Control Flow Revisited

Chris Piech
CS Bridge 2020

Chris Piech

Teaching at Stanford

CS106A	CS106B	CS109	CS221
Programming Methodologies	Programming Abstractions	Probability for Computer Scientists	Intro to Artificial Intelligence
CURRENT	LAST: FALL 2016	LAST: FALL 2018	LAST: SUM 2013

I am a professor in the **AI Lab** at Stanford. My focus is on education and healthcare!

@chrispiech

Chris Piech


Kakuma
Marsabit
Buur H
Bungoma
Kenya
Jilib
جيليب
Kisumu
Nakuru
Dadaab
Jamaame
حمامي
Migori
Olenguruone
Nairobi
Kitui
Karatu
Arusha
Malindi
Mombasa
Tanga

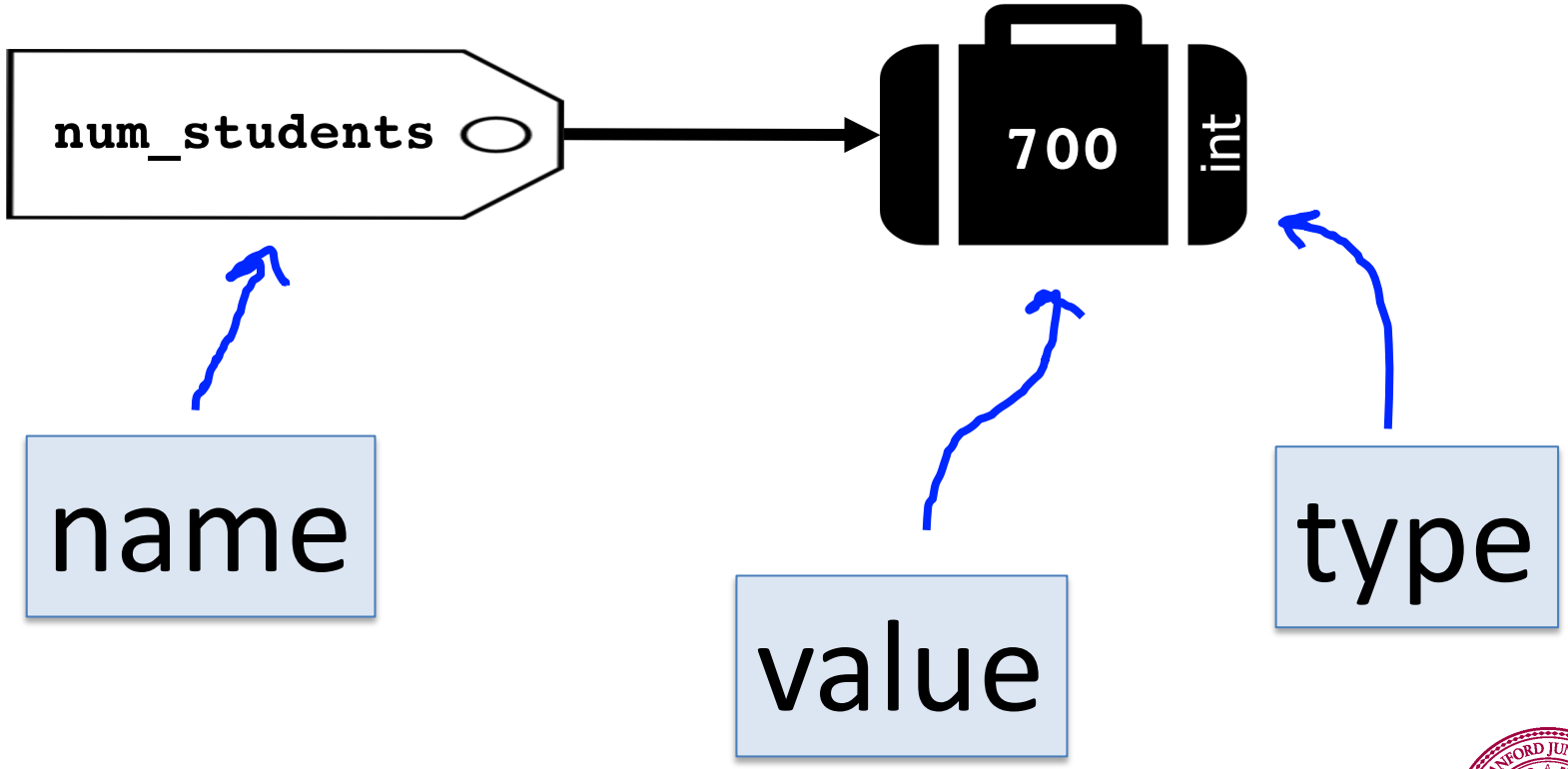
Let’s play a game

Truly important concepts

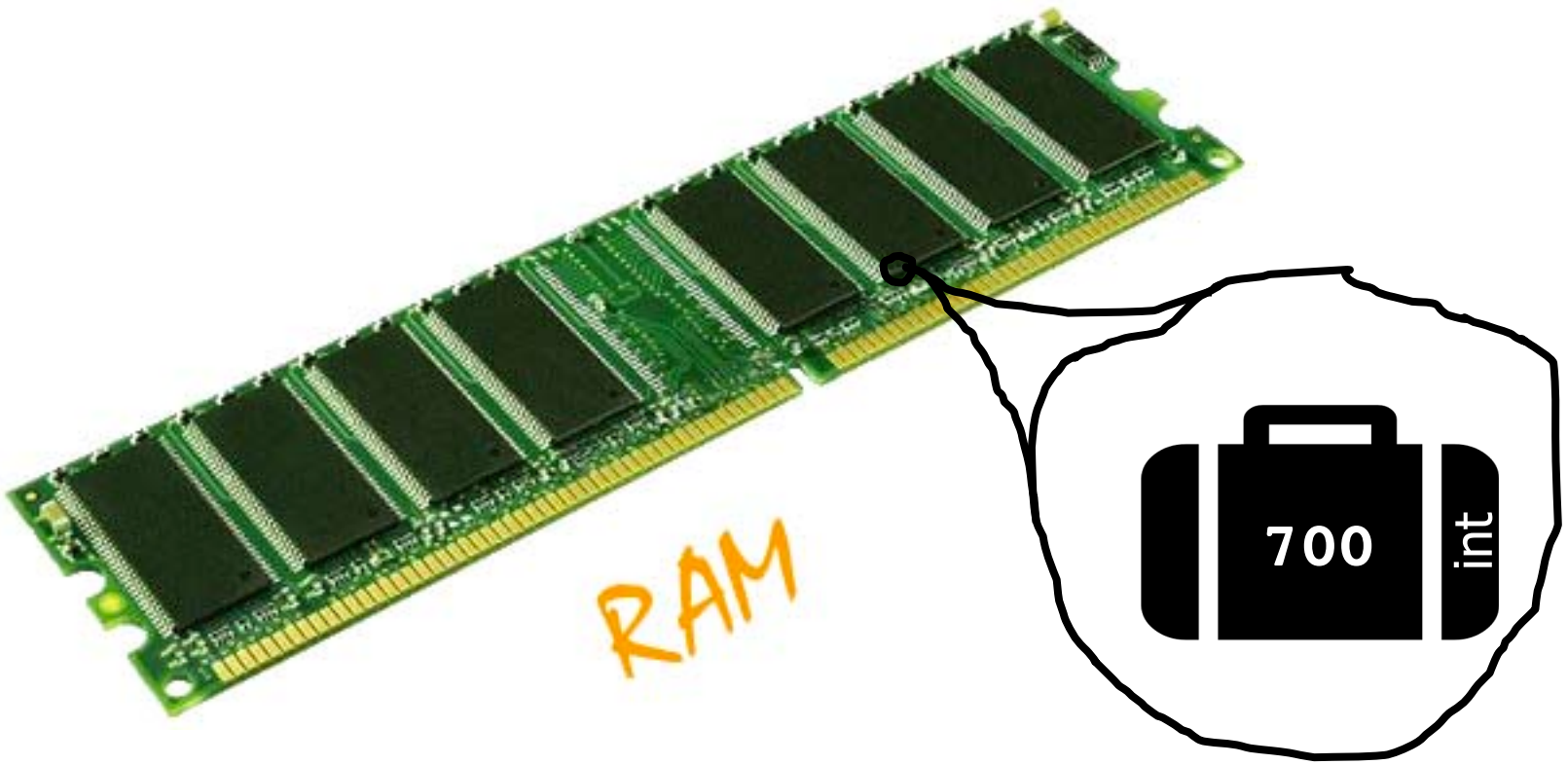
Review

Variable Analogy

```
num_students = 700
```



Teeny Tiny Suitcases



My computer has space for about 2 billion boxes

Create, Modify, Use

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# Create a variable, of type int
# called age with the value 30.
age = 31

# Modify age to be one greater.
age = age + 1

# Use the value in age (output it)
print("age is: " + age)
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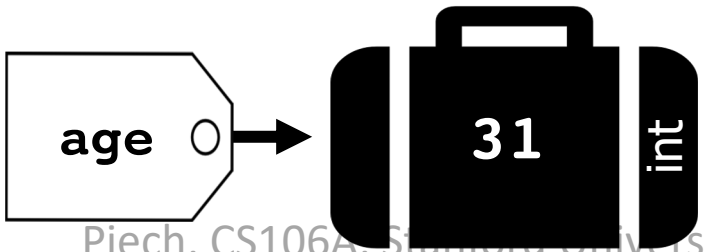

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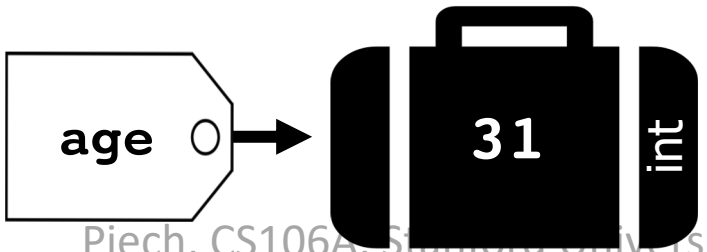

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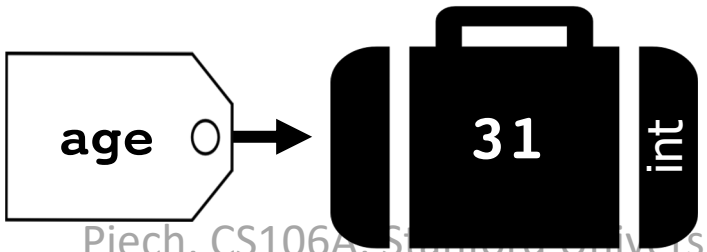

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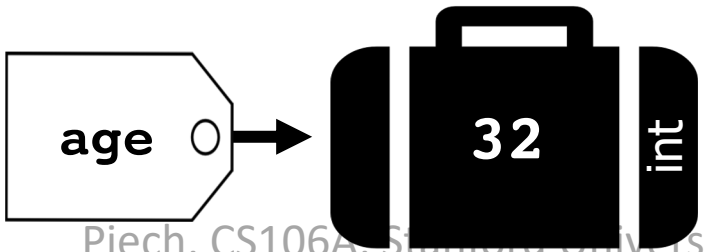

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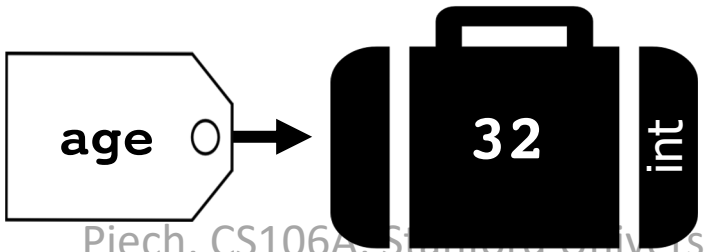

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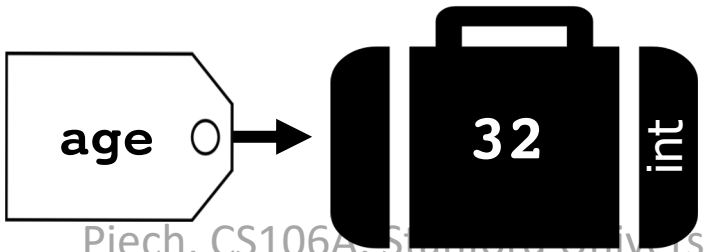


