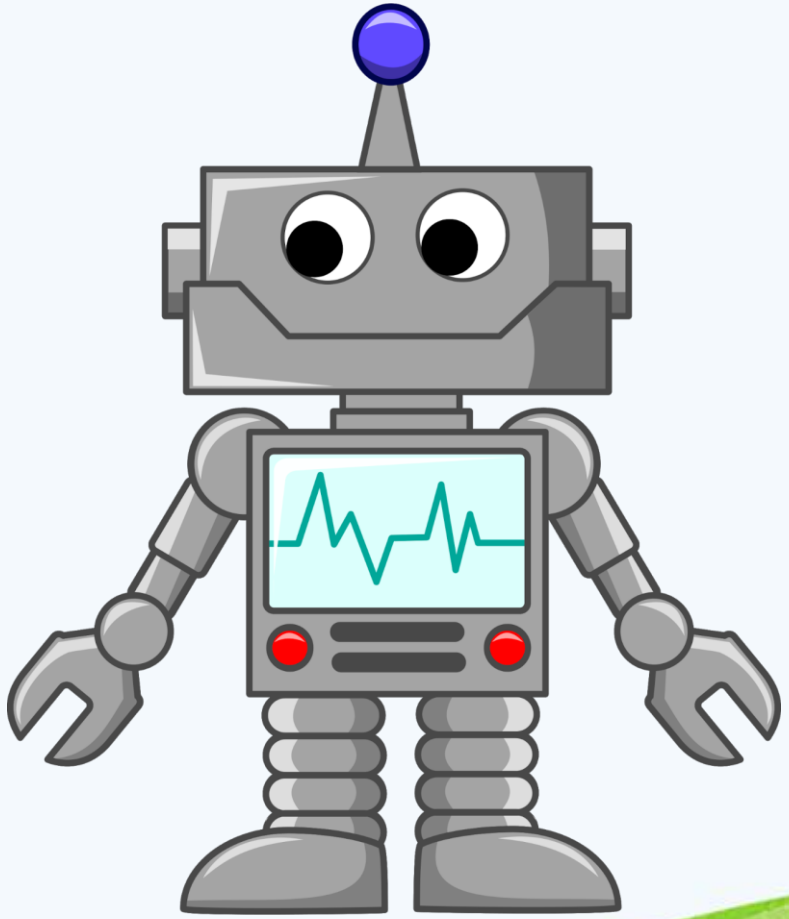
PB & J Activity



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PB & J Activity

https://www.youtube.com/watch?v=cDA3_5982h8

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Computational Thinking Algorithms Activity

Paper Airplanes
https://code.org/curriculum/course2/2/Teacher

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Final Thoughts

Contact info

STEM Center of South Texas
Region One ESC

Sylvia Escobar
STEM / LRI Specialist
Region One ESC

sescobar@esc1.net

956.984.6047

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Thank you!

WiFi: Region One Guest PW: Webb1848

Early Childhood STEAM Educator Academies

WS 110238 – Day 2

Coding and Computational Thinking

REGION ONE ESC STUDENTS FIRST

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Day 1 Recap

Norms

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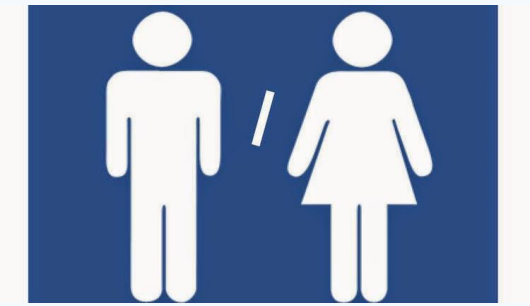
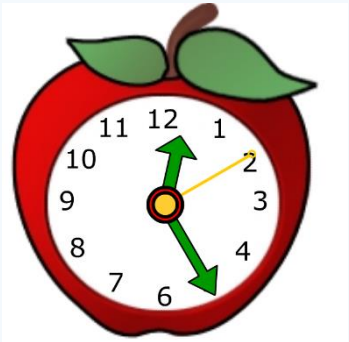


@ESC1_STEM



8:30 AM – 3:30 PM

11:45 AM – 1:00 PM

Objectives

- Answer the question "why should we teach computer science?"
- Gain an understanding of computational thinking
- Learn why we should introduce coding to prereaders
- Experience various strategies to teach fundamental Computer Science to young children

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Agenda

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Day 1

- What is Computer Science?
- What is computational thinking?
- Developing computational thinking in prereaders

