Foundations of Programming

CODE CHRYSALIS コードクリザリス

By the end of this lesson, you should be able to...

CODE CHRYSALIS コードクリサリス

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CODE CHRYSALIS コードクリサリス

By the end of this lesson, you should be able to...

1. Explain what a program is

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2. Explain why JavaScript is a useful programming language for beginners to learn

CODE CHRYSALIS コードクリサリス

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3. Describe and use JavaScript *expressions*

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5. Describe and use data *types* in JavaScript, including `numbers` and `strings`

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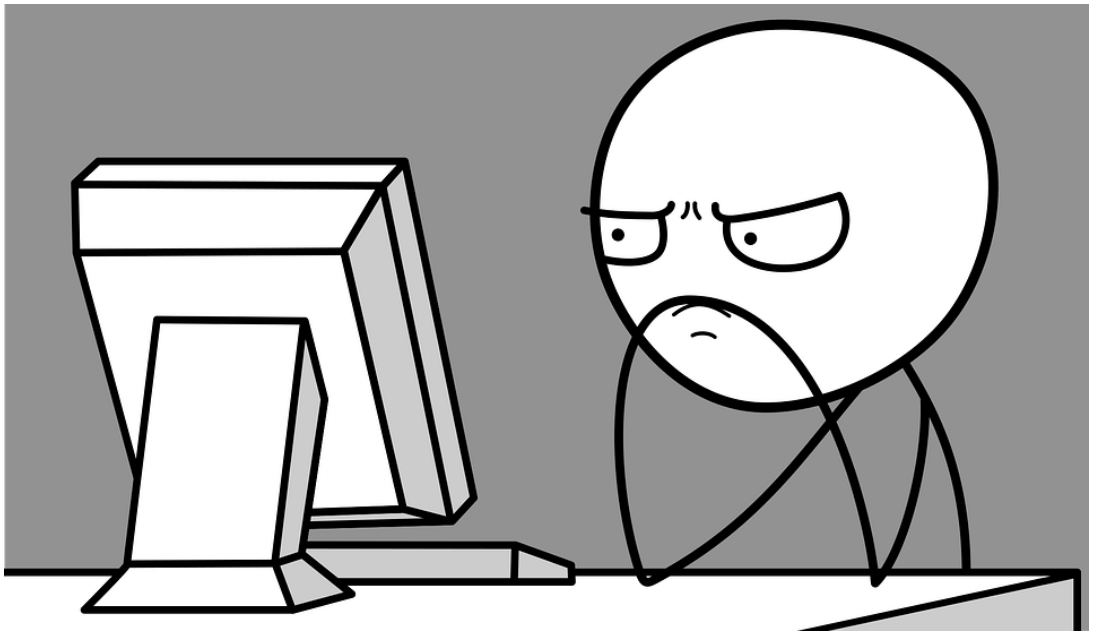
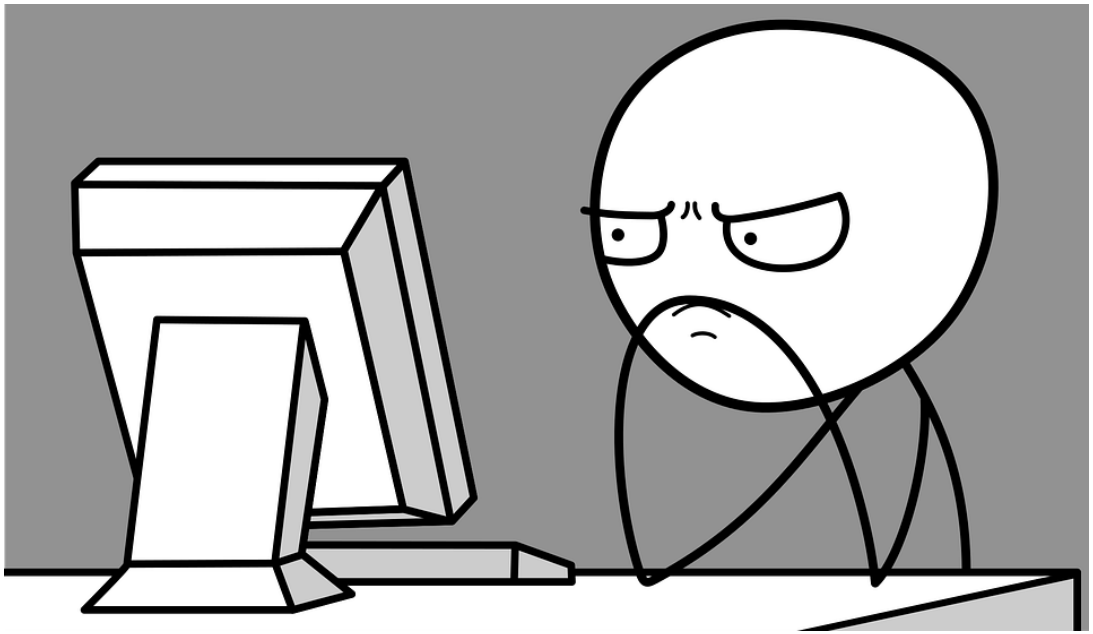
3. Describe and use JavaScript *expressions*
4. Describe and use arithmetic *operators*
5. Describe and use data *types* in JavaScript, including `numbers` and `strings`
6. Use some basic string-related native methods

CODE CHRYSALIS コードクリサリス



Why do we have computers?



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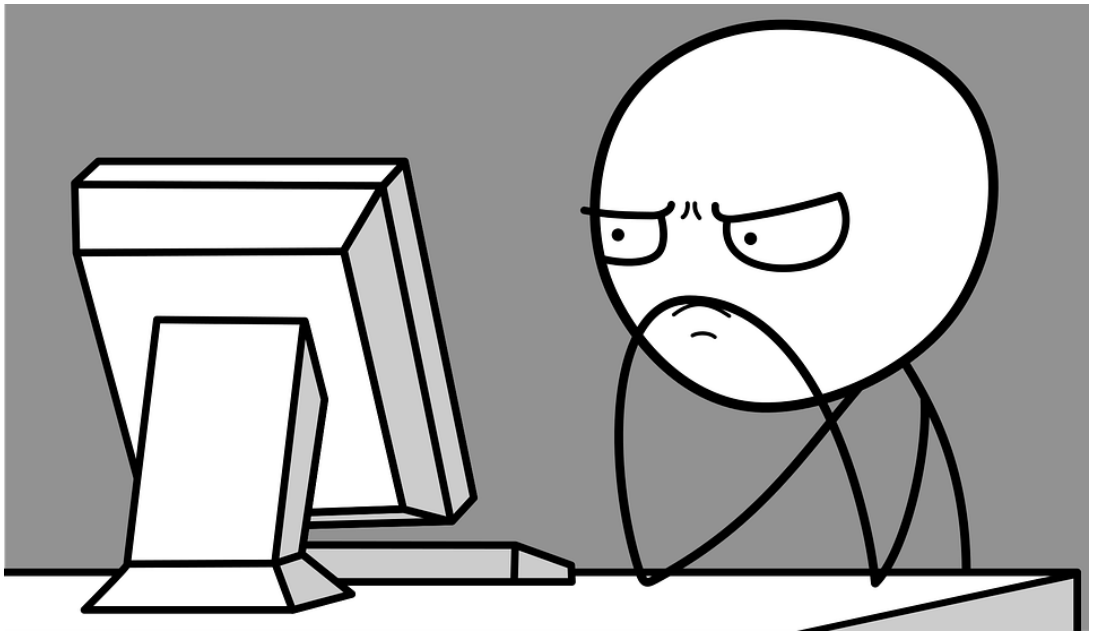

Computers are stupid, but fast.

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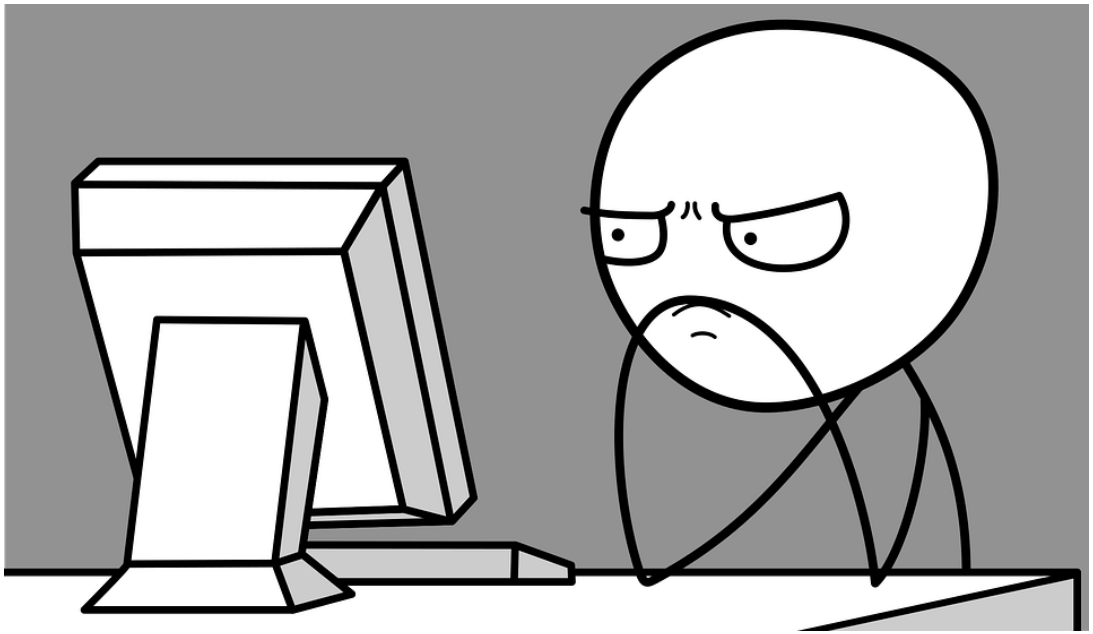
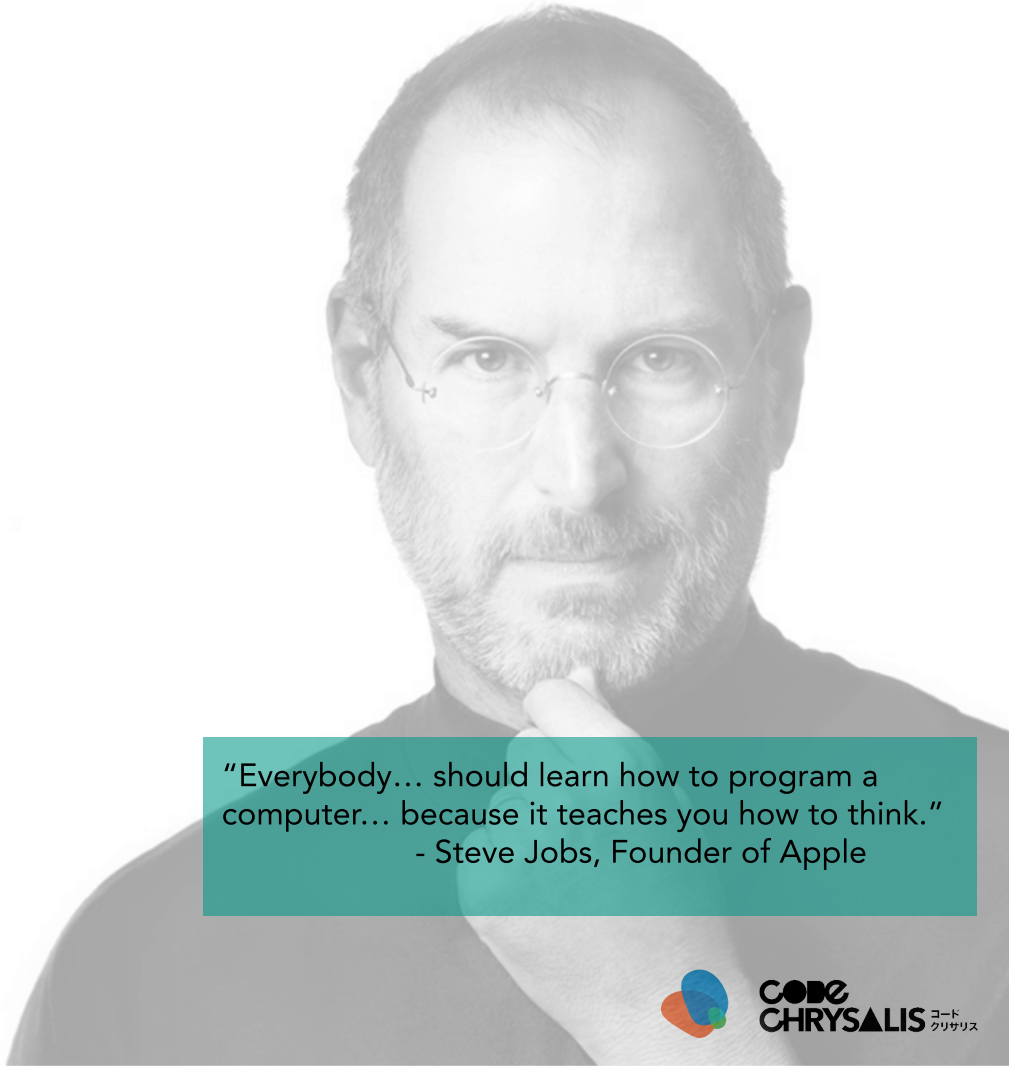