Binary Operators

+	Addition	*	Multiplication
–	Subtraction	/	Division

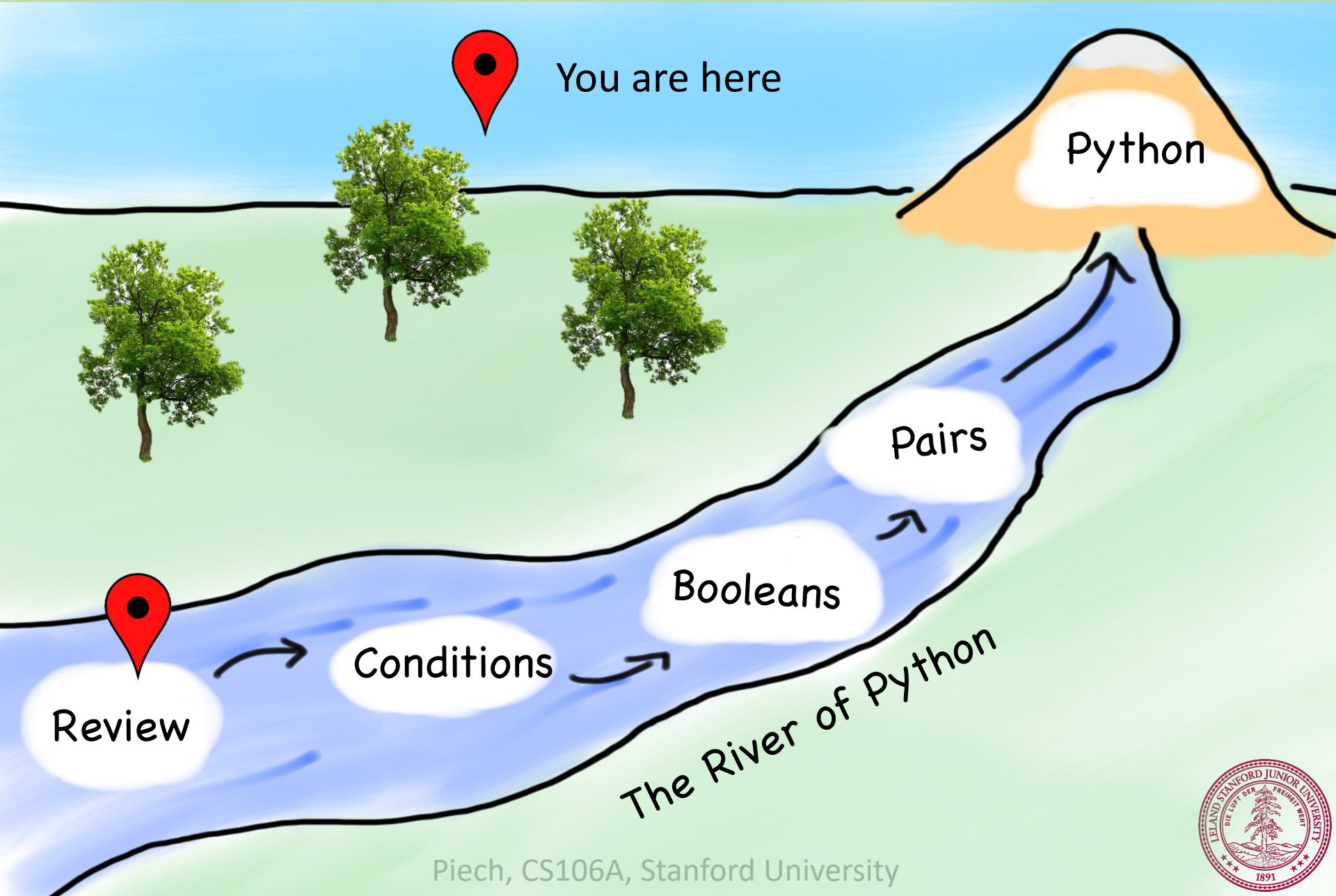
There are others too!

%	Remainder	//	Int Division
**	Exponentiation		

Today's Goal

1. Be able to use While and If in Python
2. Combine loops and variables

Today's Route



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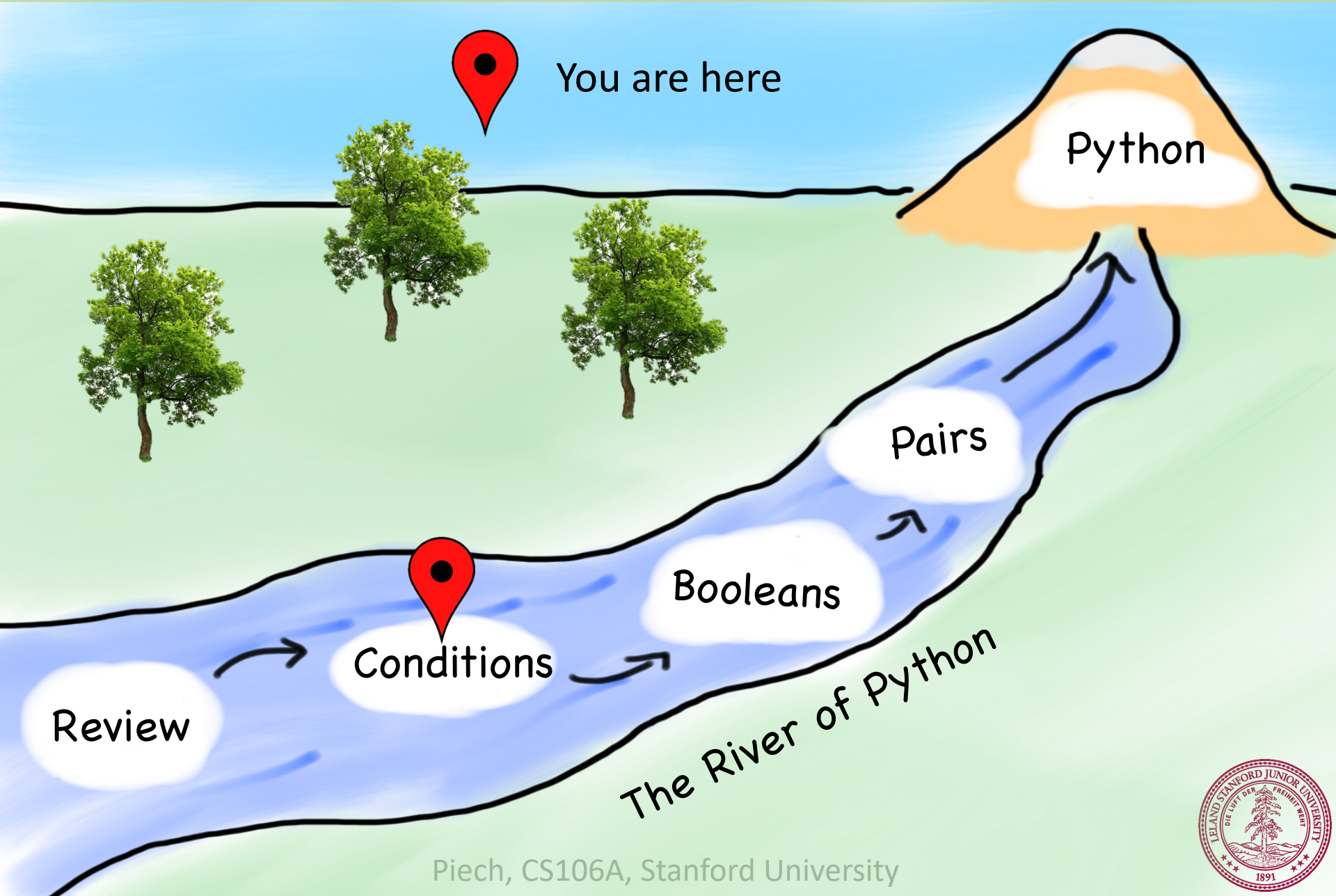

While Loop in Karel

```
while front_is_clear() :
    body
```

```
if beepers_present() :
    body
```


While Loop Redux

```
while condition :
    body
```

```
if condition :
    body
```

The condition should be a “boolean” which is either **`True`** or **`False`**

Loops in Python

Use **`while`** and **`if`** statements in Python.

They are the same as in Karel, except that the *test* can be any expression that evaluates to **True** or **False**

Conditions?

Anything that resolves to a "**True**" or "**False**" answer is a condition

$$1 < 2$$

Conditions

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$$1 < 2$$

True

Conditions

Anything that resolves to a "**True**" or "**False**" answer is a condition


```
my_var < 2
```

True

First Example

```
while 1 < 2 :
    print("programming is awesome!")
    print("woot")
```


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Comparison Operators

Operator	Meaning	Example	Value
==	equals	`1 + 1 == 2`	`True`
!=	does not equal	`3.2 != 2.5`	`True`
<	less than	`10 < 5`	`False`
>	greater than	`10 > 5`	`True`
<=	less than or equal to	`126 <= 100`	`False`
>=	greater than or equal to	`5.0 >= 5.0`	`True`

* All have equal precedence

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= vs ==

In python:

==

Is a comparison operator

=

Is used for variable assignment

Comparison Operators

```
if 1 < 2 :
   print("1 is less than 2")
```

```
num = int(input("Enter a number: "))
if num == 0:
   print("That number is 0")
else :
   print("That number is not 0.")
```

This is a condition

If Else Revisited

```
num = int(input("Enter a number: "))
if num == 0:
   print("Your number is 0 ")
else:
   if num > 0:
      print("Your number is positive")
   else:
      print("Your number is negative")
```

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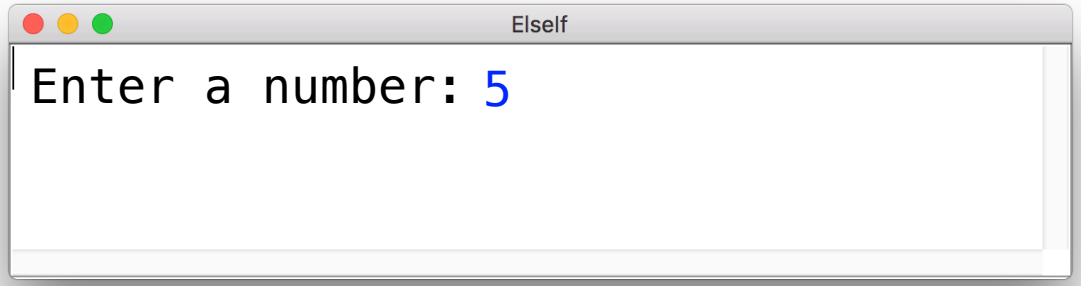

If Else Revisited

5

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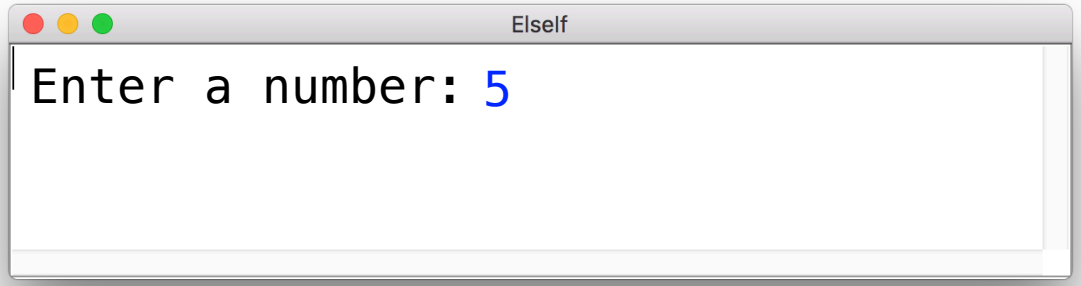

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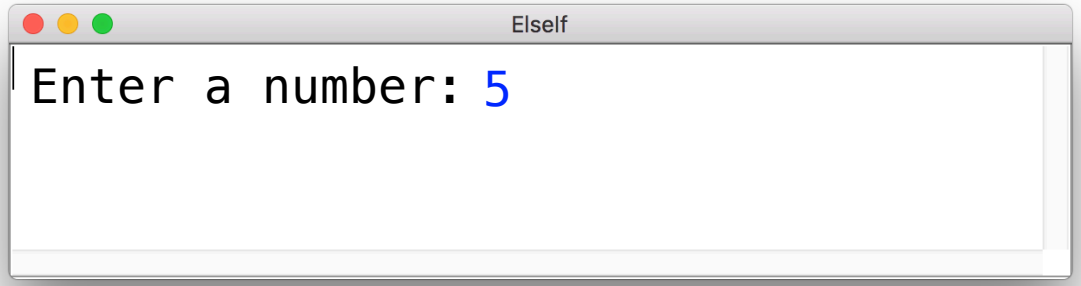