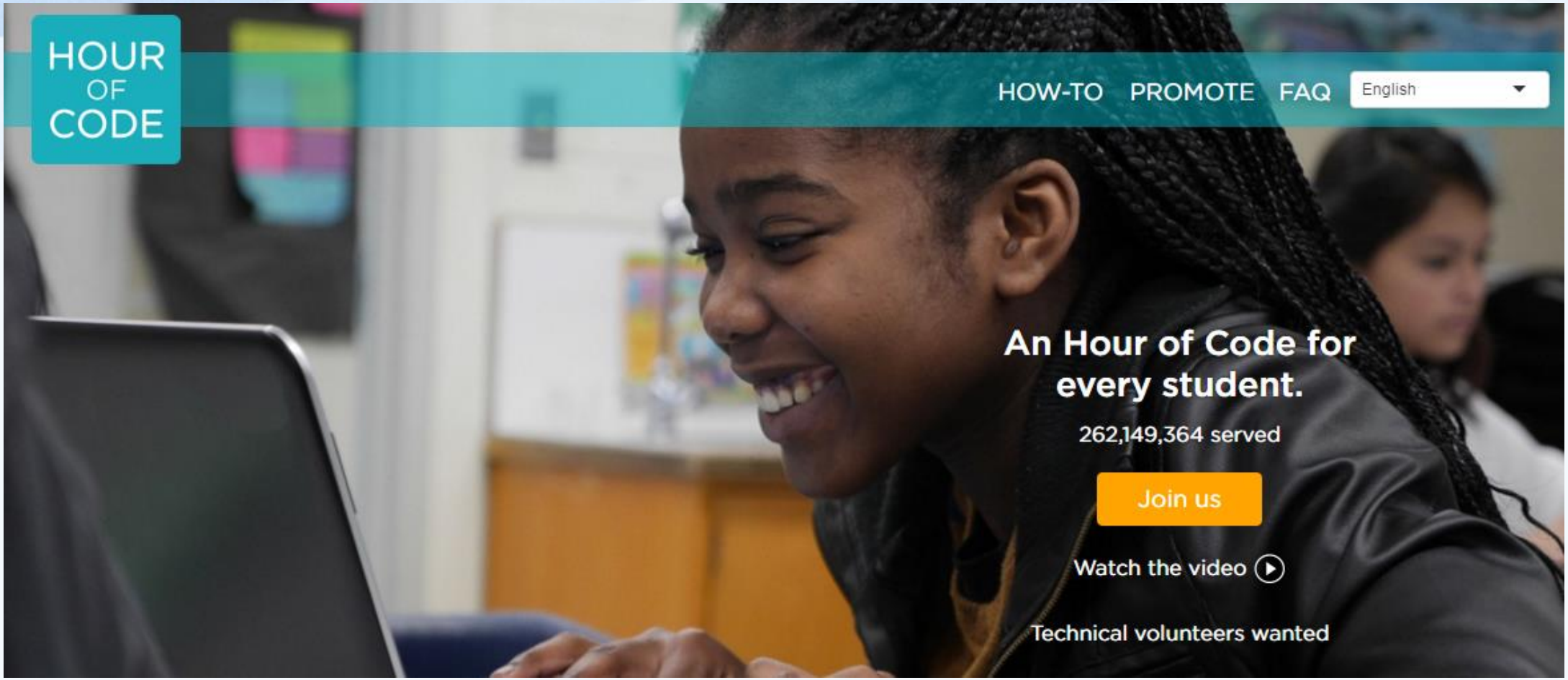
Day 2

- Teaching Computer Science fundamentals to prereaders through play
- Using electronic technology
  - LEGO WeDo 2.0
  - Code.org and Hour of Code
  - Ozobot EVO
  - Tynker Junior