Computers are stupid, but fast.

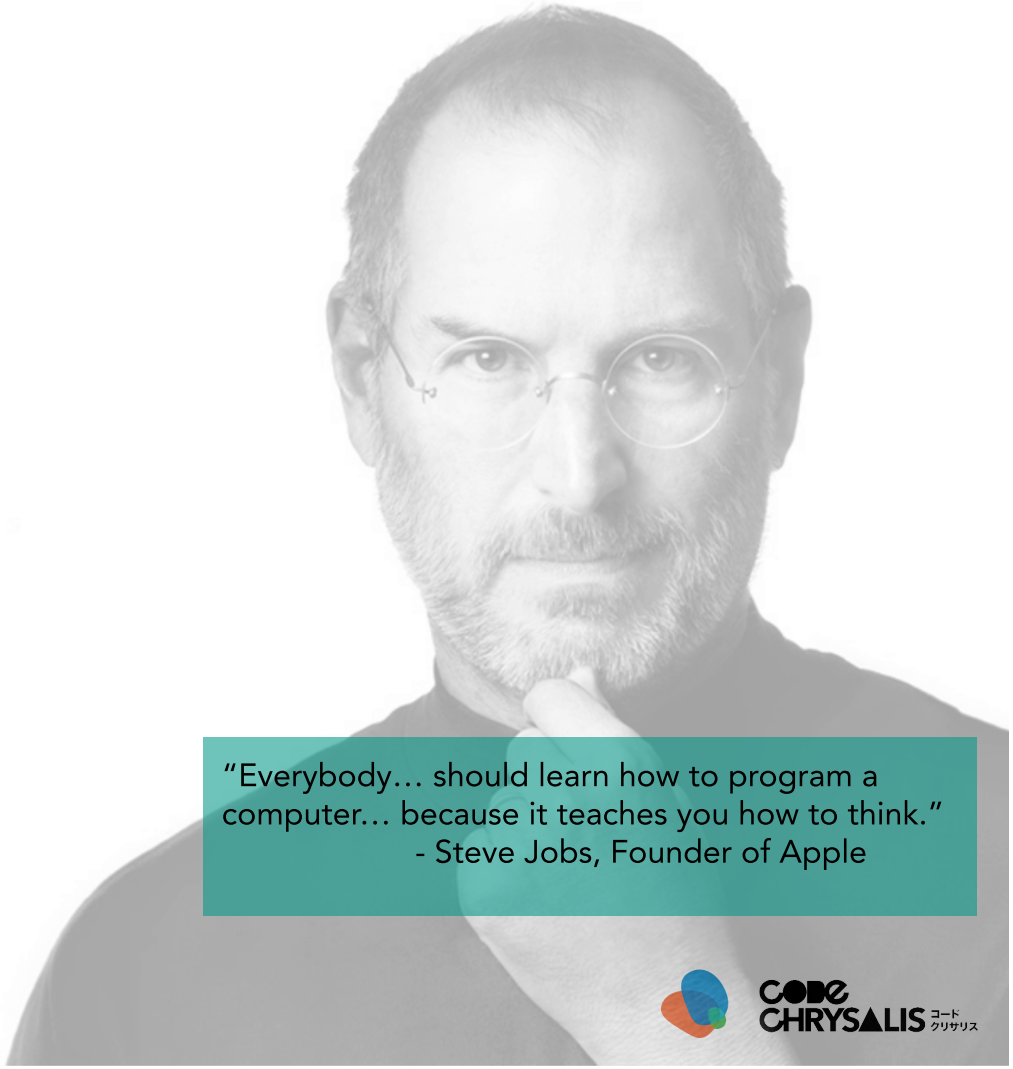
Humans are smart, but slow.

Why do we have computers?

Humans vs Computers

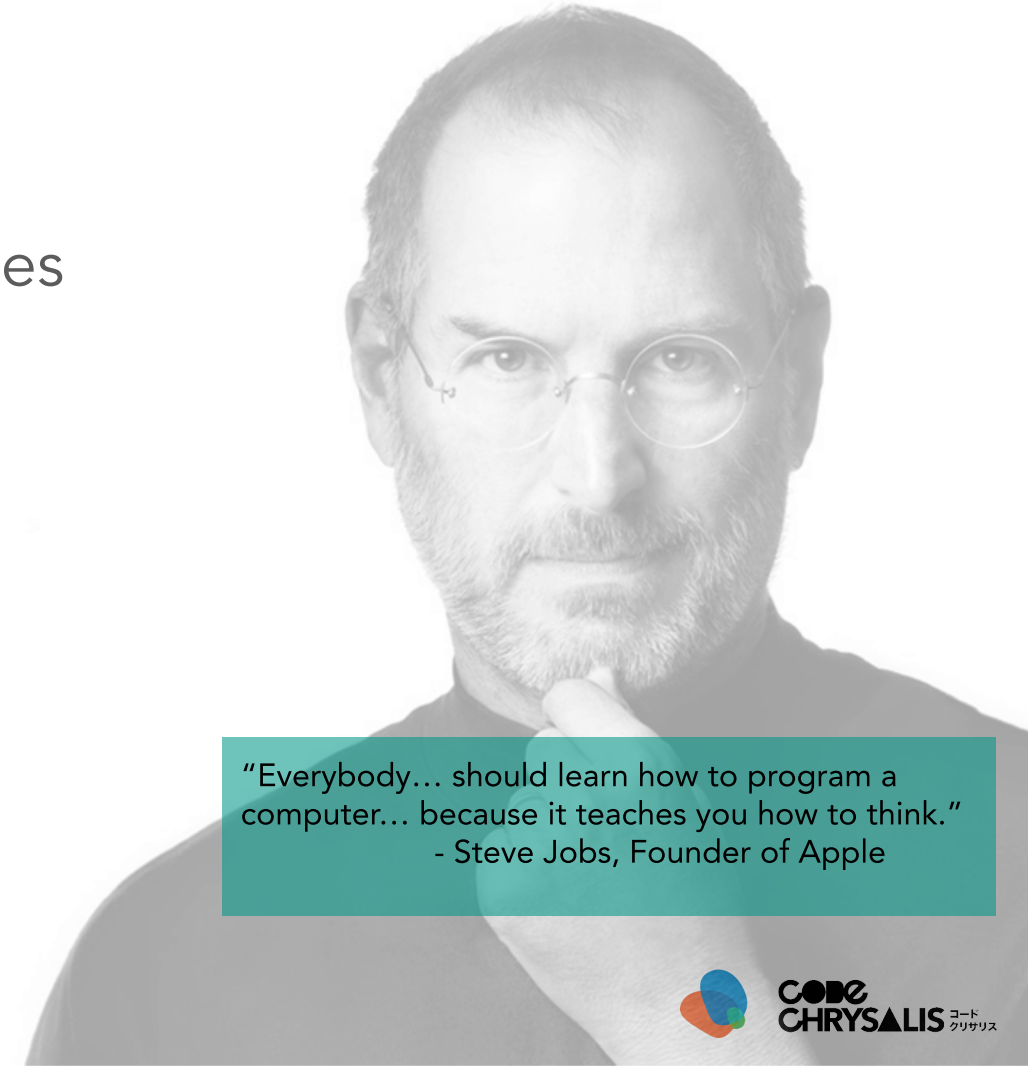


Humans vs Computers



Humans vs Computers

Humans are able to make intuitive leaps - logic that does not need further instruction.