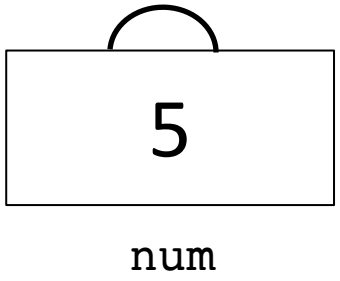

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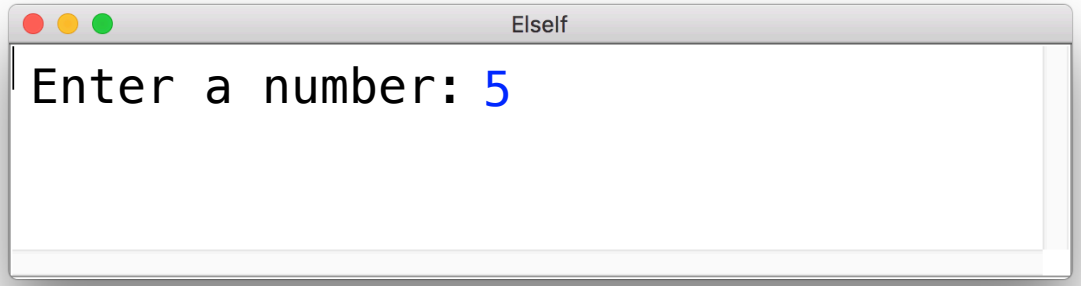

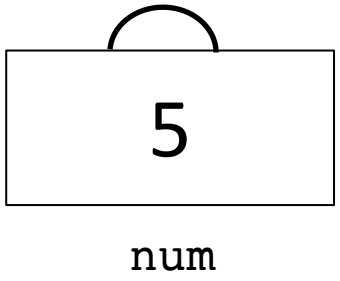

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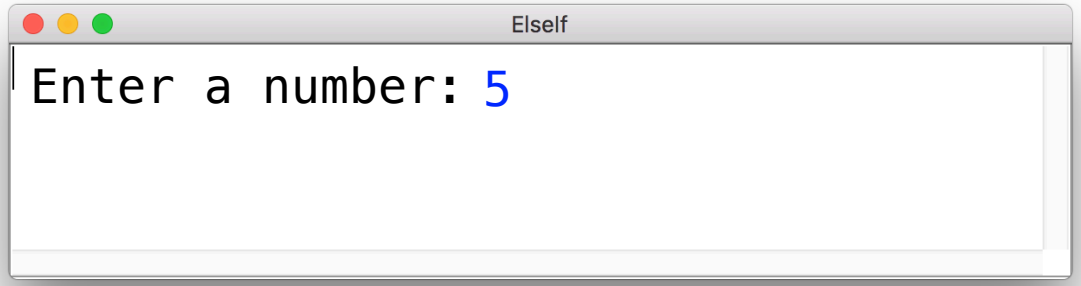

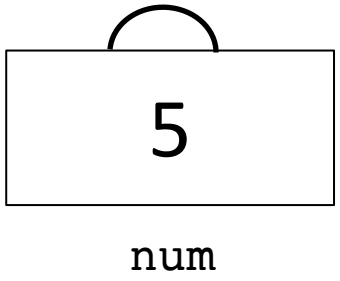

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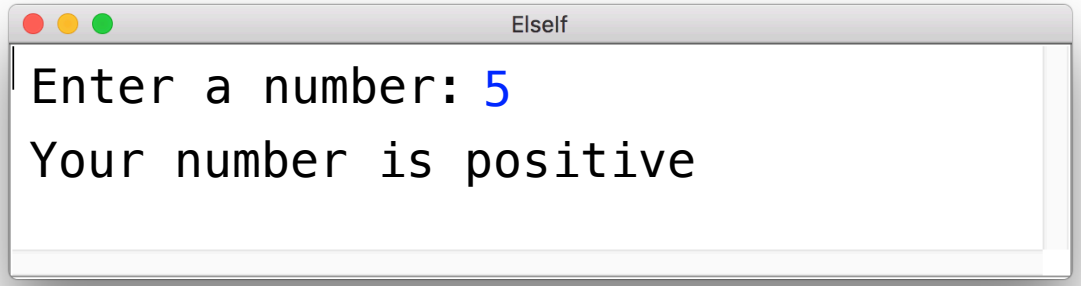

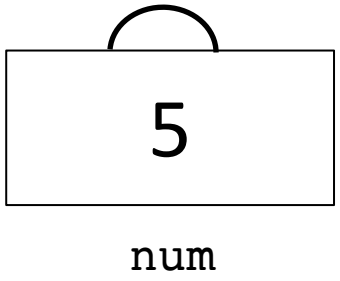

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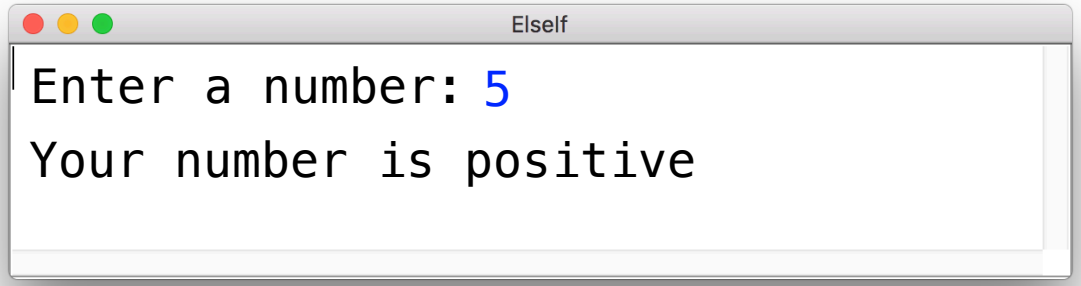

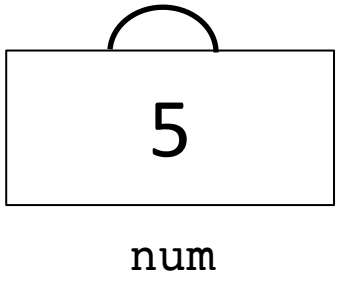

Lets do it again!

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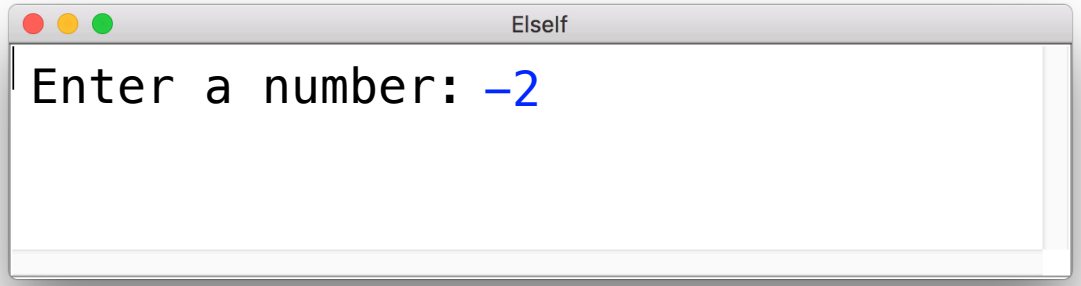

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-2

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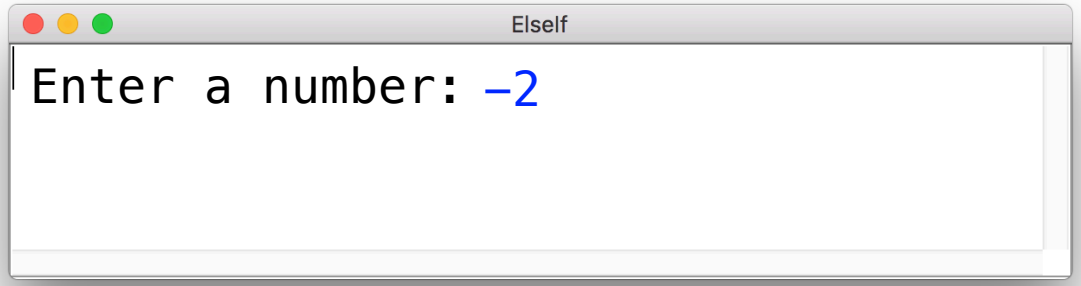

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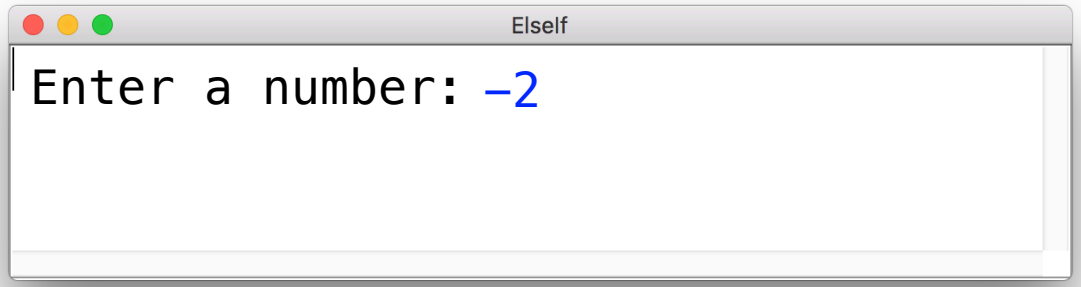

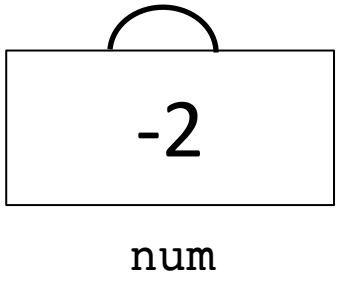

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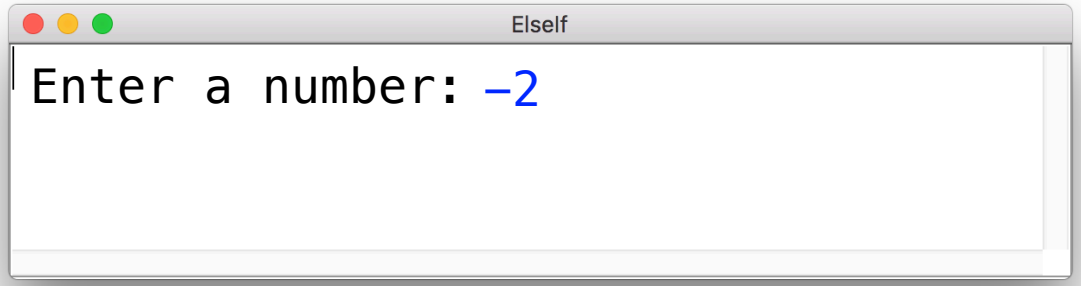

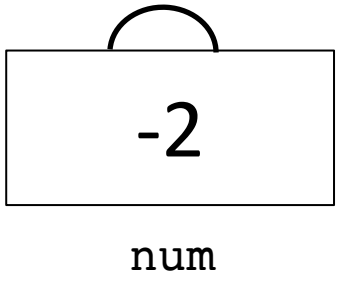

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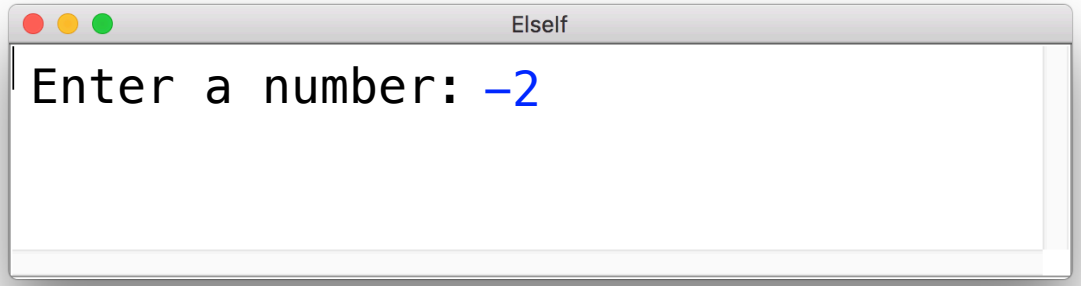