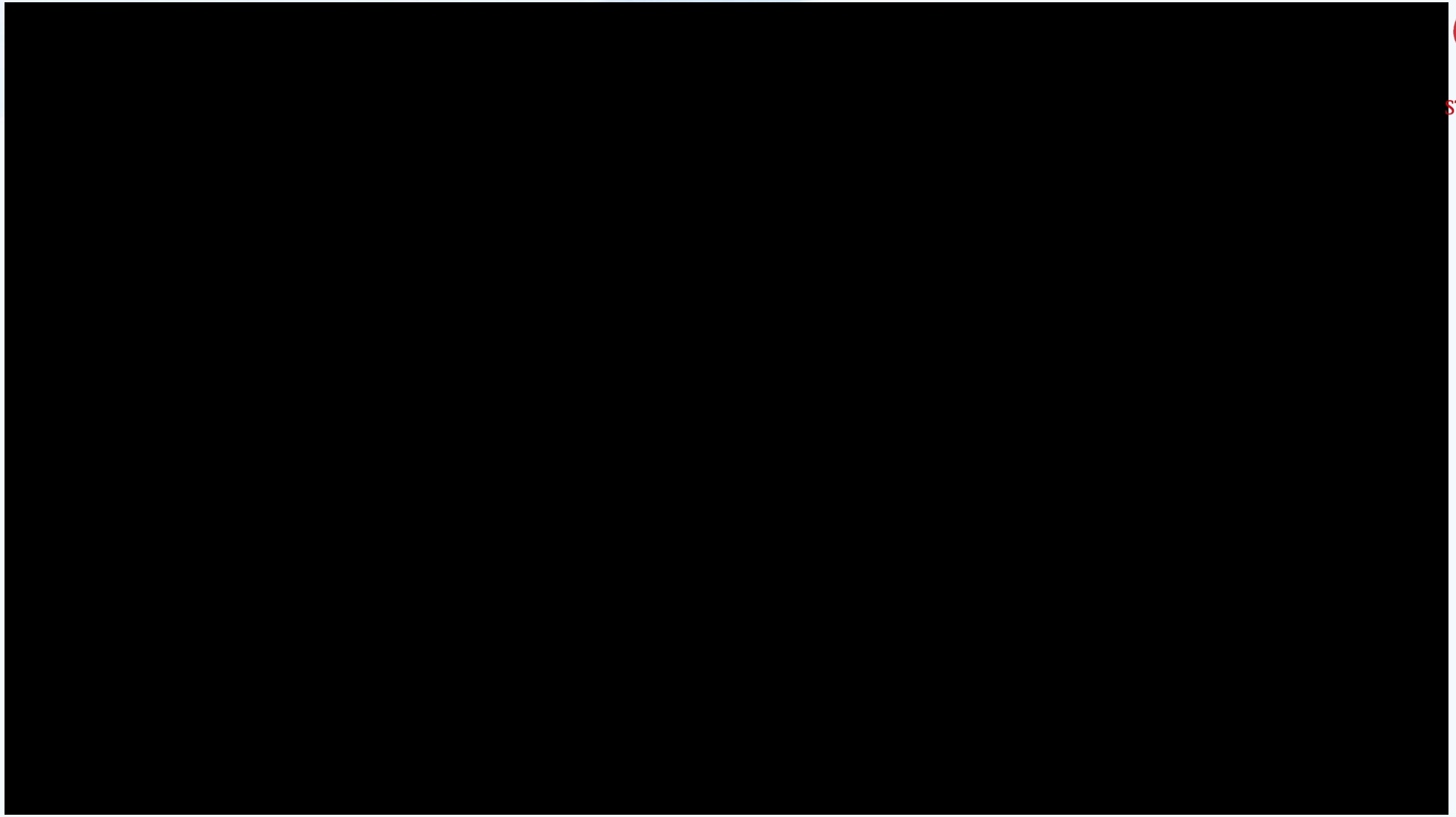
Icebreaker

Copy My LEGO Build

- Each pair will get a baggie of LEGOs. Separate them so that each of you has an identical set.
- The person with the shorter hair will be the "programmer" 1st. You will have 5 minutes to build something using your set of LEGOs. Make sure the divider folder is hiding your build from your partner. The other person can hang tight during this time.
- The "programmer" now must give the "computer" verbal instructions on how to recreate their build.
- When you are done, reveal both builds and compare.



Computer Science
Education Week DECEMBER 9-15, 2019



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Let's do an hour of code!

Daisy the Dinosaur

Kodable

Hopscotch

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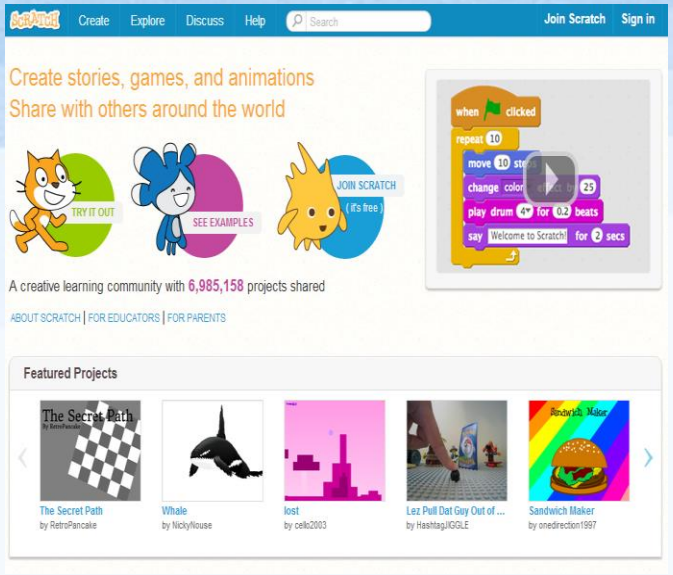
ScratchJr