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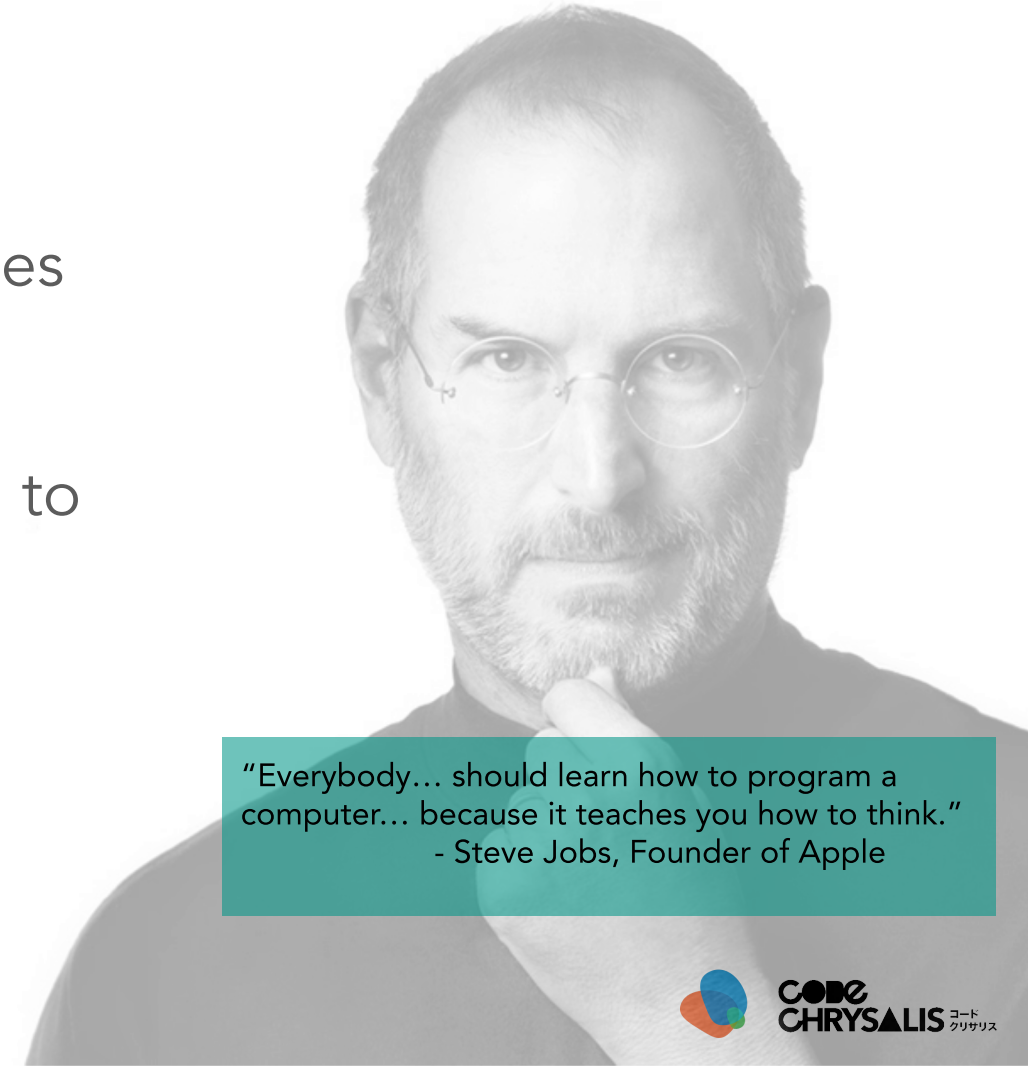
Computers cannot and need to be provided VERY specific instructions.

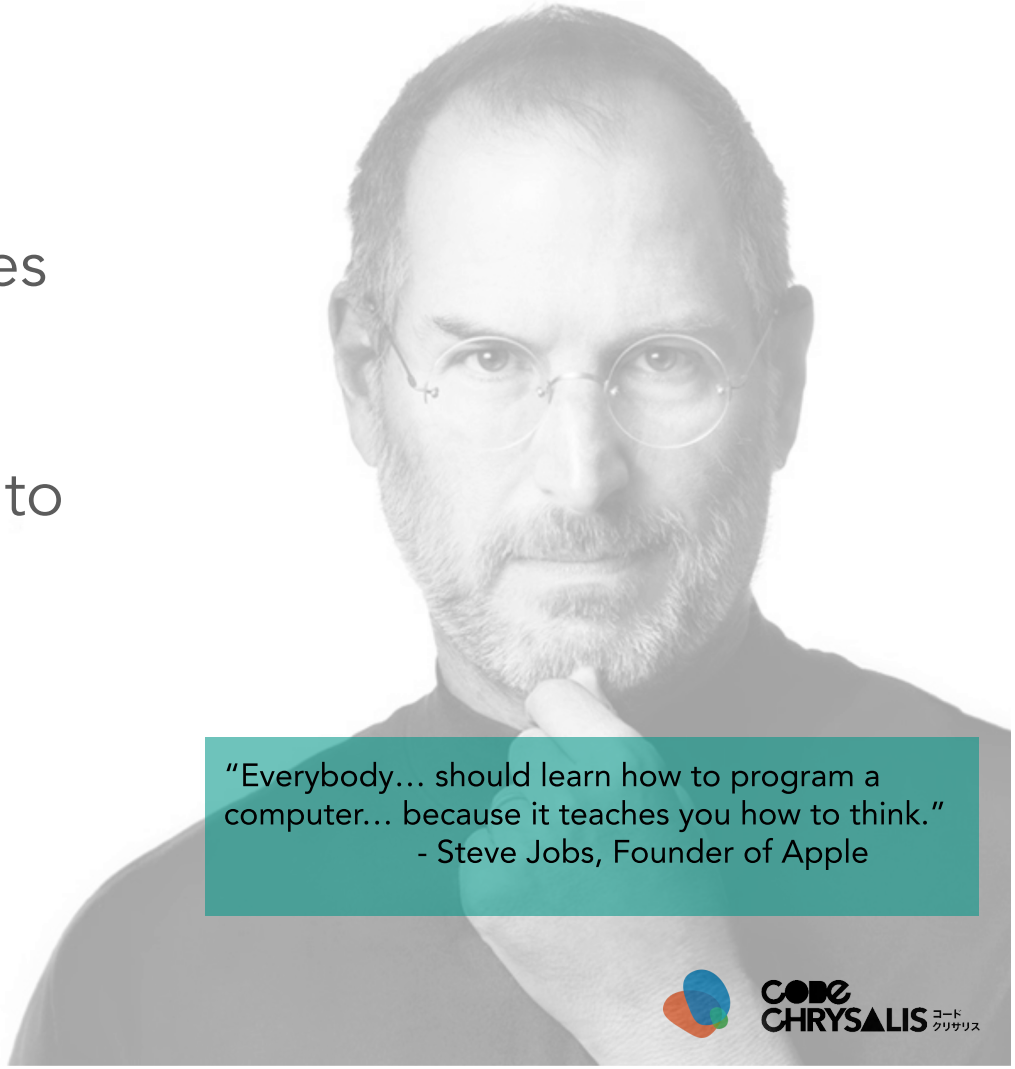


Humans vs Computers

Humans are able to make intuitive leaps - logic that does not need further instruction.

Computers cannot and need to be provided VERY specific instructions.

Lists of instructions are called ‘programs’.



If you were a computer...

"Go get me a coffee, please"

CODE CHRYSALIS コードクリサリス

If you were a computer...

"Go get me a coffee, please"

CODE CHRYSALIS コードクリサリス

If you were a computer...

- Go upstairs
- Go onto the street
- Turn to the right
- Walk until you see the FamilyMart
- Go inside
- Go to refrigerator in the back
- Grab a coffee
- Take coffee to cash register
- Give cashier correct amount
- Walk outside
- Turn to the left
- Walk until you reach our building
- Go to B2
- Give me the coffee

"Go get me a coffee, please"

CODE CHRYSALIS コードクリサリス

Is this good enough for the computer?

CODE CHRYSALIS コードクリサリス

“Go upstairs” Instructions

- Go upstairs
- Go onto the street
- Turn to the right
- Walk until you see the FamilyMart
- Go inside
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- Walk outside
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- Go to B2
- Give me the coffee

“Go upstairs”

- Stand with both legs straight
- Pick up your right leg
- Move it forward, in front of your left leg
- Put down your right leg
- Pick up your left leg
- Move it forward, in front of your left leg
- Put down your left leg
- Repeat

What is a program?

A set of instructions for a computer

CODE CHRYSALIS コードクリサリス

How do we tell a computer what to do?

CODE CHRYSALIS コードクリサリス

Programming Languages!

CODE CHRYSALIS コードクリサリス

Types of Programming

High Level Language

Middle Level Language
(Assembly Language)

Low Level Language
(Machine Language)

CODE CHRYSALIS コードクリサリス

Types of Programming

High Level Language

Middle Level Language
(Assembly Language)

Low Level Language
(Machine Language)

CODE CHRYSALIS コードクリサリス

Types of Programming

High Level Language

- Python
- Java
- PHP
- Ruby
- JavaScript
- Perl
- Cobol
- Swift
- C++
- C#
- etc.

Middle Level Language
(Assembly Language)

Low Level Language
(Machine Language)

CODE CHRYSALIS コードクリサリス

Machine Code

```
00110001 00000000 00000000
00110001 00000001 00000001
00110011 00000001 00000010
01010001 00001011 00000010
00100010 00000010 00001000
01000011 00000001 00000000
01000001 00000001 00000001
00010000 00000010 00000000
01100010 00000000 00000000
```

CODE CHRYSALIS コードクリサリス

Machine Code

```
00110001 00000000 00000000
00110001 00000001 00000001
00110011 00000001 00000010
01010001 00001011 00000010
00100010 00000010 00001000
01000011 00000001 00000000
01000001 00000001 00000001
00010000 00000010 00000000
01100010 00000000 00000000
```

CODE CHRYSALIS コードクリサリス

Machine Code

```
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00110001 00000001 00000001
00110011 00000001 00000010
01010001 00001011 00000010
00100010 00000010 00001000
01000011 00000001 00000000
01000001 00000001 00000001
00010000 00000010 00000000
01100010 00000000 00000000
```

```
Set total to 0.
Set count to 1.
[loop]
  Set compare to count.
  Subtract 11 from compare.
  If compare is 0, continue at [end].
  Add count to total.
  Add 1 to count.
  Continue at [loop].
[end]
Output total. => 55
```

CODE CHRYSALIS コードクリサリス

JavaScript

```
let total = 0;
let count = 1;
while (count <= 10) {
  total += count;
  count += 1;
}
console.log(total); // => 55
```

CODE CHRYSALIS コードクリサリス

JavaScript

```
let total = 0;
let count = 1;
while (count <= 10) {
  total += count;
  count += 1;
}
console.log(total); // => 55
```

CODE CHRYSALIS コードクリサリス

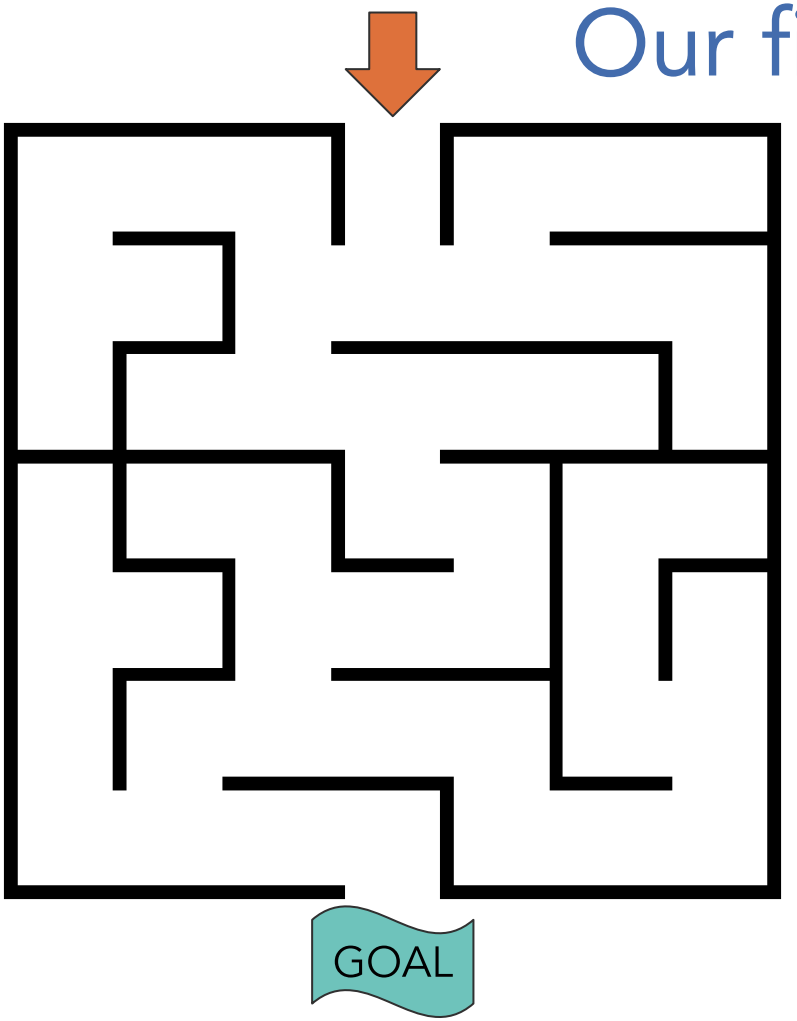
JavaScript

```
let total = 0;
let count = 1;
while (count <= 10) {
  total += count;
  count += 1;
}
console.log(total); // => 55
```

```
const total = sum(range(1, 10));
console.log(total); // => 55
```