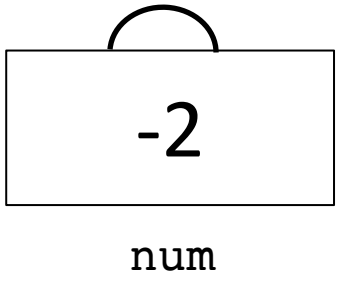

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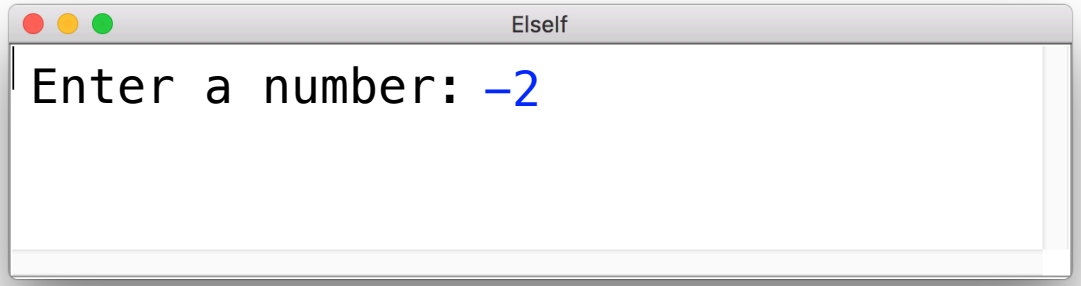

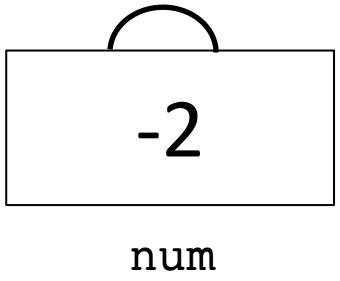

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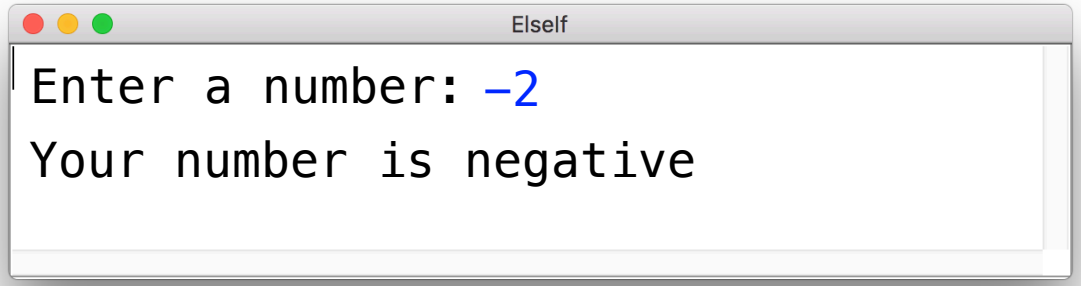
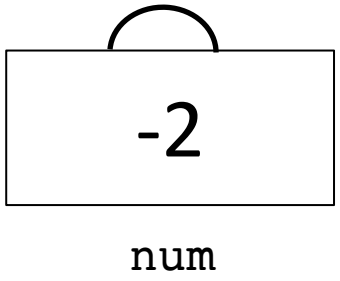




Amazing

Guess My Number

GuessMyNumber

```
I am thinking of a number between 0 and 99...
Enter a guess: 50
Your guess is too high

Enter a new number: 25
Your guess is too low

Enter a new number: 40
Your guess is too low

Enter a new number: 45
Your guess is too low

Enter a new number: 48
Congrats! The number was: 48
```

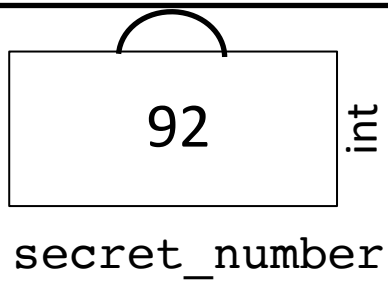
Brace yourself!

Guess My Number

```
secret_number = random.randint(1, 99)
print("I am thinking of a number between 1 and 99...")
guess = int(input("Enter a guess: "))
# True if guess is not equal to secret number
while guess != secret_number:
    # True if guess is less than secret number
    if guess < secret_number:
        print("Your guess is too low")
    else:
        print("Your guess is too high")

    print("") # an empty line
    guess = int(input("Enter a new guess: "))

print("Congrats! The number was: " + str(secret_number))
```



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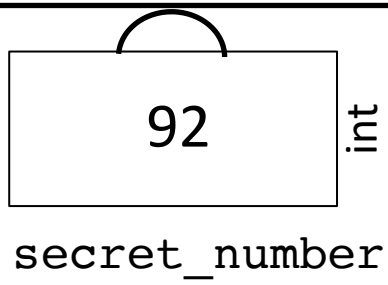
    print("") # an empty line
    guess = int(input("Enter a new guess: "))

print("Congrats! The number was: " + str(secret_number))
```



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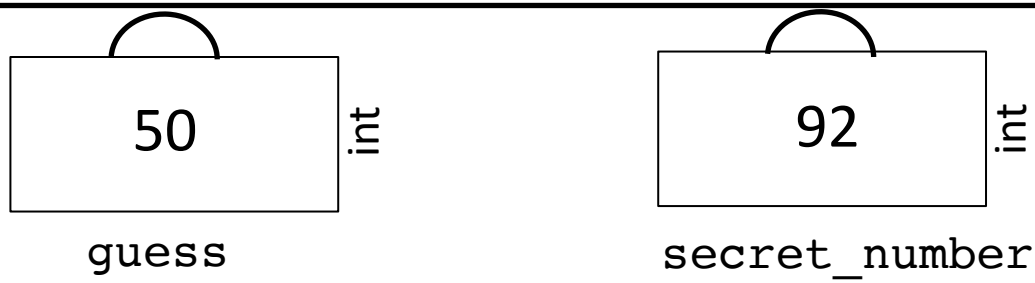

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```

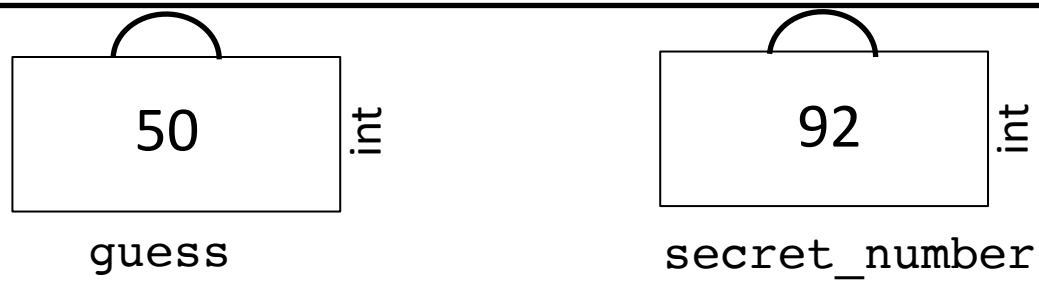

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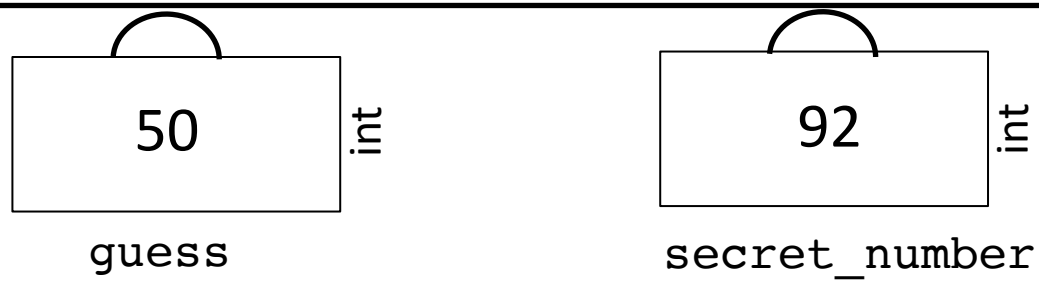
```



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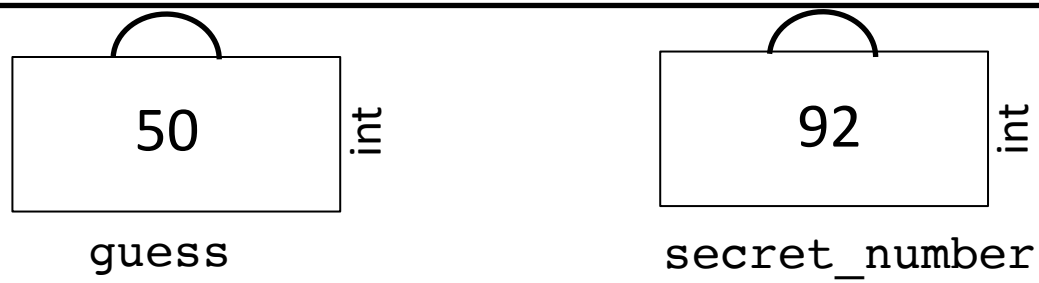

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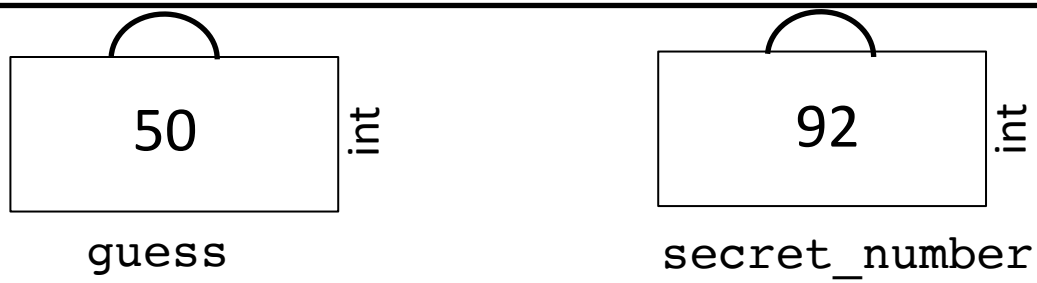

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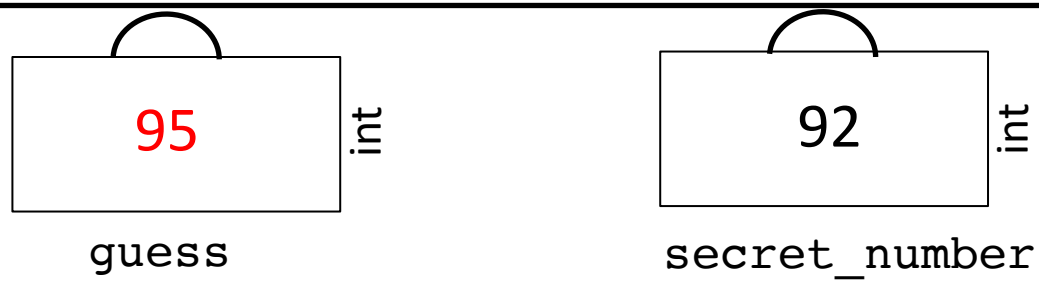

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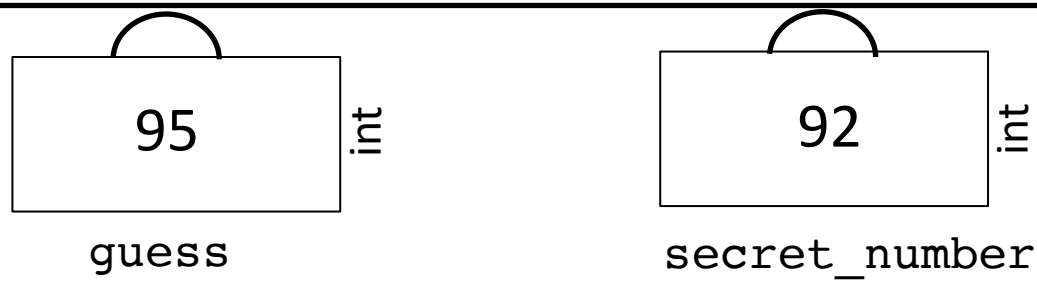