Lightbot HOC

Tynker

Apps

Cargo-bot



Scratch.mit.edu

Lightbot.com

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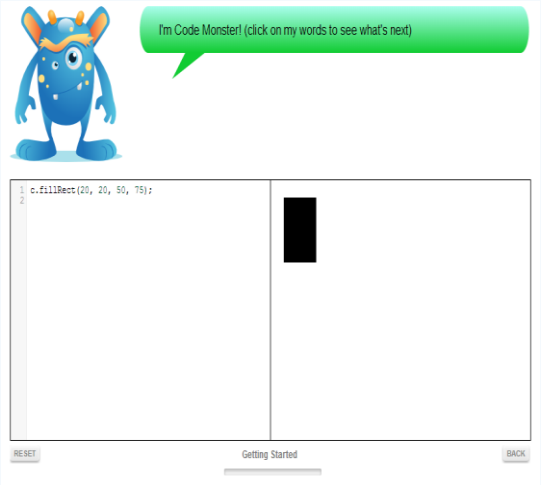
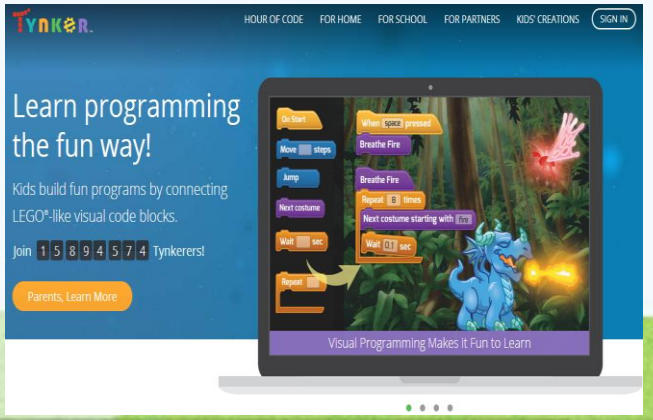


crunchzilla.com/
Code-Monster

Tynker.com



CODEMONKEY

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ozobot
IMAGINATION IN PLAY

Color code reference chart

OzoCodes

ozobot

SPEED


SNAIL DOSE


SLOW


CRUISE


FAST


TURBO


NITRO BOOST

DIRECTION


GO LEFT


GO STRAIGHT


GO RIGHT


JUMP LEFT


JUMP STRAIGHT


JUMP RIGHT


U TURN


U TURN (LINE END)

TIMERS


TIMER ON (30 SEC. TO STOP)


TIMER OFF


PAUSE (3 SEC.)

COOL MOVES


TORNADO


ZIGZAG


SPIN


BACKWALK

WIN/EXITS


WIN/EXIT (PLAY AGAIN)


WIN/EXIT (GAME OVER)