CODE CHRYSALIS コードクリサリス

Our first program



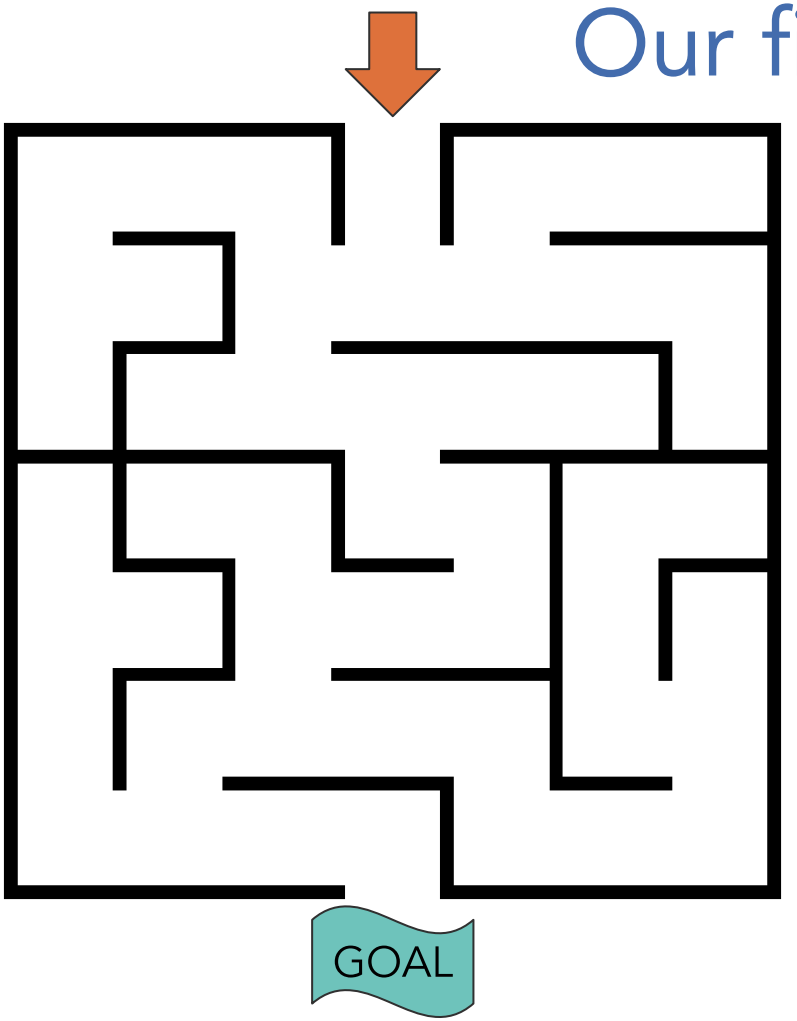
The mission:
Reach the GOAL using only 2 instructions:

- Move forward 1 space
- Turn clockwise 90° (turn RIGHT)

Can it be done?

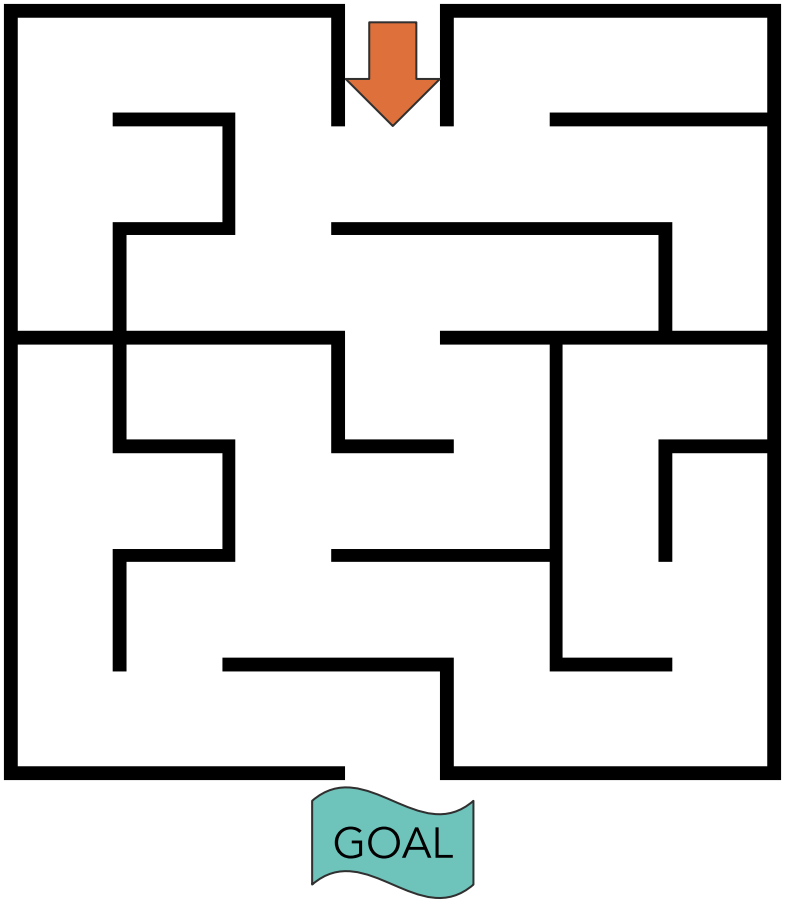
How many steps do you think it will take?
(Take *30 seconds* to write your guess on your whiteboard)

Our first program



The solution:

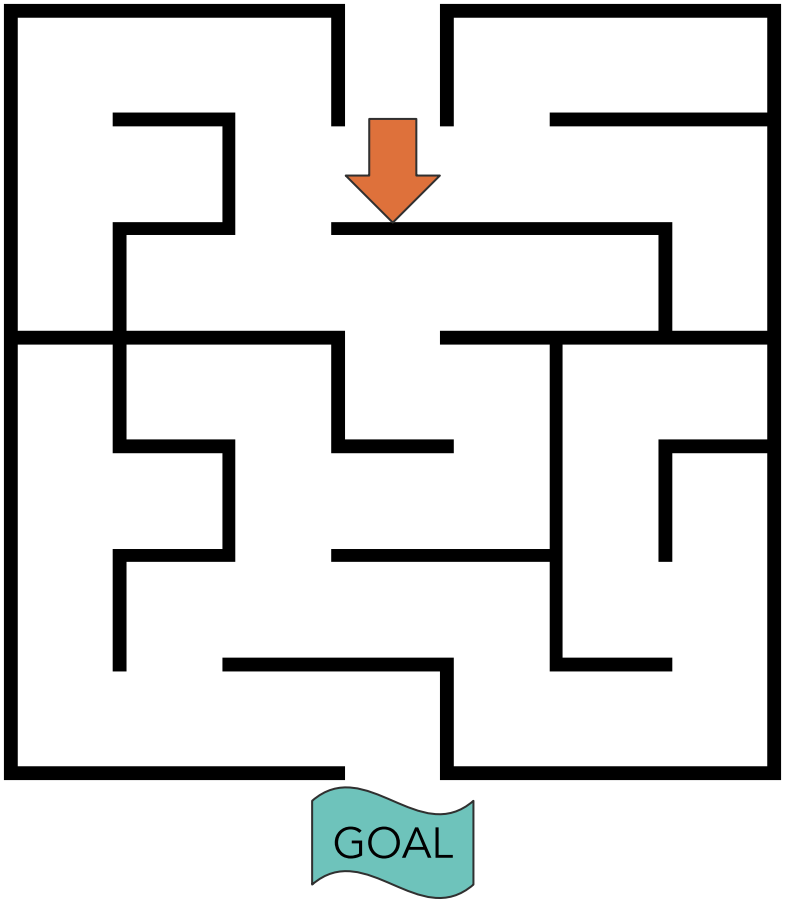
Our first program



The solution:

1. Move forward 1 space

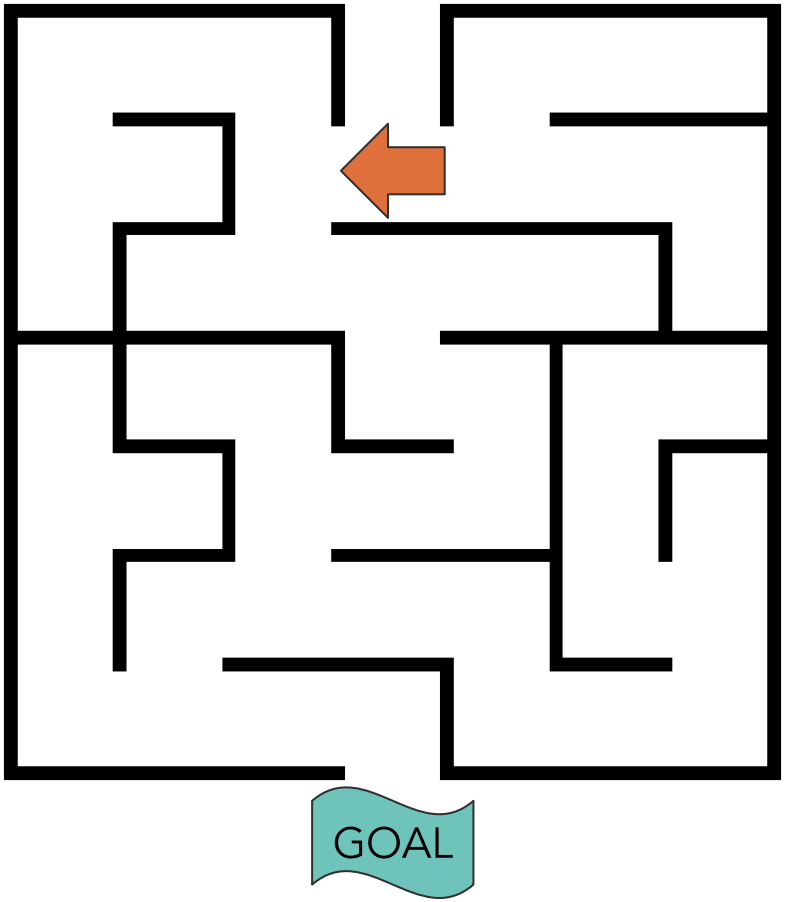
Our first program



The solution:

1. Move forward 1 space
2. Move forward 1 space

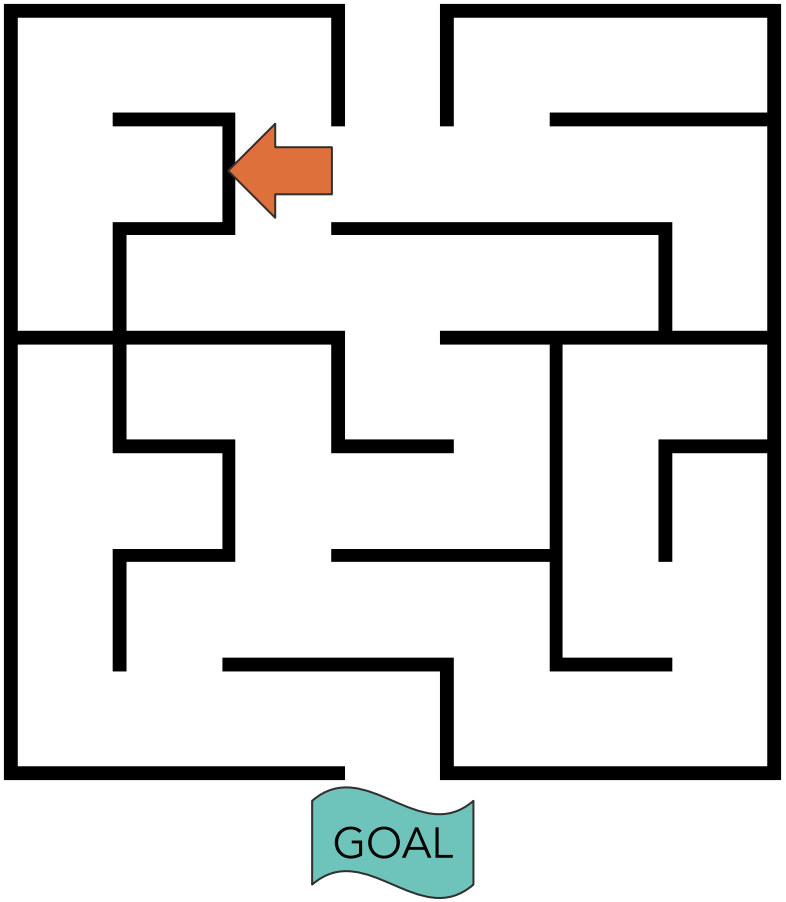
Our first program



The solution:

1. Move forward 1 space
2. Move forward 1 space
3. Turn clockwise 90° (turn RIGHT)

Our first program

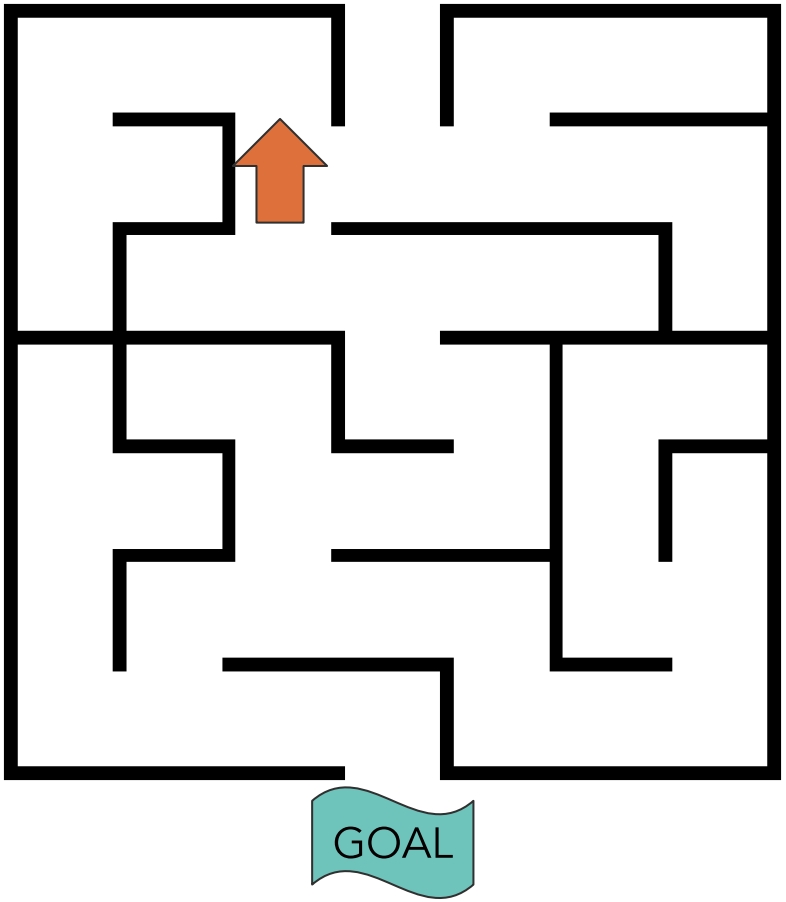


The solution:

1. Move forward 1 space
2. Move forward 1 space
3. Turn clockwise 90° (turn RIGHT)
4. Move forward 1 space

CODE CHRYSALIS コードクリサリス

Our first program



The solution:

1. Move forward 1 space
2. Move forward 1 space
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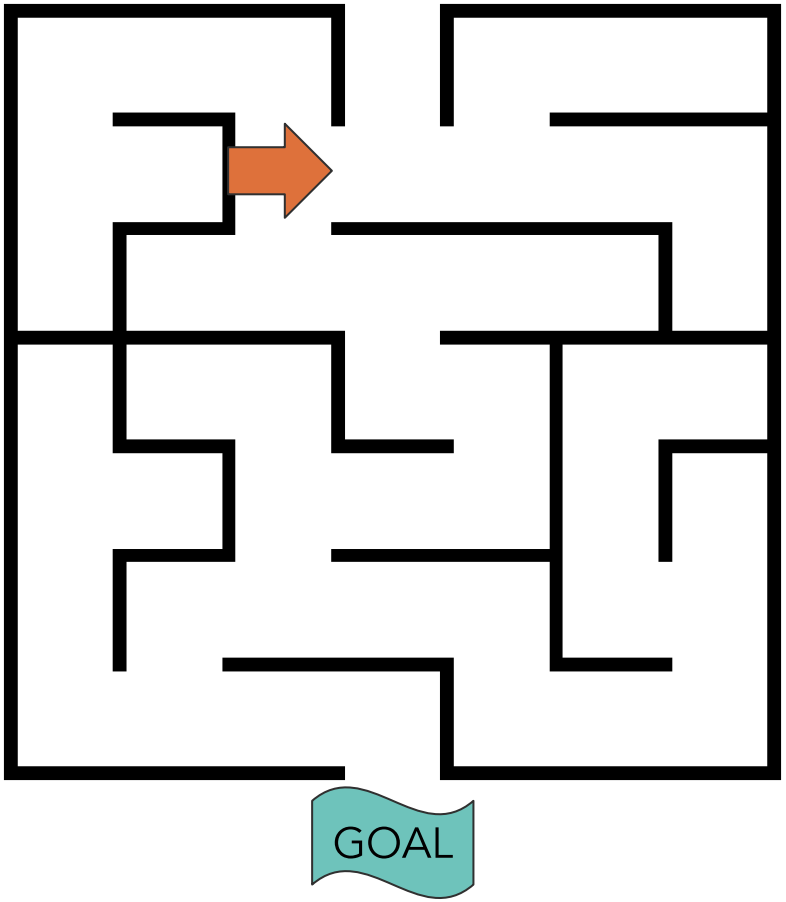
4. Move forward 1 space
5. Turn clockwise 90° (turn RIGHT)

CODE CHRYSALIS コードクリサリス

Our first program

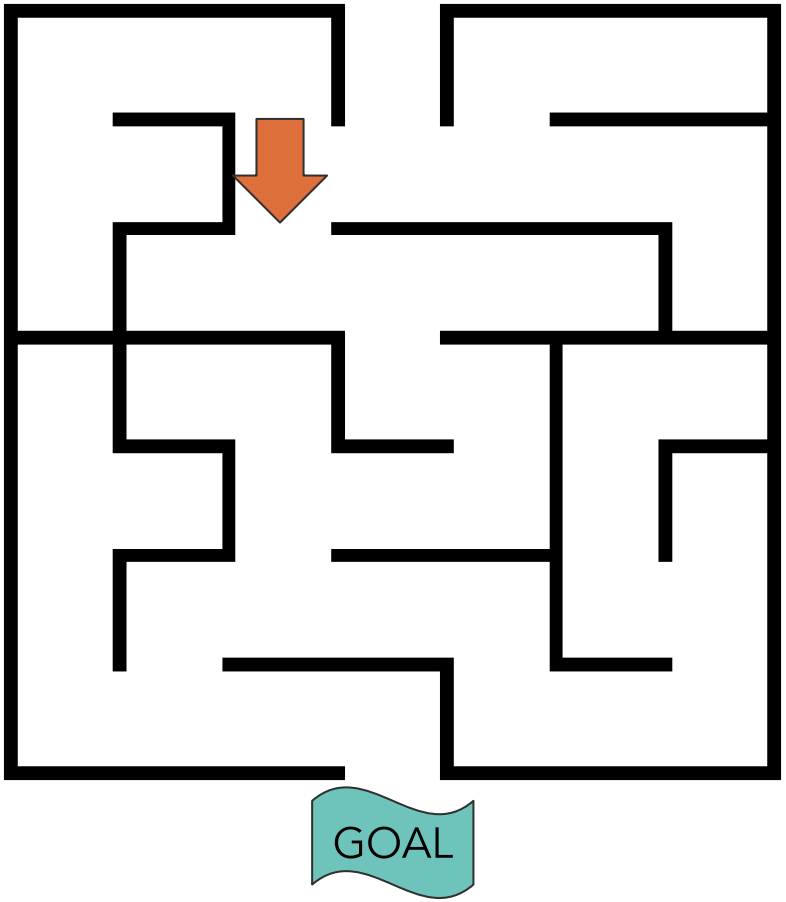


The solution:

1. Move forward 1 space
2. Move forward 1 space
3. Turn clockwise 90° (turn RIGHT)
4. Move forward 1 space
5. Turn clockwise 90° (turn RIGHT)
6. Turn clockwise 90° (turn RIGHT)

CODE CHRYSALIS コードクリサリス

Our first program



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4. Move forward 1 space
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6. Turn clockwise 90° (turn RIGHT)
7. Turn clockwise 90° (turn RIGHT)

