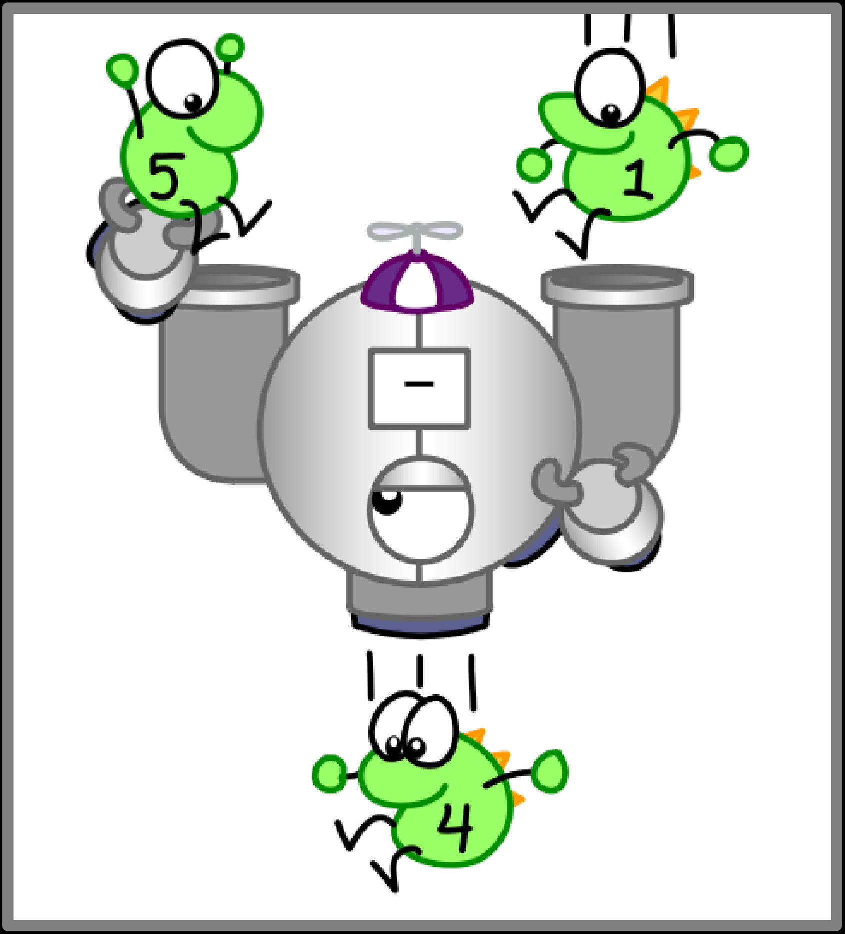
CS10:
The Beauty and Joy of Computing

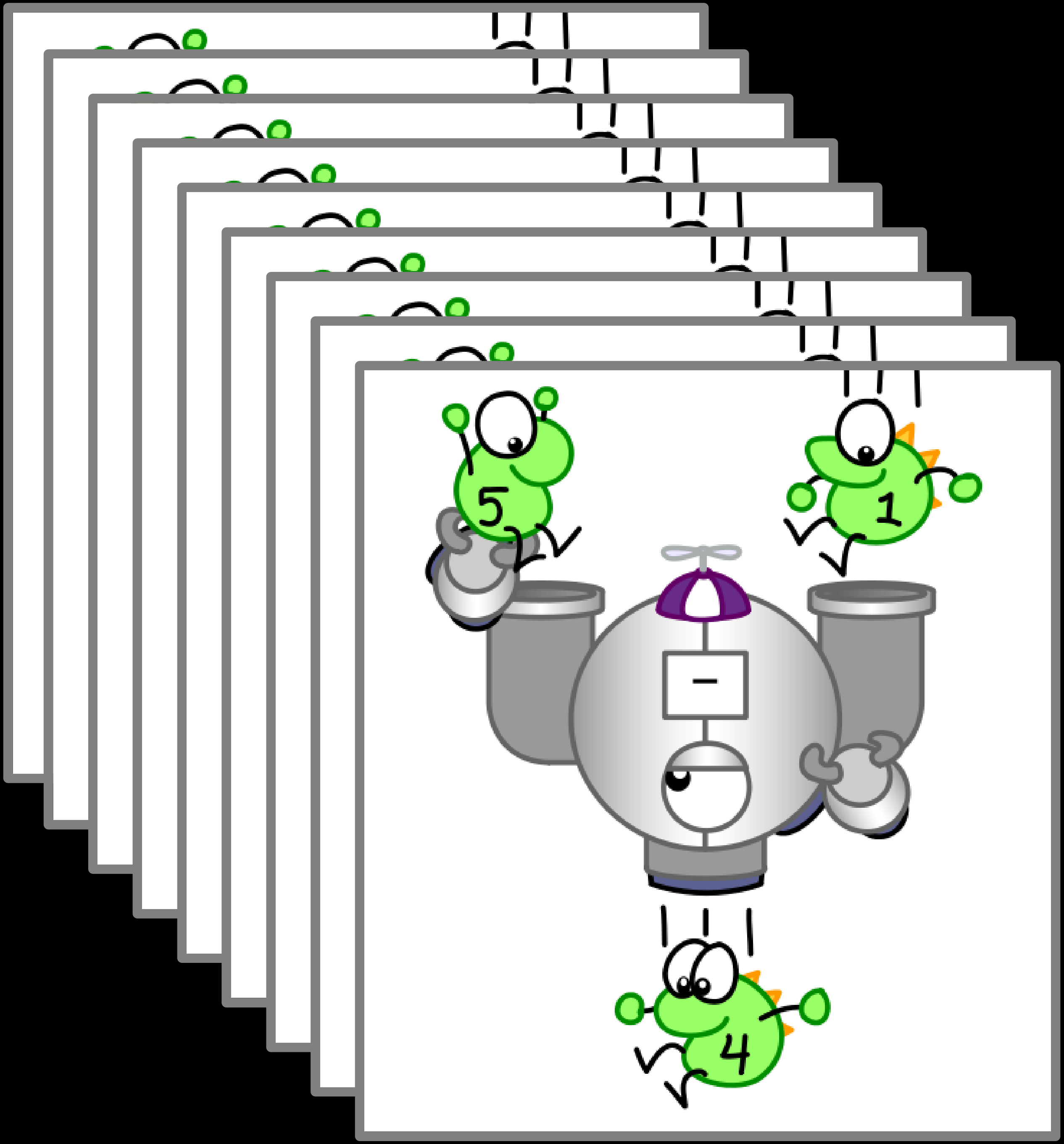
Lecture #4
Functions

Water-propelled jetpacks?! Coming this March!

You already know functions.

Functions perform an operation on a set of **zero or more inputs** and produce either **zero or one outputs.**