COUNTERS

FIVE DOWN TO STOP


ENABLE X-ING COUNTER


ENABLE TURN COUNTER


ENABLE PATH COLOR COUNTER


ENABLE OZOPILL COUNTER


OZOPILL +1


OZOPILL -1

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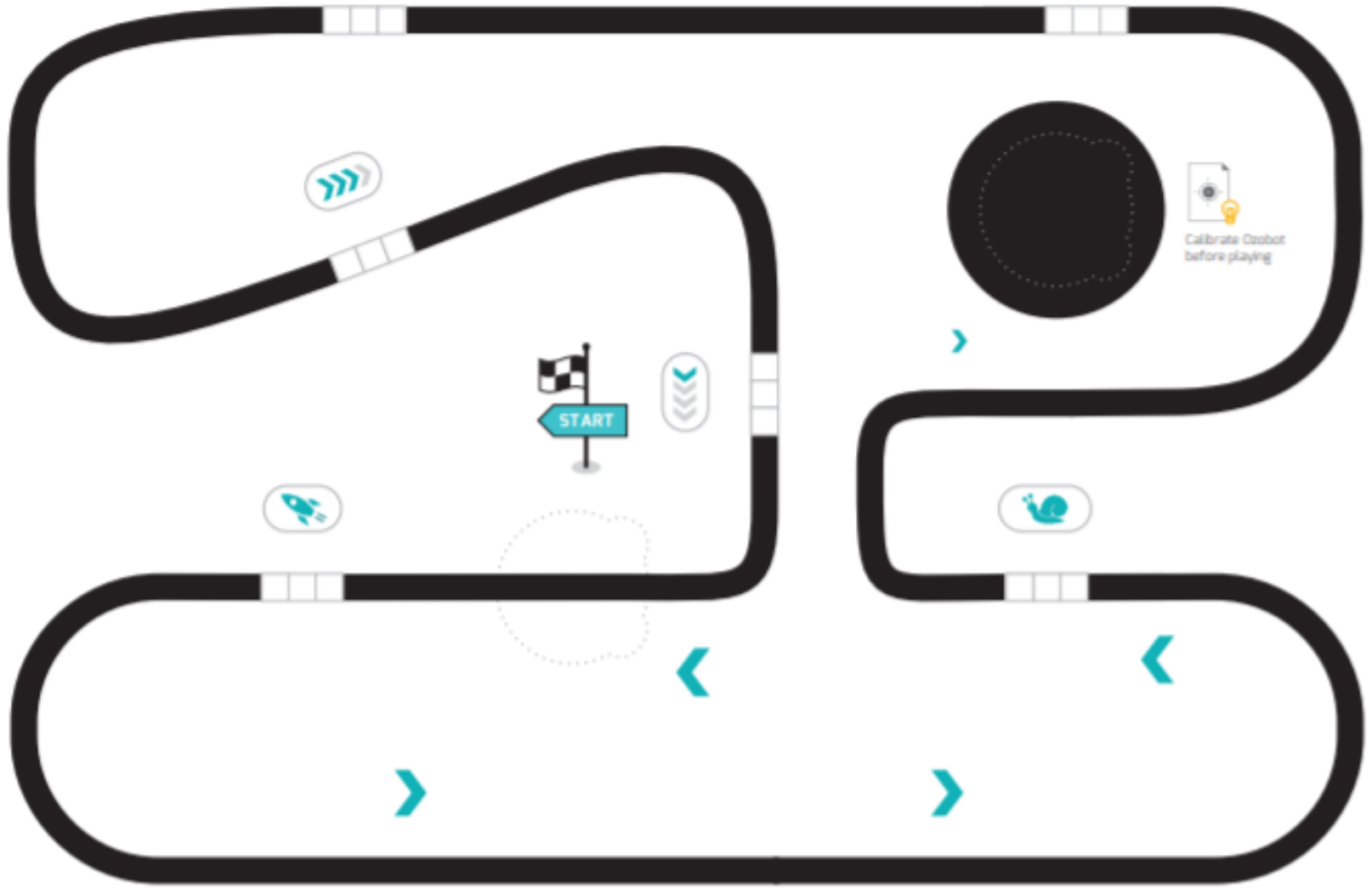
Tour de Ozobot

SPEED TEST

Name: _____



ozobot edu

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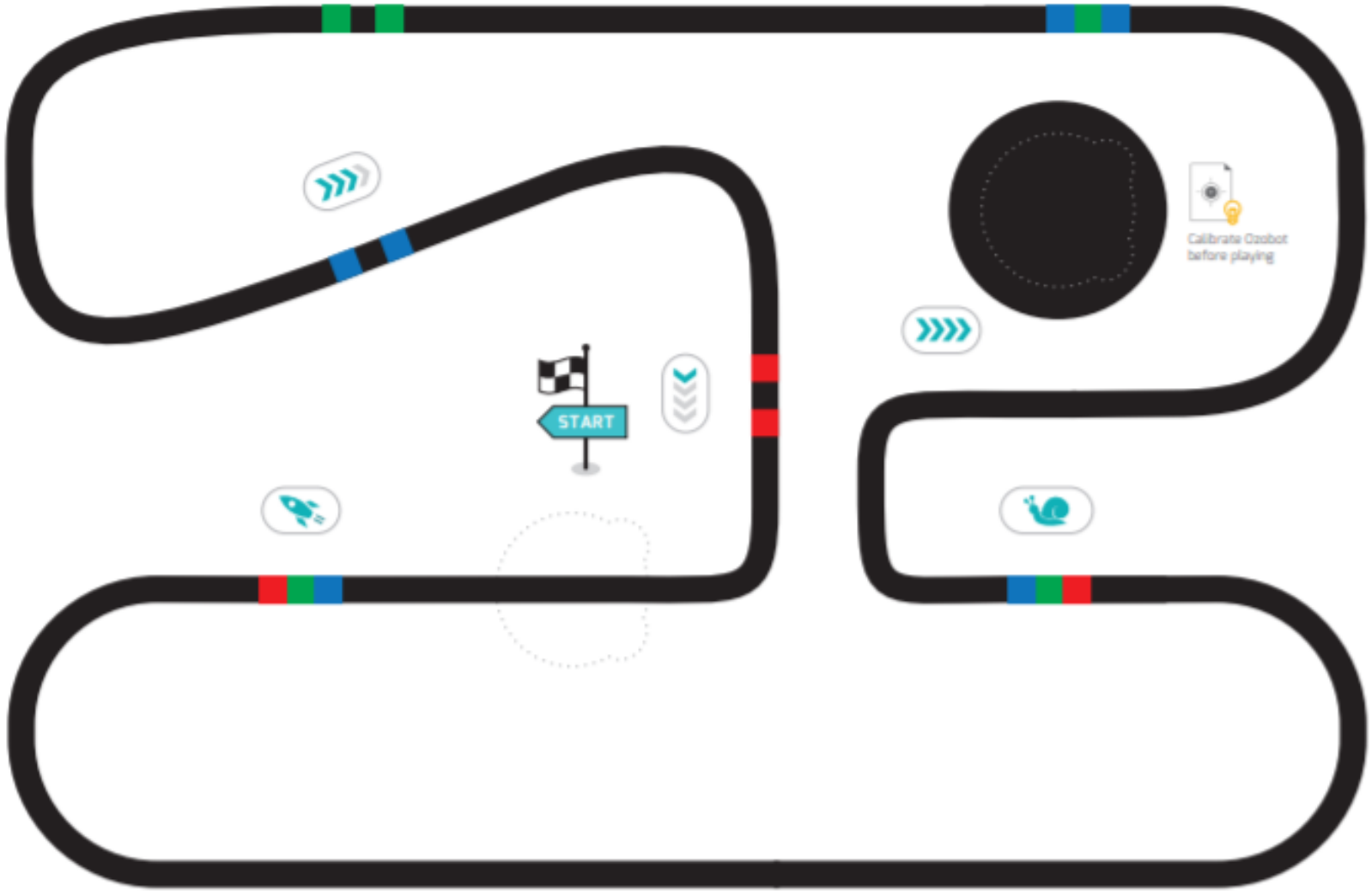
Tour de Ozobot