CODE CHRYSALIS コードクリサリス

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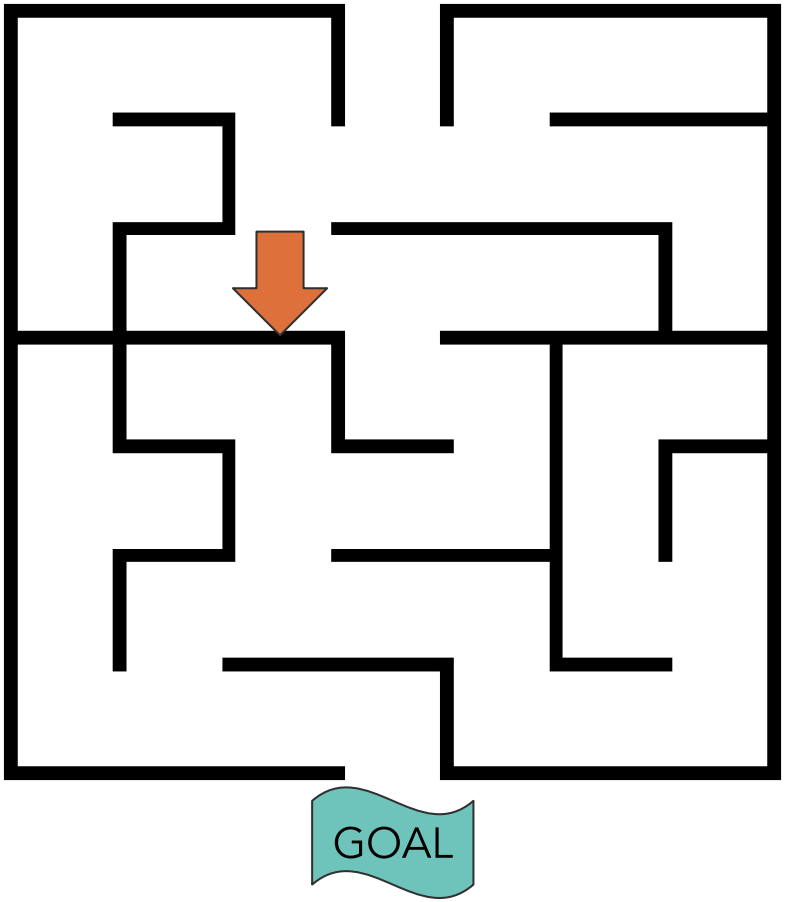
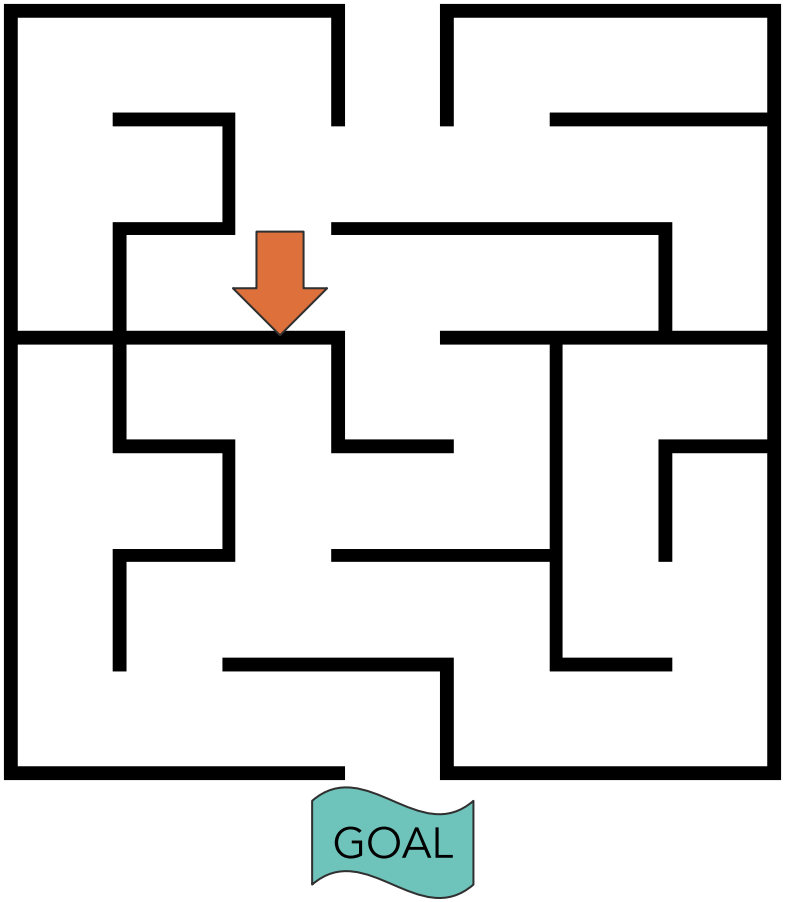


The solution:

1. Move forward 1 space
2. Move forward 1 space
3. Turn clockwise 90° (turn RIGHT)
4. Move forward 1 space
5. Turn clockwise 90° (turn RIGHT)
6. Turn clockwise 90° (turn RIGHT)
7. Turn clockwise 90° (turn RIGHT)
8. Move forward 1 space

CODE CHRYSALIS コードクリサリス

Our first program



The solution:

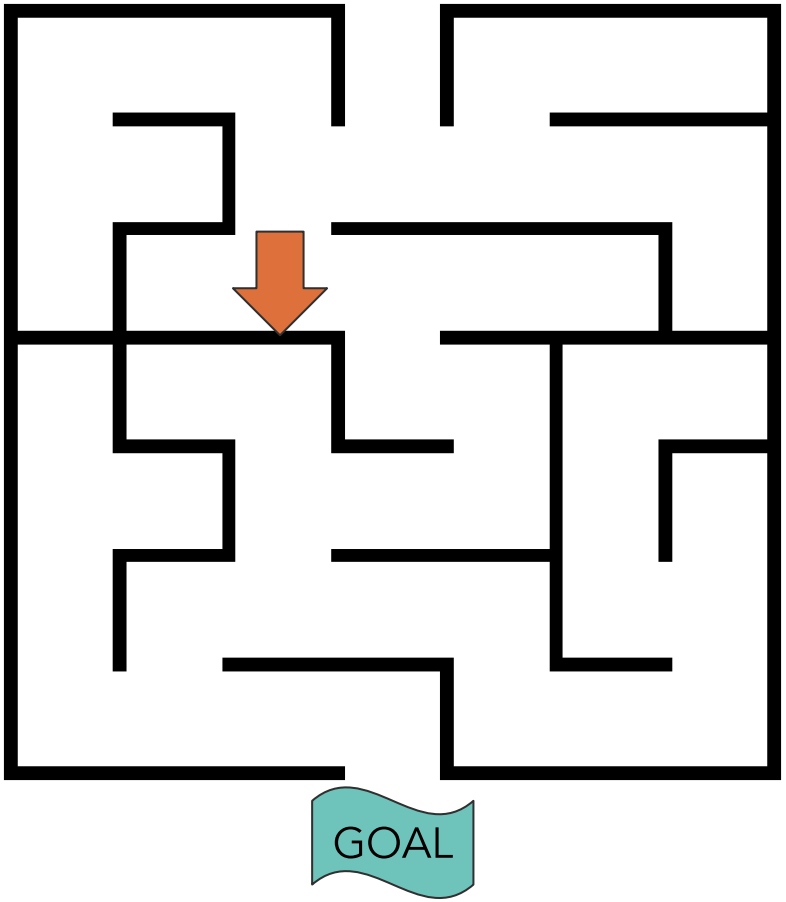
1. Move forward 1 space
2. Move forward 1 space
3. Turn clockwise
4. Move
5. T
6.
7. Tu
8. M

This is getting repetitive!!!
Let's simplify the instructions.

F: Forward T: Turn

CODE CHRYSALIS コードクリサリス

Our first program

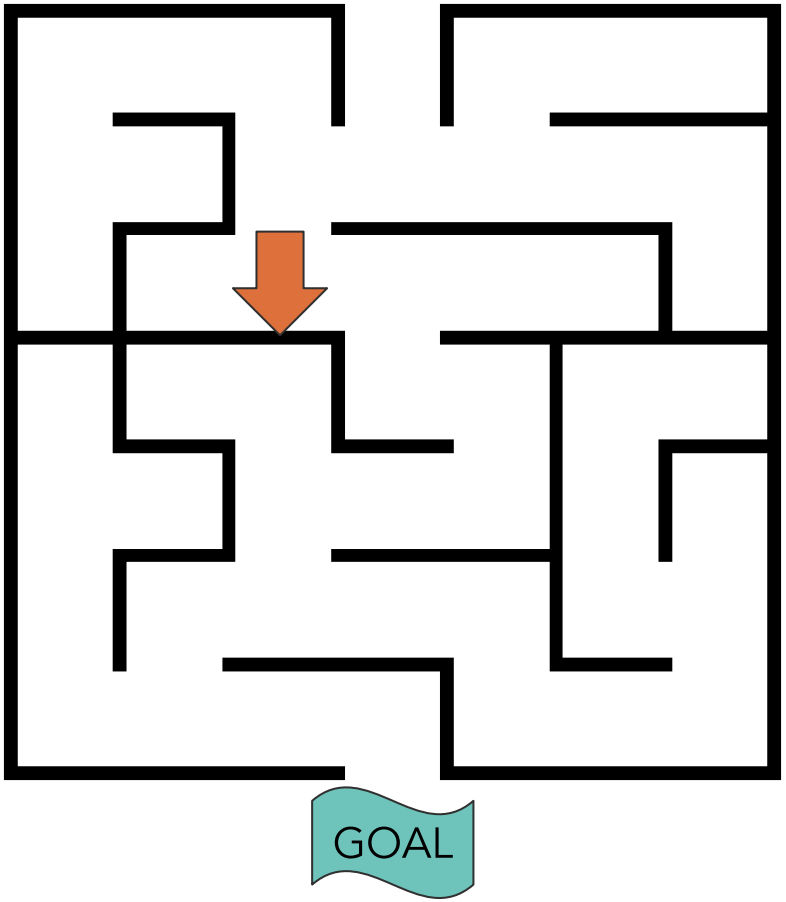


The solution:

1. F ~~Move forward 1 space~~
2. F ~~Move forward 1 space~~
3. T ~~Turn clockwise 90° (turn RIGHT)~~
4. F ~~Move forward 1 space~~
5. T ~~Turn clockwise 90° (turn RIGHT)~~
6. T ~~Turn clockwise 90° (turn RIGHT)~~
7. T ~~Turn clockwise 90° (turn RIGHT)~~
8. F ~~Move forward 1 space~~