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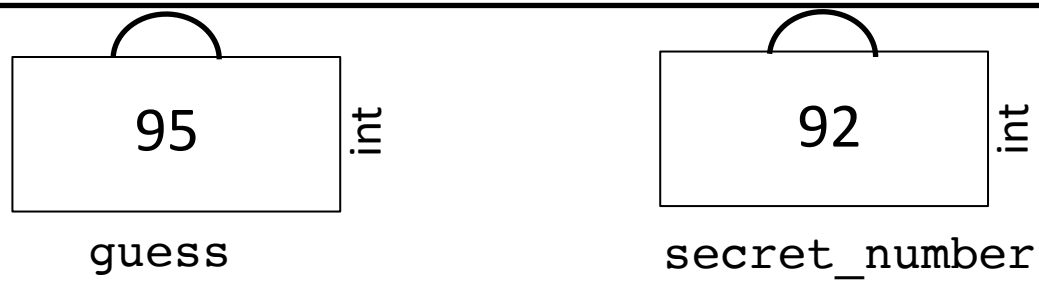

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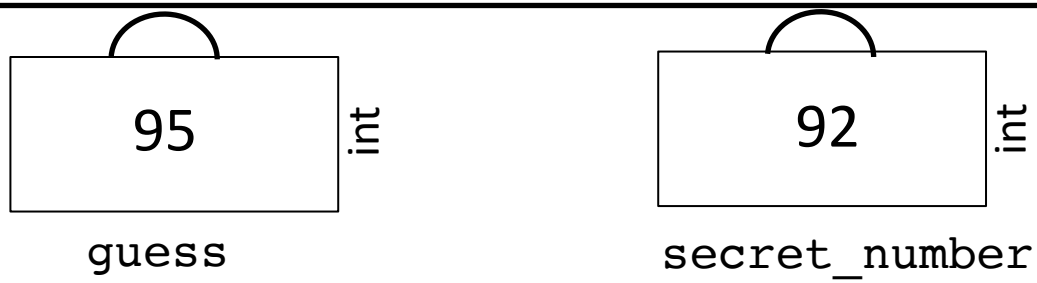

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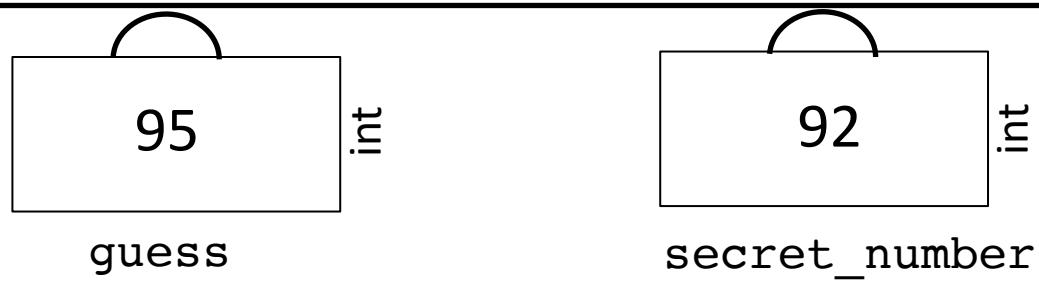

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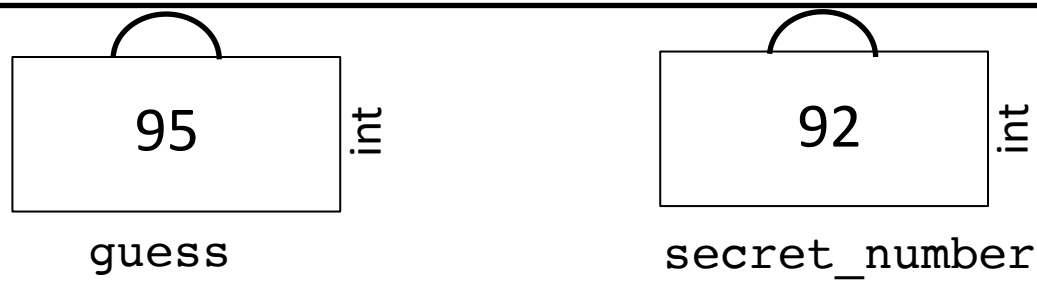

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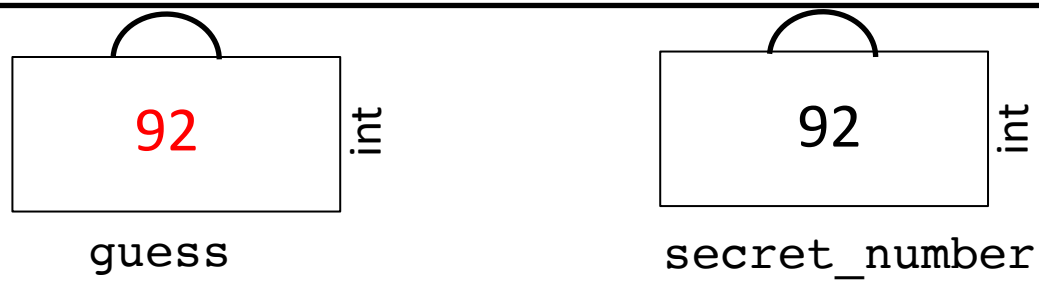

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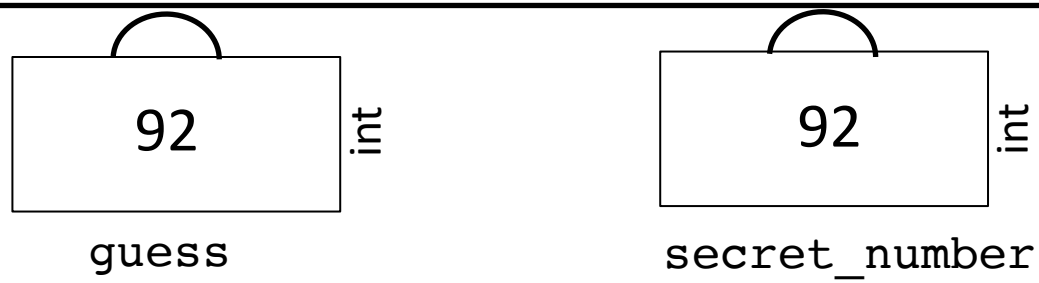

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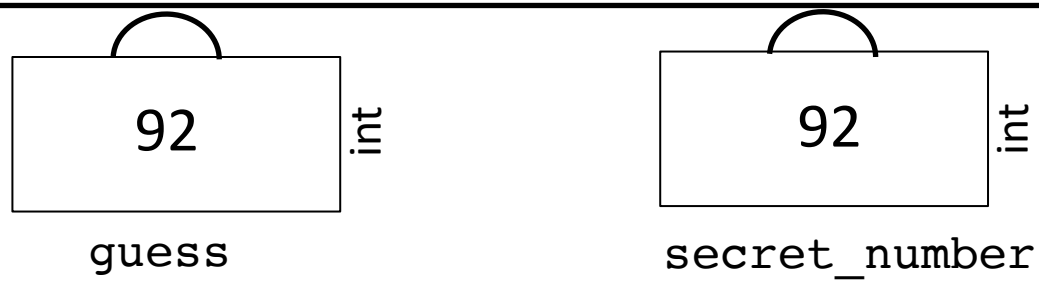

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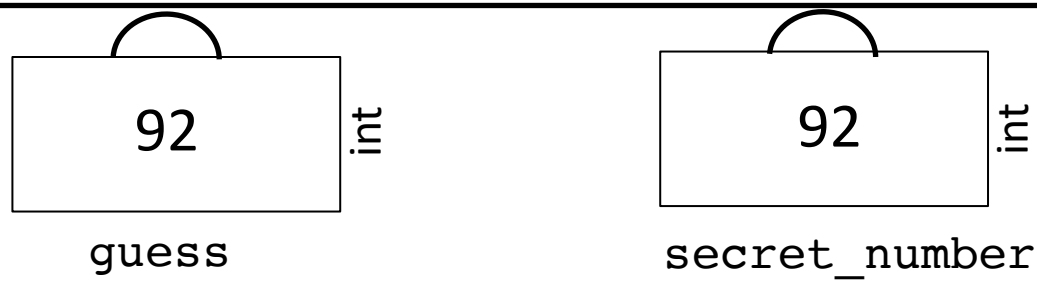

Conditions in Python

Think about what variables you want to declare before the loop starts!

Guess My Number

```
secret_number = random.randint(1, 99)
print("I am thinking of a number between 1 and 99...")
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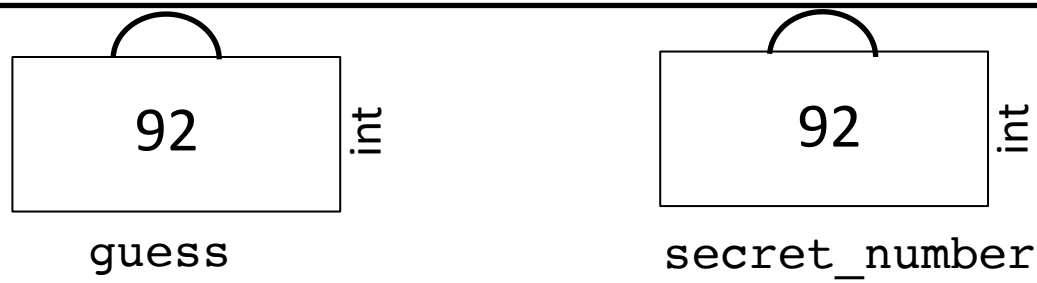

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print("Congrats! The number was: " + str(secret_number))
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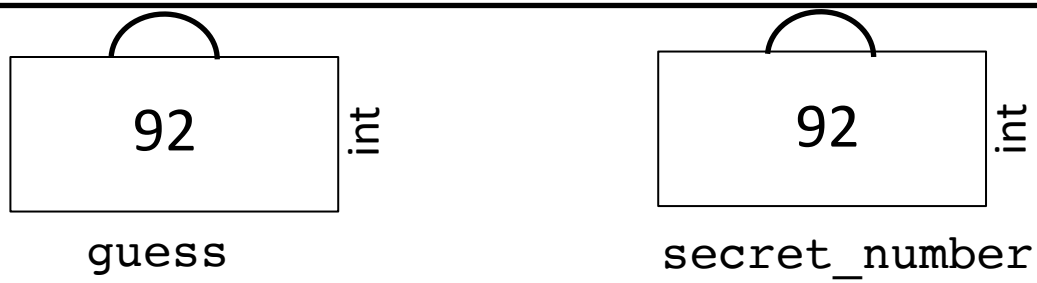
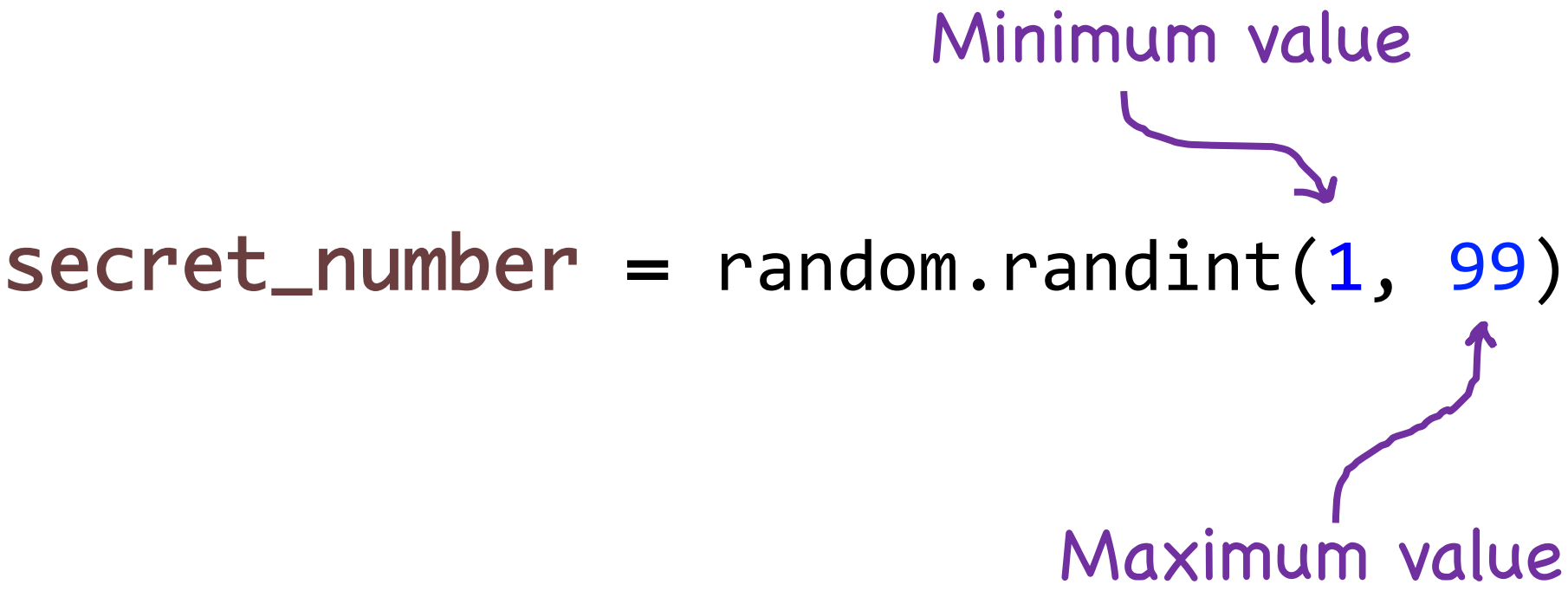


Random Integers



Challenge: Three Sixes in a row

- Write a program that simulates one **dice roll** at a time. Count how many dice rolls until you get **three sixes in a row**!