SPEED TEST

Name: _____



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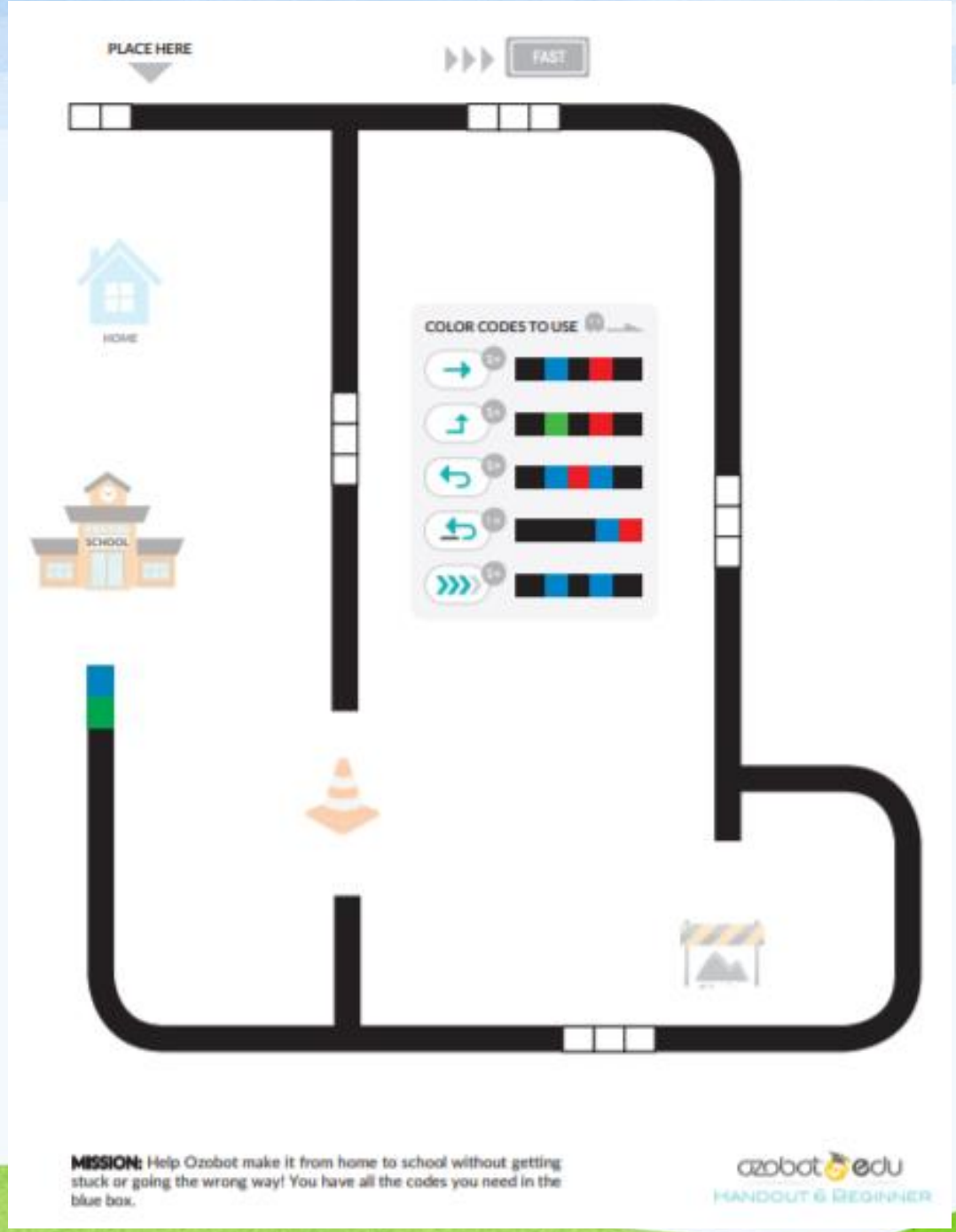