For a function,
the same inputs
MUST PROVIDE
same outputs.

Otherwise, we
call it a
procedure.

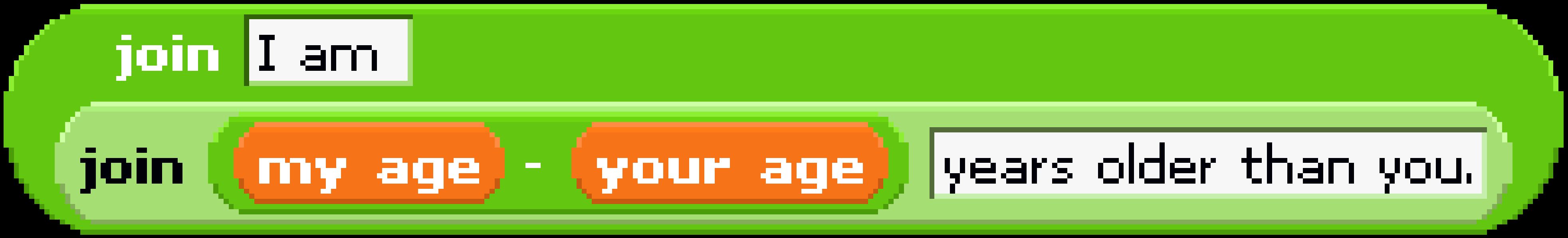
Functions and You

Why make functions?

1

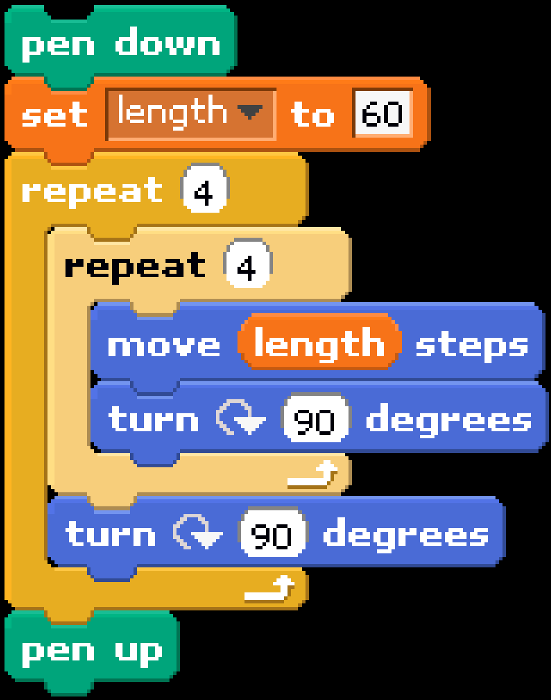
They can be composed together to make even more magnificent things.