```
You rolled a 6
You rolled a 6
You rolled a 3
You rolled a 2
You rolled a 1
You rolled a 4
You rolled a 6
You rolled a 6
You rolled a 6
Number of times rolled = 152
```

Example: Sentinel Loops

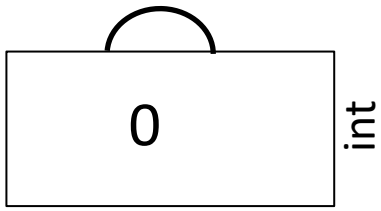
```
def main():
    num_dice_rolls = 0
    # repeat these lines
    dice_value = random.randint(1, 6)
    num_dice_rolls += 1

    print(num_dice_rolls)
```


Example: Sentinel Loops

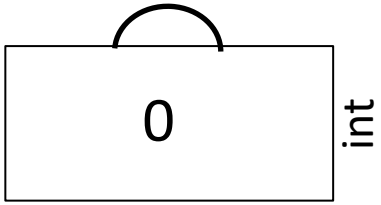
```
def main():
    num_dice_rolls = 0
    sixes_in_a_row = 0
    while sixes_in_a_row < GOAL_IN_A_ROW:
        dice_value = random.randint(1,6)
        print('You rolled a ' + str(dice_value))
        if dice_value == GOAL_VALUE:
            sixes_in_a_row += 1
        else:
            sixes_in_a_row = 0
        num_dice_rolls += 1
    print(num_dice_rolls)
```


Example: Sentinel Loops

```
def main():
    num_dice_rolls = 0
    sixes_in_a_row = 0
    while sixes_in_a_row < GOAL_IN_A_ROW:
        dice_value = random.randint(1,6)
        print('You rolled a ' + str(dice_value))
        if dice_value == GOAL_VALUE:
            sixes_in_a_row += 1
        else:
            sixes_in_a_row = 0
        num_dice_rolls += 1
    print(num_dice_rolls)
```



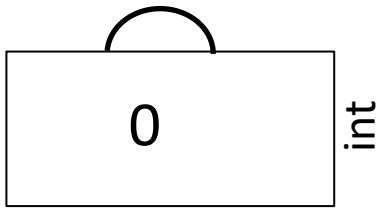
num_dice_rolls



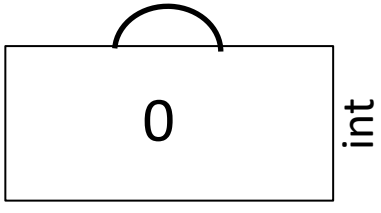
sixes_in_a_row

Example: Sentinel Loops

```
def main():
    num_dice_rolls = 0
    sixes_in_a_row = 0
    while sixes_in_a_row < GOAL_IN_A_ROW:
        dice_value = random.randint(1,6)
        print('You rolled a ' + str(dice_value))
        if dice_value == GOAL_VALUE:
            sixes_in_a_row += 1
        else:
            sixes_in_a_row = 0
        num_dice_rolls += 1
    print(num_dice_rolls)
```



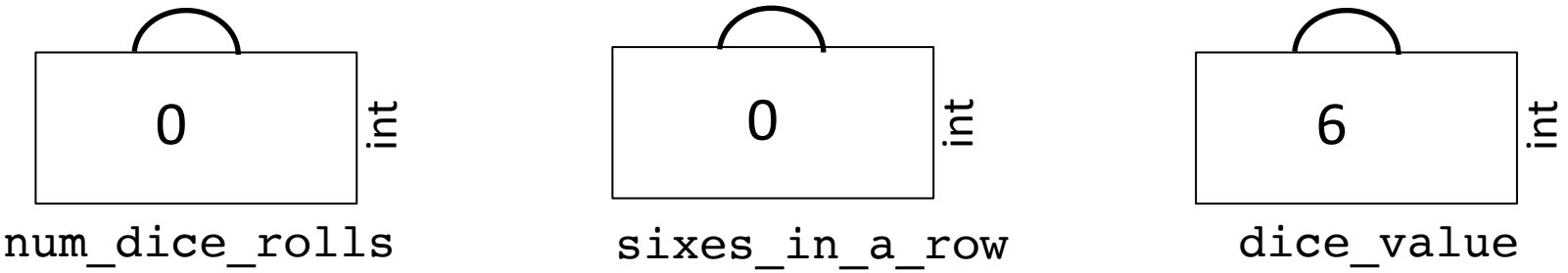
num_dice_rolls



sixes_in_a_row

Example: Sentinel Loops

```
def main():
    num_dice_rolls = 0
    sixes_in_a_row = 0
    while sixes_in_a_row < GOAL_IN_A_ROW:
        dice_value = random.randint(1,6)
        print('You rolled a ' + str(dice_value))
        if dice_value == GOAL_VALUE:
            sixes_in_a_row += 1
        else:
            sixes_in_a_row = 0
        num_dice_rolls += 1
    print(num_dice_rolls)
```



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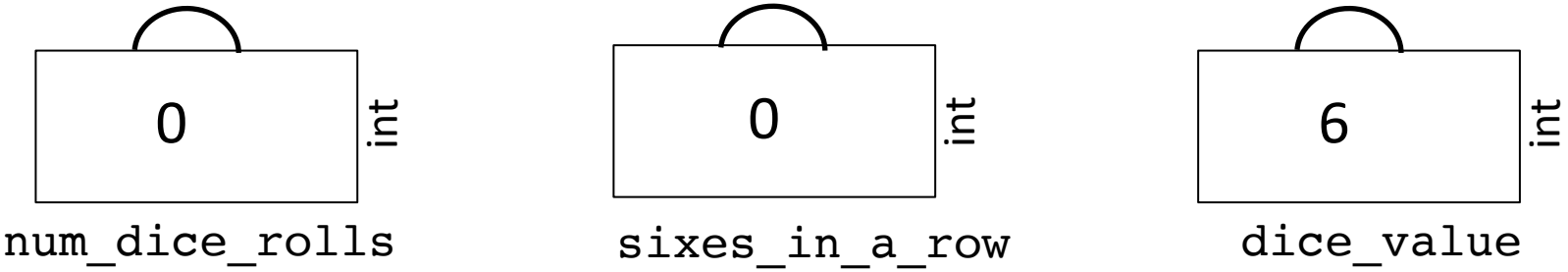
```



Example: Sentinel Loops

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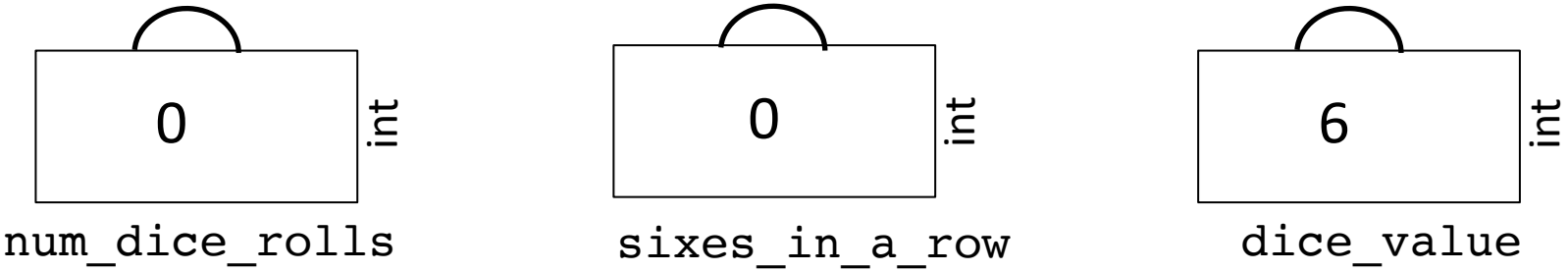

Example: Sentinel Loops

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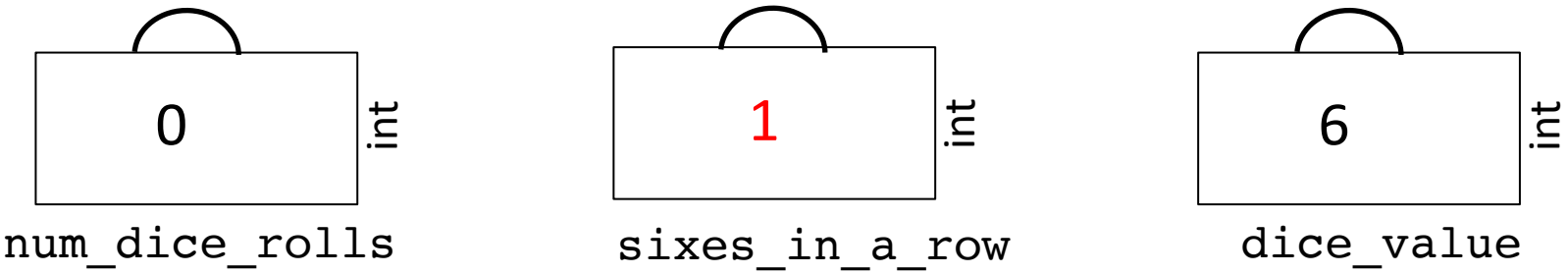

Example: Sentinel Loops

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    num_dice_rolls = 0
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        dice_value = random.randint(1,6)
        print('You rolled a ' + str(dice_value))
        if dice_value == GOAL_VALUE:
            sixes_in_a_row += 1
        else:
            sixes_in_a_row = 0
        num_dice_rolls += 1
    print(num_dice_rolls)
```
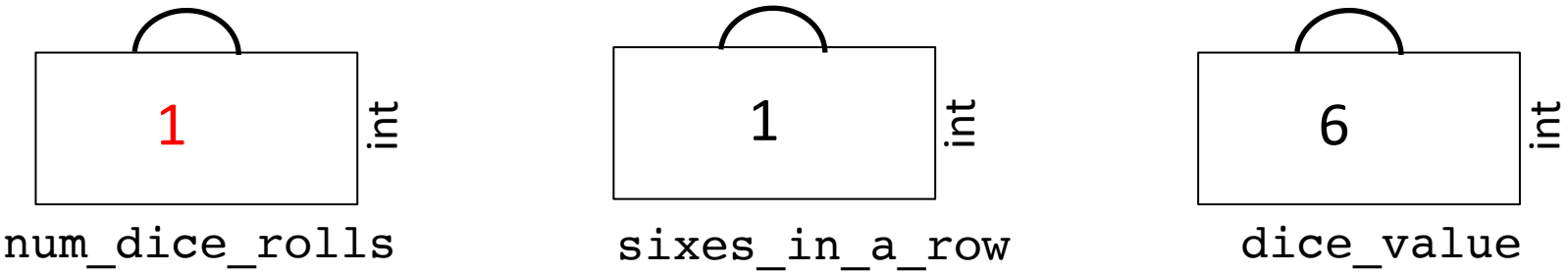
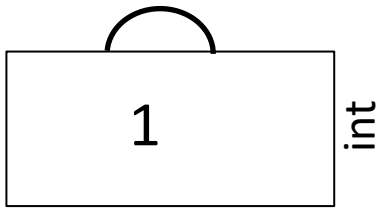
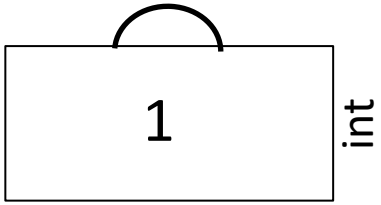



Example: Sentinel Loops