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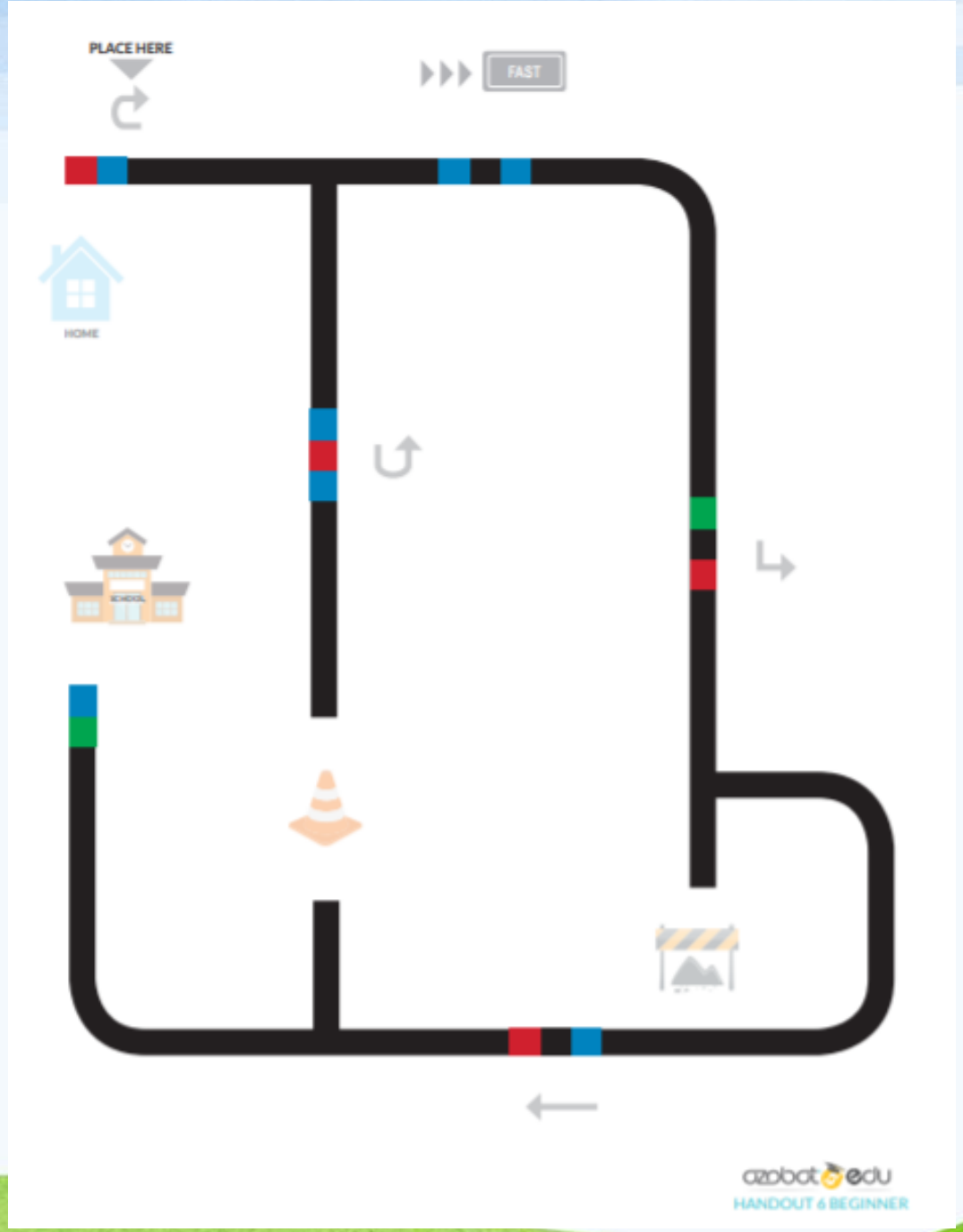

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LEGO WeDo 2.0

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tynker_@esc1.net

drone2018

Why Teach Coding to Prereaders?