They are literally the building blocks of almost everything that we create when we program.



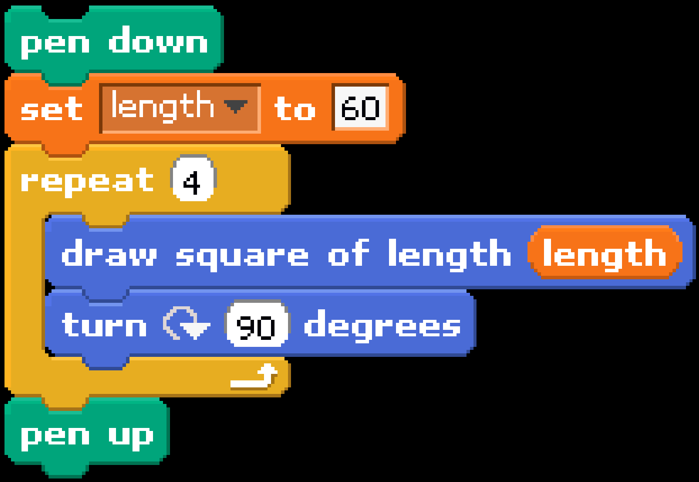
```
join I am
join my age - your age years older than you.
```

Why make functions?



```
pen down
set length to 60
repeat 4
    repeat 4
        move (length) steps
        turn ↻ 90 degrees
    turn ↻ 90 degrees
pen up
```

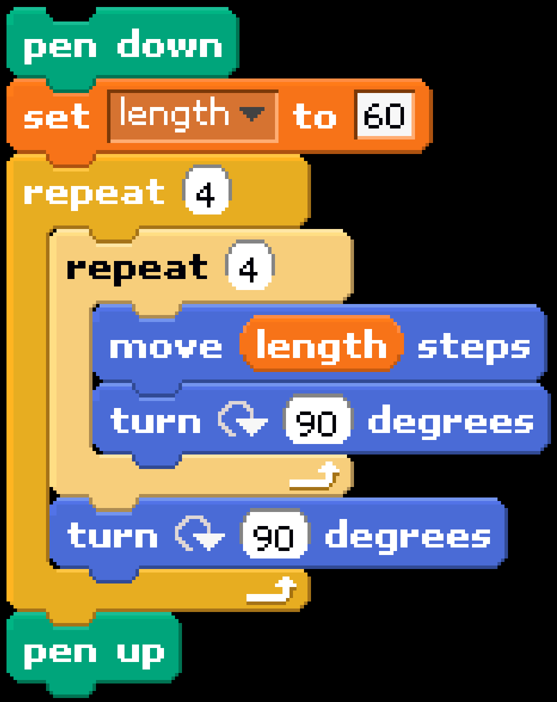
2



```
pen down
set length to 60
repeat 4
    draw square of length (length)
    turn ↻ 90 degrees
pen up
```

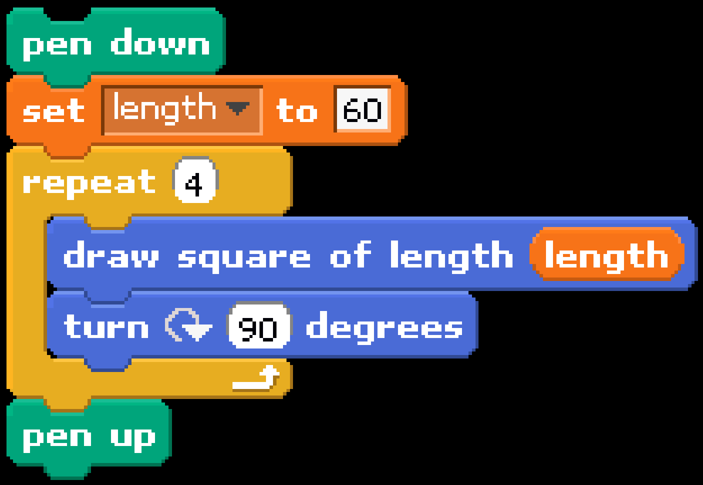
They make it easy to repeat code.

Why make functions?



```
pen down
set length to 60
repeat 4
    repeat 4
        move (length) steps
        turn ⟳ 90 degrees
    turn ⟳ 90 degrees
pen up
```

3



```
pen down
set length to 60
repeat 4
    draw square of length (length)
    turn ⟳ 90 degrees
pen up
```

They make it easy to be concise.