```
def main():
    num_dice_rolls = 0
    sixes_in_a_row = 0
    while sixes_in_a_row < GOAL_IN_A_ROW:
        dice_value = random.randint(1,6)
        print('You rolled a ' + str(dice_value))
        if dice_value == GOAL_VALUE:
            sixes_in_a_row += 1
        else:
            sixes_in_a_row = 0
        num_dice_rolls += 1
    print(num_dice_rolls)
```



num_dice_rolls



sixes_in_a_row

Example: Sentinel Loops

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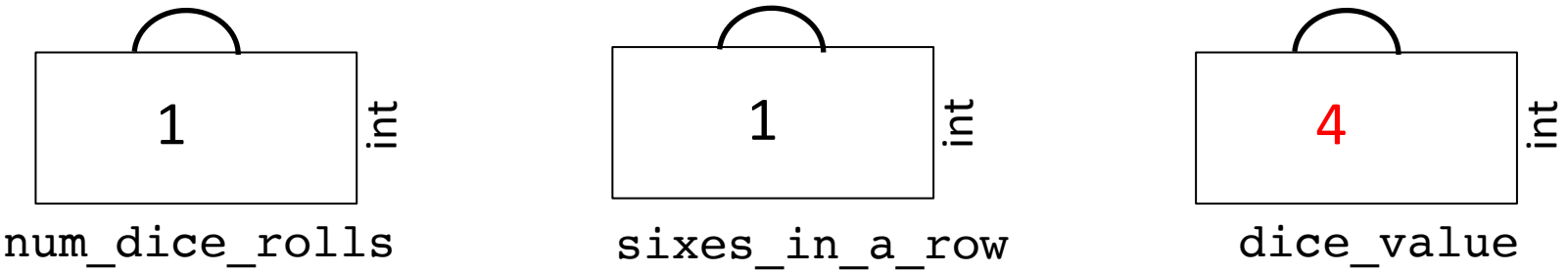
```



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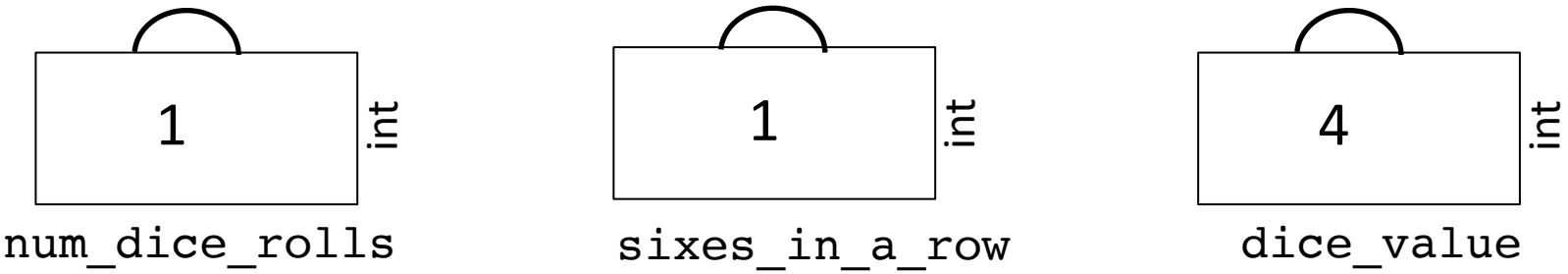

Example: Sentinel Loops

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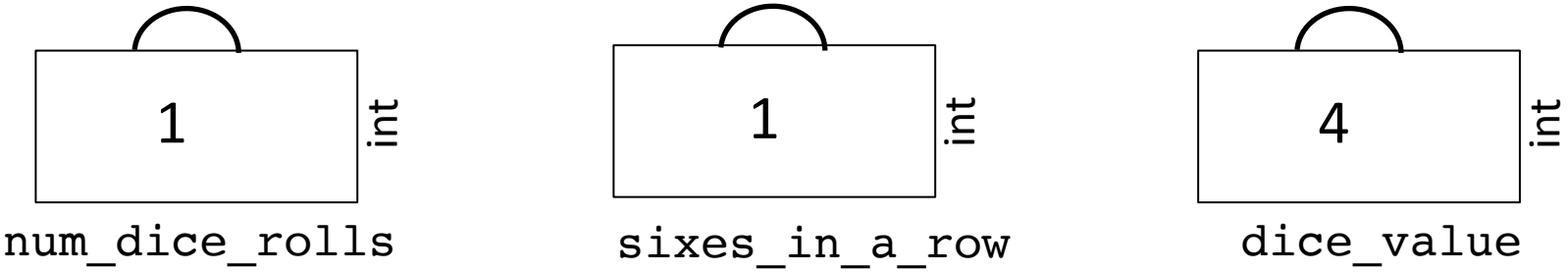

Example: Sentinel Loops

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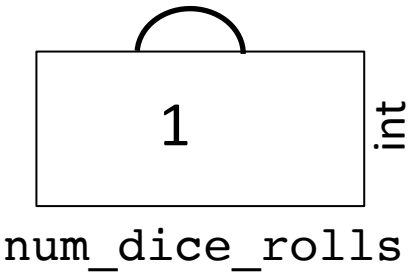

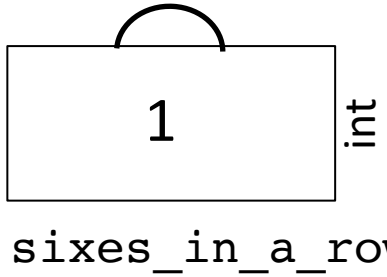

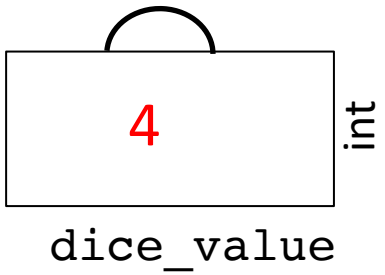

Example: Sentinel Loops

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        num_dice_rolls += 1
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```

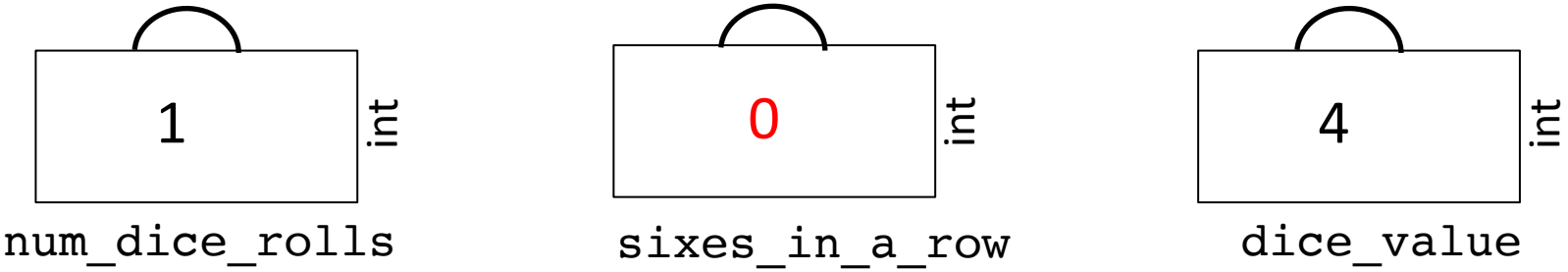

Example: Sentinel Loops

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def main():
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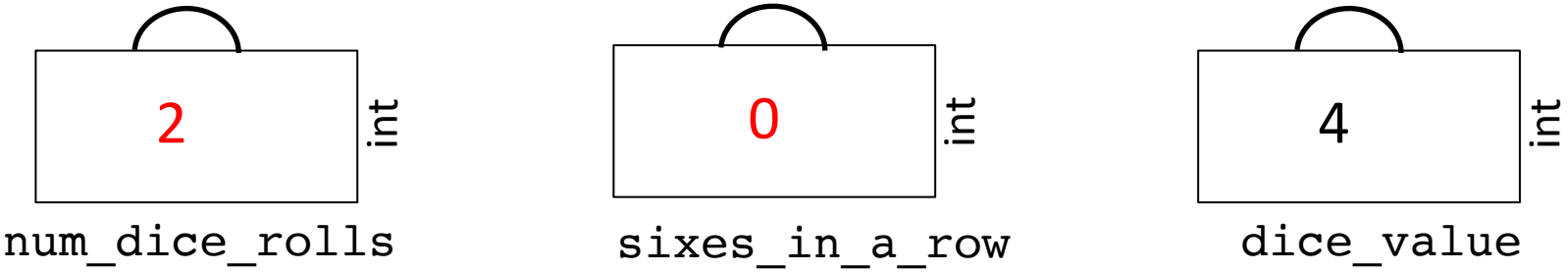
        num_dice_rolls += 1
    print(num_dice_rolls)
```



Example: Sentinel Loops

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        else:
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        num_dice_rolls += 1
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```
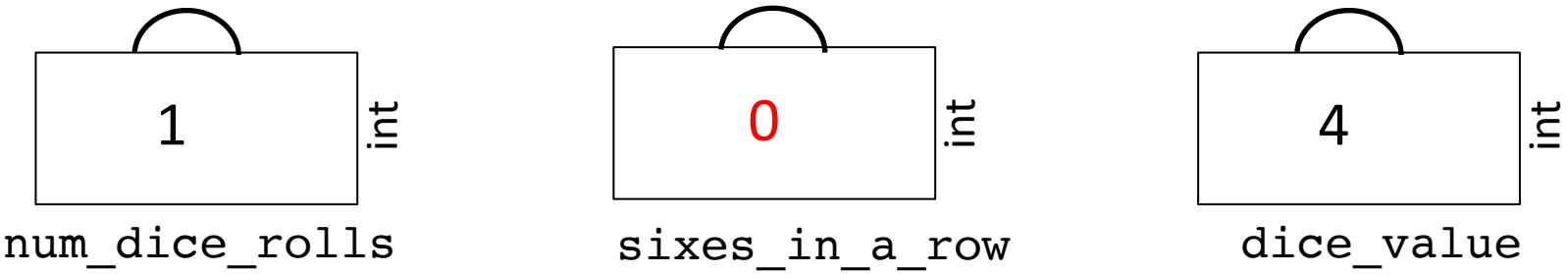
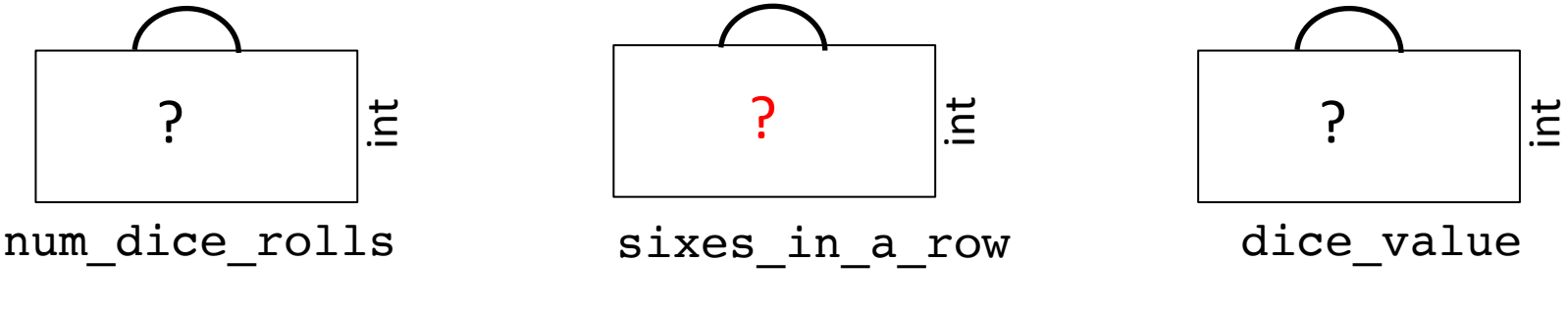



When will it get to this line?