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- To lay down the foundations for children to think like a computer programmer through fun hands-on games and activities
- To give children the ability to understand how to "tinker" and shape their digital world
- To offer children experiences that integrate communication, thinking, and problem solving

Go On a Treasure Hunt

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- A treasure hunt requires many of the skills that computer programmers use when coding. By creating a treasure hunt with instructions and directions, children can follow to find their treasure. This teaches children about **algorithms**, a set of instructions to help a computer perform a specific task.
- There is no prep required for this activity! Simply place "treasures" all around the room or garden, then draw a map with instructions. A simple example could be: 2 big steps forward, 3 big steps right, Climb under the table, 4 big steps left, and so on.
- If they make a mistake they must go back and start again (**debug** the code!) until they find where the treasure is hidden.

Solve a Maze

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- Following a maze is a great coding activity for preschoolers because it helps them to develop resilience. If they find they are going in the wrong direction, they need to go back and try again until they find another path to follow.
- To add some extra fun make a blindfolded maze! Have one child act as the 'computer' and one as the 'programmer'. The programmer has to give instructions (**algorithm!**) to help the blindfolded computer through the maze!

Story Sequence

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- Telling stories is a great way to help preschoolers develop coding skills. Break up the story into pieces, perhaps by picture, mix them up and have the kids put the story in the right order.
- Kids will have to study each piece and think logically in order to work out which piece of the story goes first and put each piece in the correct order to be able to read the story from start to finish. This teaches the important skills of **sequencing**, which is a vital part of understanding how to code.
- All kids love a good story, so why not break it down for them.

Puzzles

- **Problem-solving** is one of the things computer programmers need to be good at. Puzzles can help pre-schoolers with this type of skill because essentially you are giving them a problem to solve. Kids need to look at what the puzzle looks like, and examine the pieces to eventually put them all together to finish the puzzle. Breaking a big picture into small steps is the foundation of coding!

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Building Blocks

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- Building blocks are perfect for encouraging future engineers and programmers. Children can get creative and build something they can be proud of.
- Building something out of blocks takes patience, persistence, and determination; all skills needed in computer programming!
- **Logical thinking** is also important. Children need to think about how and if the blocks can balance and where to put them in order to do so.
- To add a twist, you can make a chain reaction with blocks and dominoes! Chain reactions help children understand **cause-and-effect**, and, they are a whole lot of fun!

Follow a LEGO Set

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- Coding is essentially giving a computer a step-by-step guide in order to produce a desired result. Lego is the perfect way to demonstrate this process to pre-schoolers.
- There are many different Lego sets for all ages and skill levels, and kids can move up as they get better at it. You might be surprised that even pre-readers can follow instructions for a LEGO set.
- Once they have finished their Lego piece, they can practice writing their own instructions for you to make it. Having them "teach" you how to do something will teach them how to build their own instructions. **Building instructions** is a foundational coding concept.
- If you are unable to create the Lego piece with the instructions given, they will realize that there is something wrong with the instructions, and need to go back and amend them in order for you to achieve the desired result. This is the concept of **debugging**!

Games Using Math

- Pretty much any game or activity that uses mathematics skills is a useful coding activity for pre-schoolers. There are lots of easy and fun number sense games that help teach preschoolers to understand numbers. It could be a board game, a made-up sports game, or a maze or treasure hunt giving clues in the form of maths.
- One way to get preschoolers counting is by using a grid maze. Kids have to be able to count the spaces in the grid to give their 'computer' the right instructions.
- Anything that gets pre-schoolers using their math skills will help them to develop computer programming skills.

If-Then Coding Game

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- If Then is what's called a conditional statement in programming. The program queries if one condition exists, then it commands it to do something. It can be as basic as a True or False question and answer or it can prompt an action.
- For every round, there is one Programmer and everyone else is a Computer. The Programmer stands in front of the Computers and gives them his command. If I ___ (fill in the blank), then you ____ (fill in the blank). For example, the Programmer below gave the command "**If** I turn in a circle, **Then** you turn in a circle."
- Difficulty Level 1: If I do this, then you do this
- Difficulty Level 2: If I do this, then you do that
- Difficulty Level 3: If I do this, then you do that, else you do something else
- Difficulty Level 4: If-Then-Else speed round with eliminations
- While, Do……Repeat

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Contact info

STEM Center of South Texas
Region One ESC

Sylvia Escobar
STEM / LRI Specialist
Region One ESC

sescobar@esc1.net

956.984.6047

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Thank you!