CODE CHRYSALIS コードクリサリス

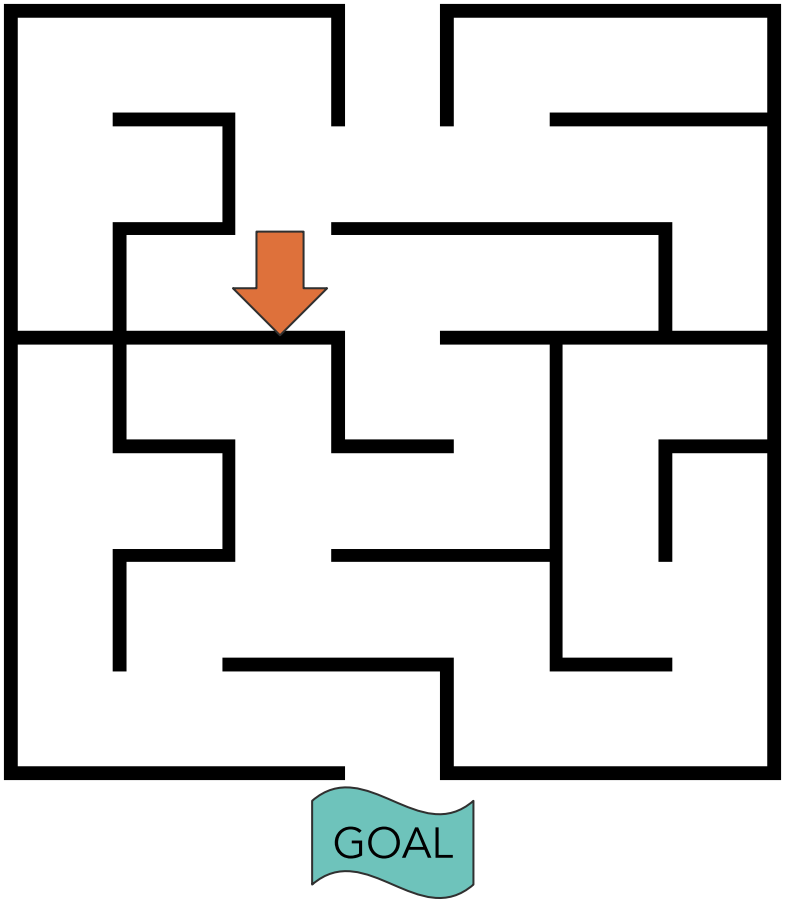
Our first program



The solution:

1. F
2. F
3. T
4. F
5. T
6. T
7. T
8. F

Our first program



The solution:

1. F
2. F
3. T
4. F
5. T
6. T
7. T
8. F

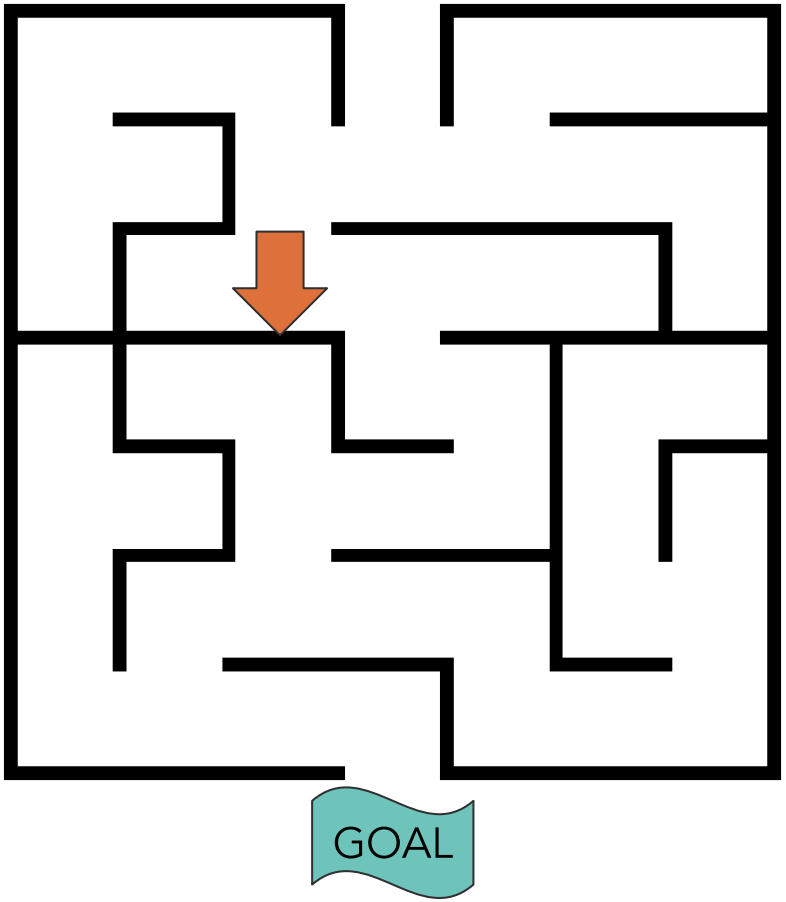
It's your turn.

Finish the instructions to get to the GOAL.

(With a partner, take up to 5 minutes to write the solution on your whiteboard.)

CODE CHRYSALIS コードクリサリス

Our first program



The solution:

1. F
2.
3.
4.

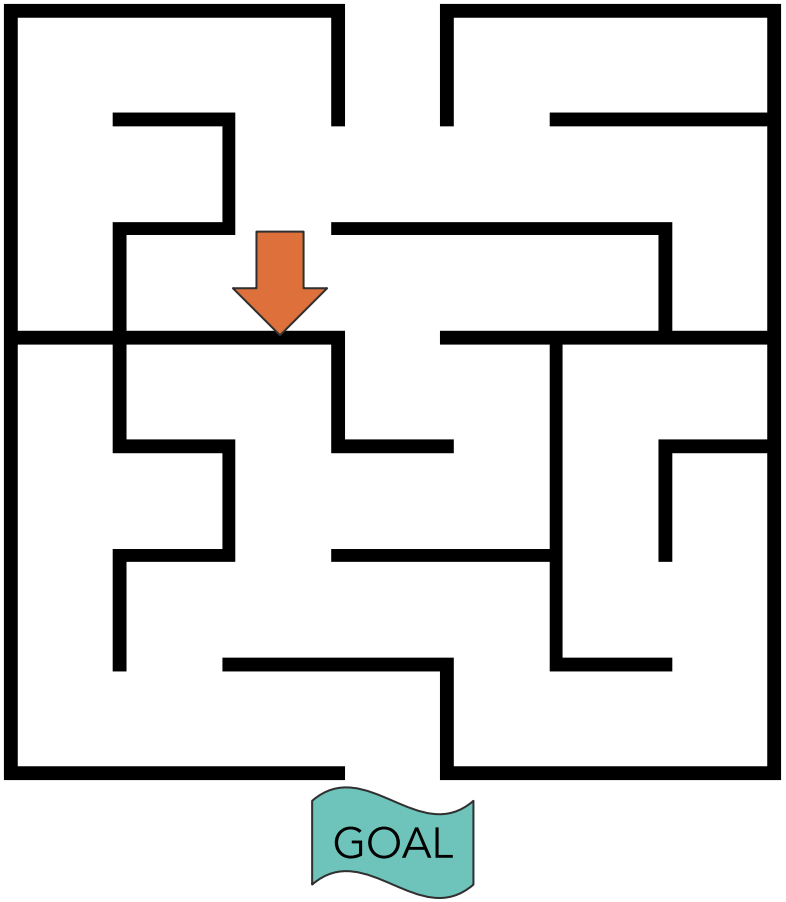
We will not always give you the solution.

You will know that your code is correct if it gives you the correct answer.

Finish

(With a partner, take u utes to write the solution on your whiteboard.)

Our first program



The solution:

1. F
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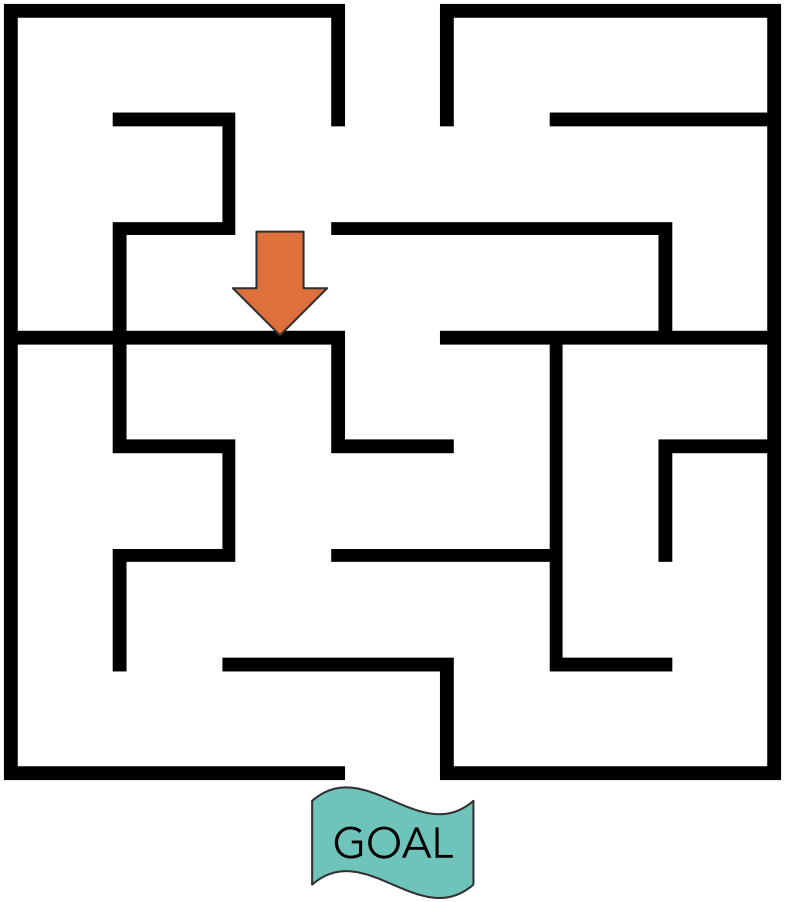
4.

Finish

(With a partner, take u utes to write the solution on your whiteboard.)

Our first program



The solution:

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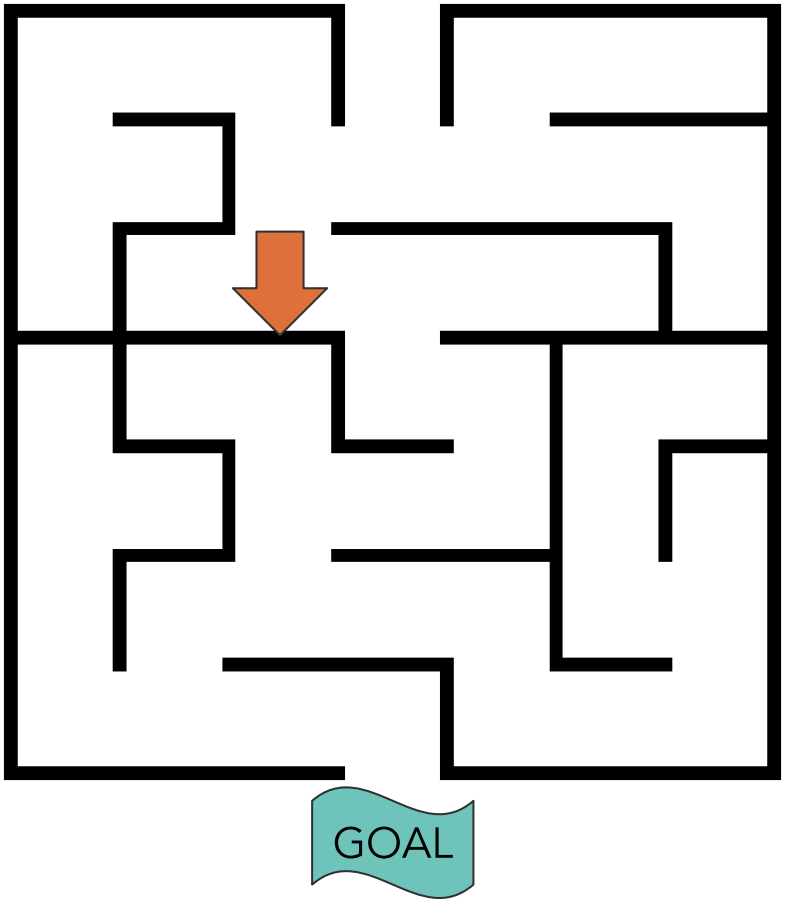
3.
4.