Types of Functions

Command

No outputs

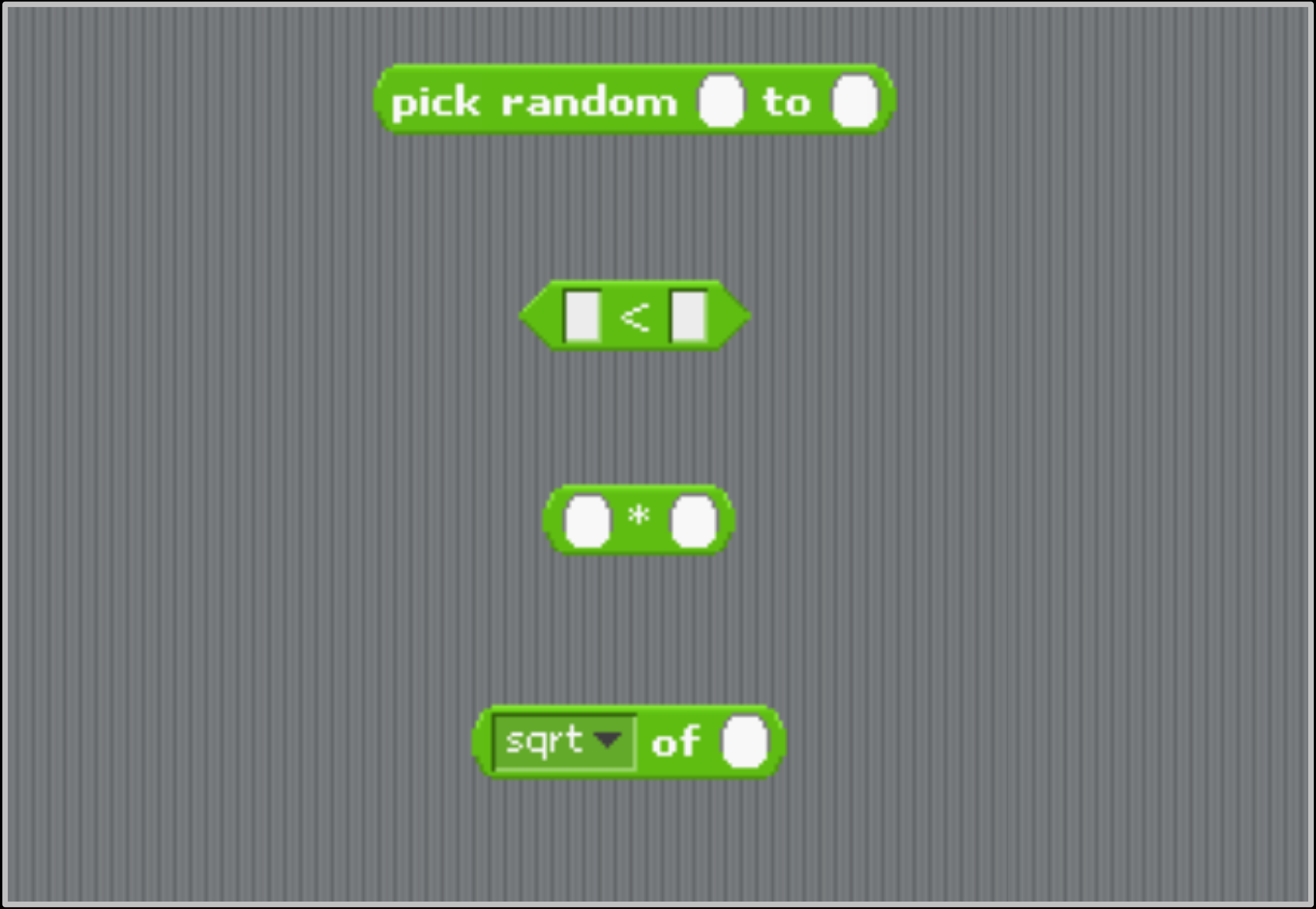
Reporter

Any type of output

Predicate

Boolean output

Which of the following is NOT a function?



Functions will always produce the same output when they're given the same inputs.

Procedures won't necessarily do this. They depend on things other than the function's parameters to do their job.

Why it Matters

If a function only depends on the information it gets as input, then nothing else can affect the output. It can run on any computer or processor and get the same answer.

This makes it incredibly easy to parallelize functions. Functional programming is a great tool for writing software that runs on multiple systems at the same time.

Quick Preview: Recursion

Recursion is a technique for defining functions that use themselves to complete their own definition.

We will spend a lot of time on this. Fear not!