Finish

(With a partner, take u utes to write the solution on your whiteboard.)

Our first program



The solution:

1. F
2.
3.
4.

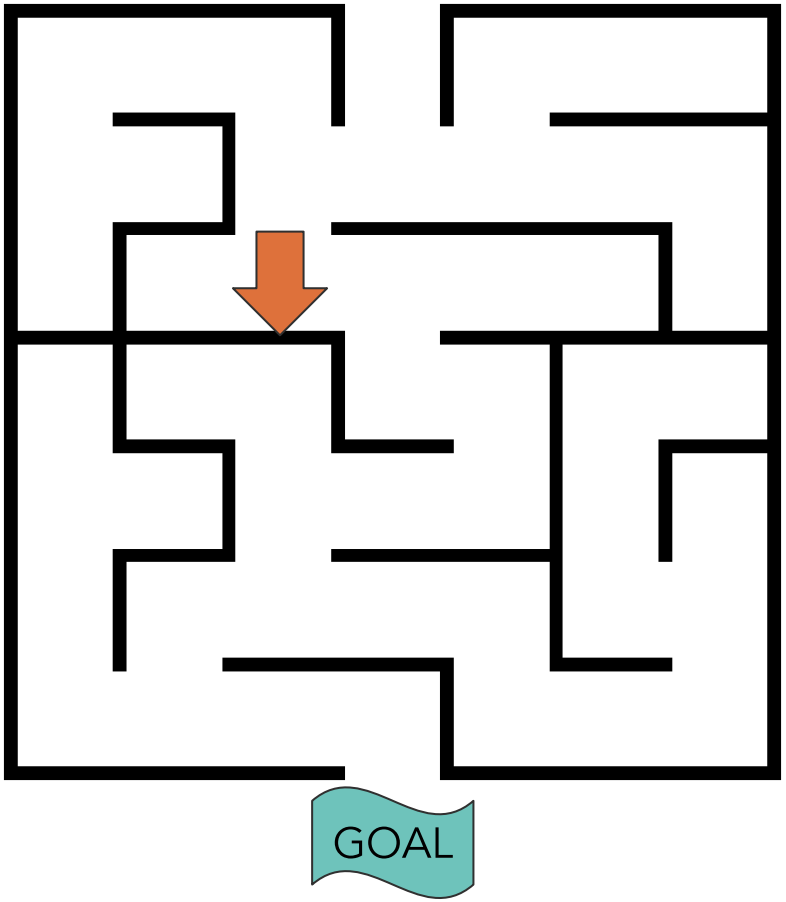
What happens if you change ONE SINGLE INSTRUCTION?

Finish

(With a partner, take u utes to write the solution on your whiteboard.)

CODE CHRYSALIS コードクリサリス

Our first program



The solution:

1. F
2.
3.
4.

What happens if you change ONE SINGLE INSTRUCTION?

Every single instruction and symbol can MAKE or BREAK your program.

Finish

(With a partner, take u utes to write the solution on your whiteboard.)

CODE CHRYSALIS コードクリサリス

Our first program

Writing a program in JavaScript is very similar to solving this maze, except that there are more *instructions* available to use when writing programs.

We will teach you how to use *many* of these instructions, which will put you on the path to JavaScript mastery.

```
break       export      super       <           0 1 2 3 4
case        extends     switch      >           5 6 7 8 9
catch       finally     this        =           a-z
class       for         throw       +           A-Z
const       function    try         -           {}
continue    if          typeof      *           []
debugger    import      var         /           ()
default     in          void        %           ;
delete      instanceof  while       '           ,
do          new         with        "           .
else        return      yield       `
```

Why JavaScript?

Everyone has a JavaScript engine on their computer that they use every day.

JavaScript is the Language of the Web (browser)

Programming Fundamentals

(JS fundamentals)

Vocabulary

Vocabulary

Vocabulary

Types

Vocabulary

Types

Different categories of data
(**`number`**, **`string`**)

Vocabulary

Types

Different categories of data
(**`number`**, **`string`**)

Operator

CODE CHRYSALIS コードクリサリス

Vocabulary

Types

Different categories of data (**`number`**, **`string`**)

Operator

Does something, helps resolve an expression (**`+`**, **`*`**)

CODE CHRYSALIS コードクリサリス

Vocabulary

Types — Different categories of data (**`number`**, **`string`**)

Operator — Does something, helps resolve an expression (**`+`**, **`*`**)

Expression

Vocabulary

Types

Different categories of data (**`number`**, **`string`**)

Operator

Does something, helps resolve an expression (**`+`**, **`*`**)

Expression

Any code that resolves to a value (**`6*7`**, **`"book" + "shelf"`**)

(Some) Types in JavaScript

Type	Examples
number	`1, -5, 1.0001`
string	`"Hello world!", 'I love coding!'`
boolean	`true, false`
null	`null`
undefined	`undefined`
object	`[1, 234.05, 'asdf', true, [1, 2, 3]]` `{ a: 1, b: "two", c: null }`
function	`function() { /* function body */ }`

Arithmetic Operators

+	Addition	`1 + 2 => 3`
−	Subtraction	`5 - 3 => 2`
/	Division	`1 / 2 => 0.5`
*	Multiplication	`2 * 2 => 4`
%	Remainder	`17 % 5 => 2`
**	Exponentiation	`2 ** 3 => 8`

Expressions

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Expressions

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Arithmetic expressions: expressions that evaluate to a `number`

`1+2` evaluates to 3

`6/3` evaluates to 2

Vocabulary

Concatenation:

Joining two strings together

```
"butter" + "fly"
```

What does the addition operator do in this case?

REVIEW TIME

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- What is a program?

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  - `*`

CODE CHRYSALIS コードクリサリス

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  - +

CODE CHRYSALIS コードクリサリス

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  - *
  - +
  - %

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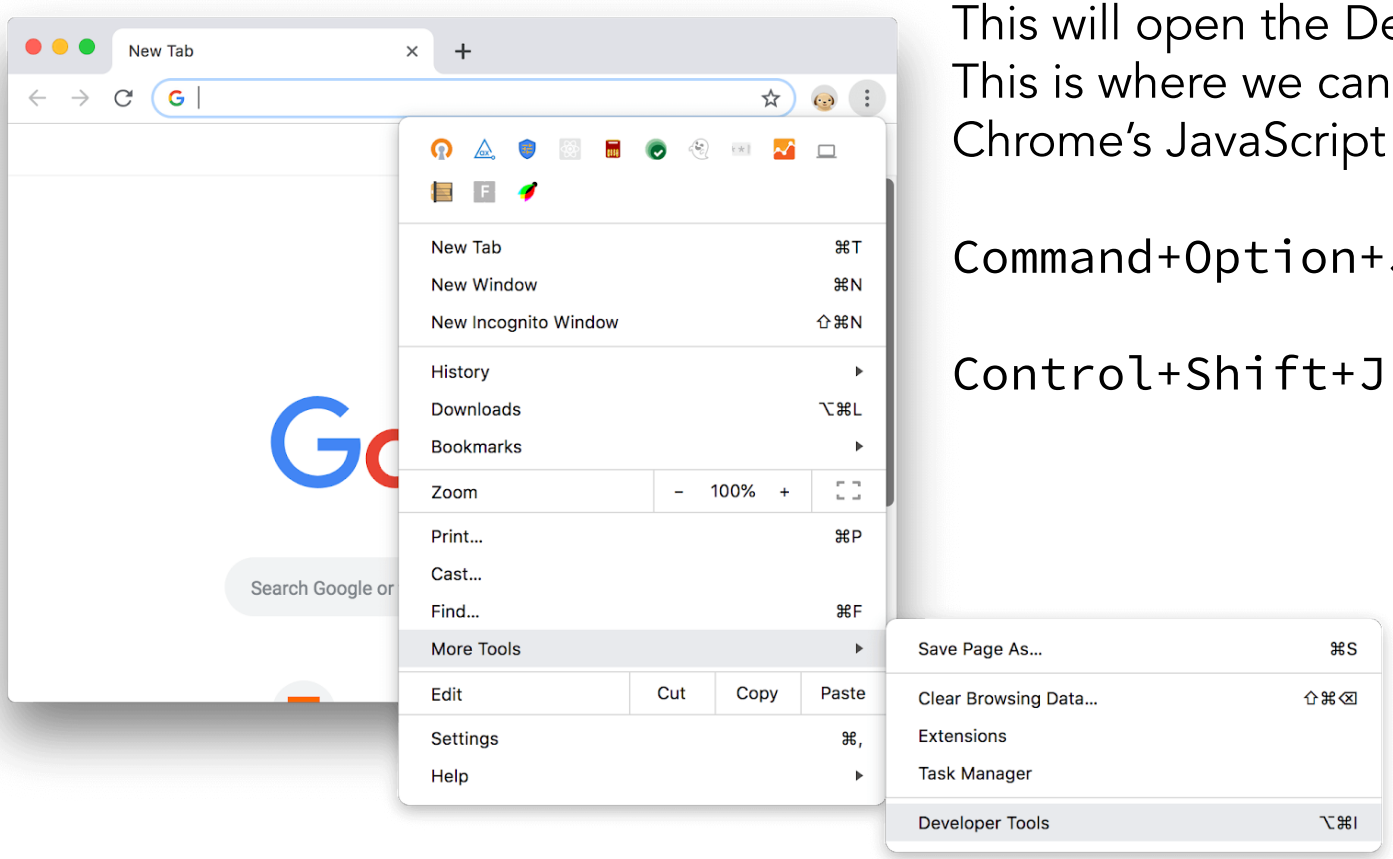
Find the Developer Tools in Chrome



This will open the Developer Console. This is where we can interact with Chrome's JavaScript engine.

`Command+Option+J` on Mac

`Control+Shift+J` on Windows/Linux

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Activity

- You can write JavaScript directly in the console
  - Open the Developer Tools in Chrome
    - Open the Console in Developer Tools
      - Type `5 + 5;` and press return

2 minutes

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Activity

- Finish the Basic Requirements on the "foundations" lesson.

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