```
def main():
    num_dice_rolls = 0
    sixes_in_a_row = 0
    while sixes_in_a_row < GOAL_IN_A_ROW:
        dice_value = random.randint(1,6)
        print('You rolled a ' + str(dice_value))
        if dice_value == GOAL_VALUE:
            sixes_in_a_row += 1
        else:
            sixes_in_a_row = 0
        num_dice_rolls += 1
    print(num_dice_rolls)
```



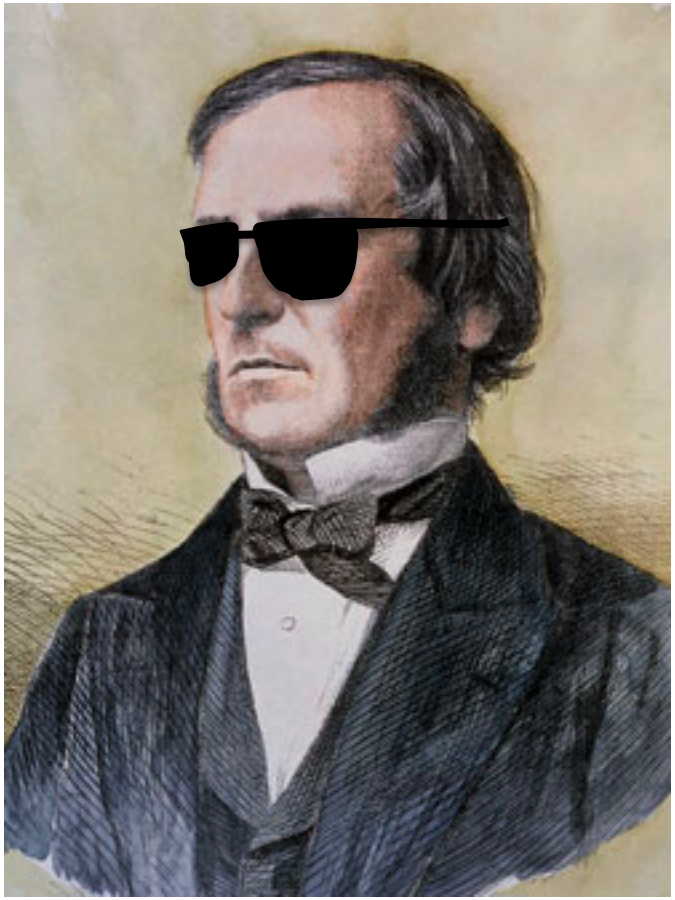
Logical Operators

In order of precedence:

Operator	Example	Result
`not`	`not (2 == 3)`	`True`
`and`	`(2 == 3) and (-1 < 5)`	`False`
`or`	`(2 == 3) or (-1 < 5)`	`True`

```
num1 = int(input("Enter a positive number: "))
num2 = int(input("Enter another number: "))

if num1 < 0 or num2 < 0:
    print("invalid input")
```

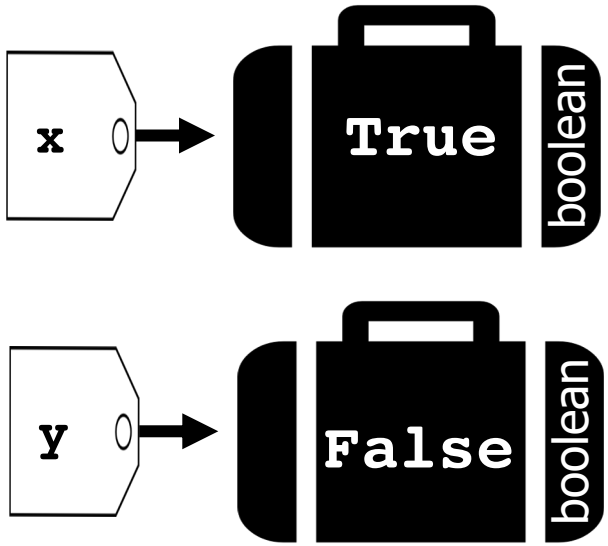

George Boole



English Mathematician teaching in Ireland 1815 – 1864
Boole died of being too cool

Boolean Variables

```
# Store expressions that evaluate to True/False
x = 1 < 2     # True
y = 5.0 == 4.0  # False
```



Boolean Variables

```
# Store expressions that evaluate to True/False
x = 1 < 2    # True
y = 5.0 == 4.0  # False

# Directly set to True/False
is_teaching = True
is_rock_climbing = False
```


Boolean Variables

```
# Store expressions that evaluate to True/False
x = 1 < 2    # True
y = 5.0 == 4.0  # False

# Directly set to True/False
is_teaching = True
is_rock_climbing = False

play_again = input('Play again? "y" or "n"') == 'y'
if play_again:
    ...
```



Please ...
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DRINKS
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*know your logical precedence


```
food = True
drinks = True
is_allowed = not food or drinks
```

*know your logical precedence


```
food = True
drinks = True
is_allowed = not food or drinks
```

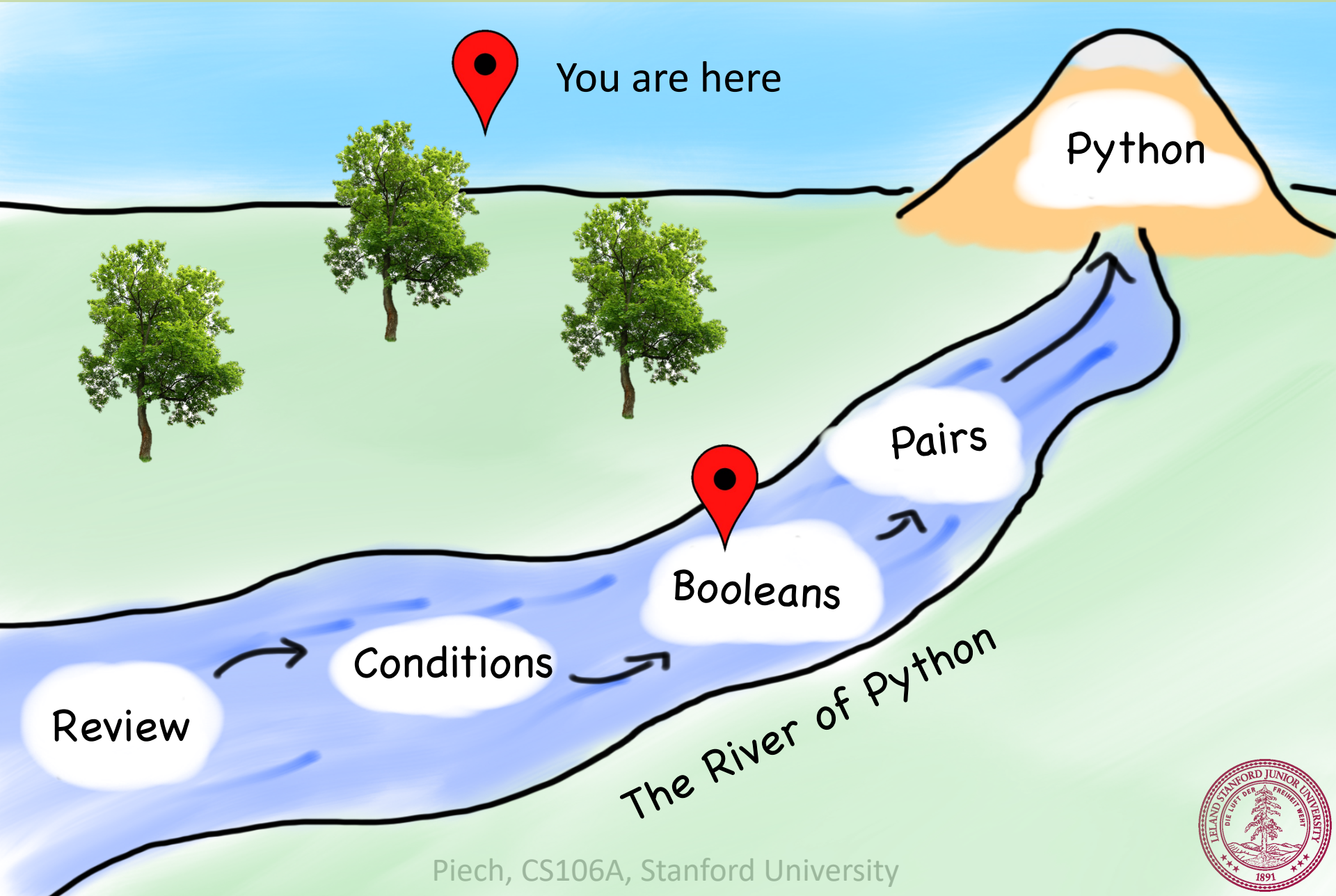
False

*know your logical precedence

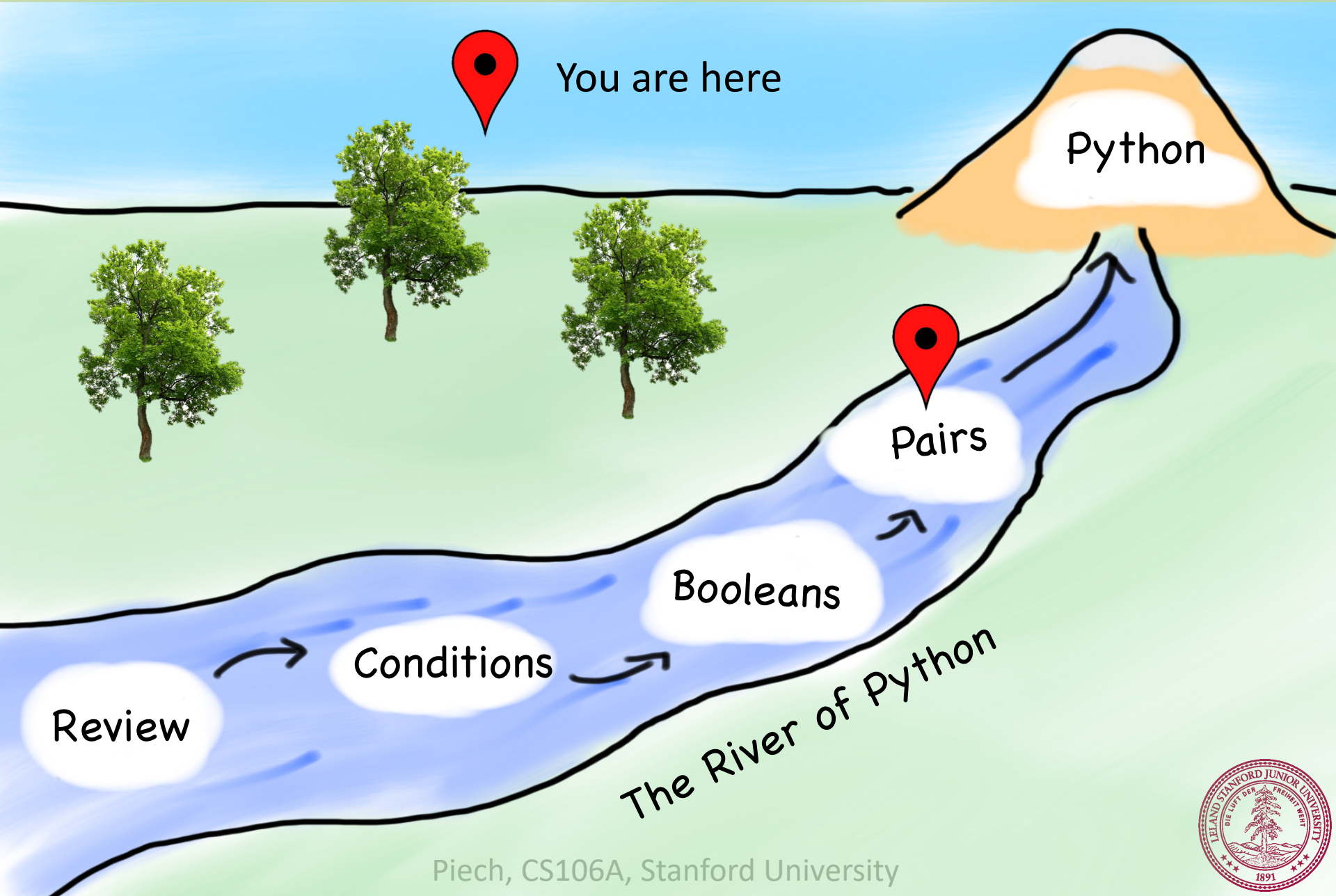

```
food = True
drinks = True
is_allowed = not food or drinks
```

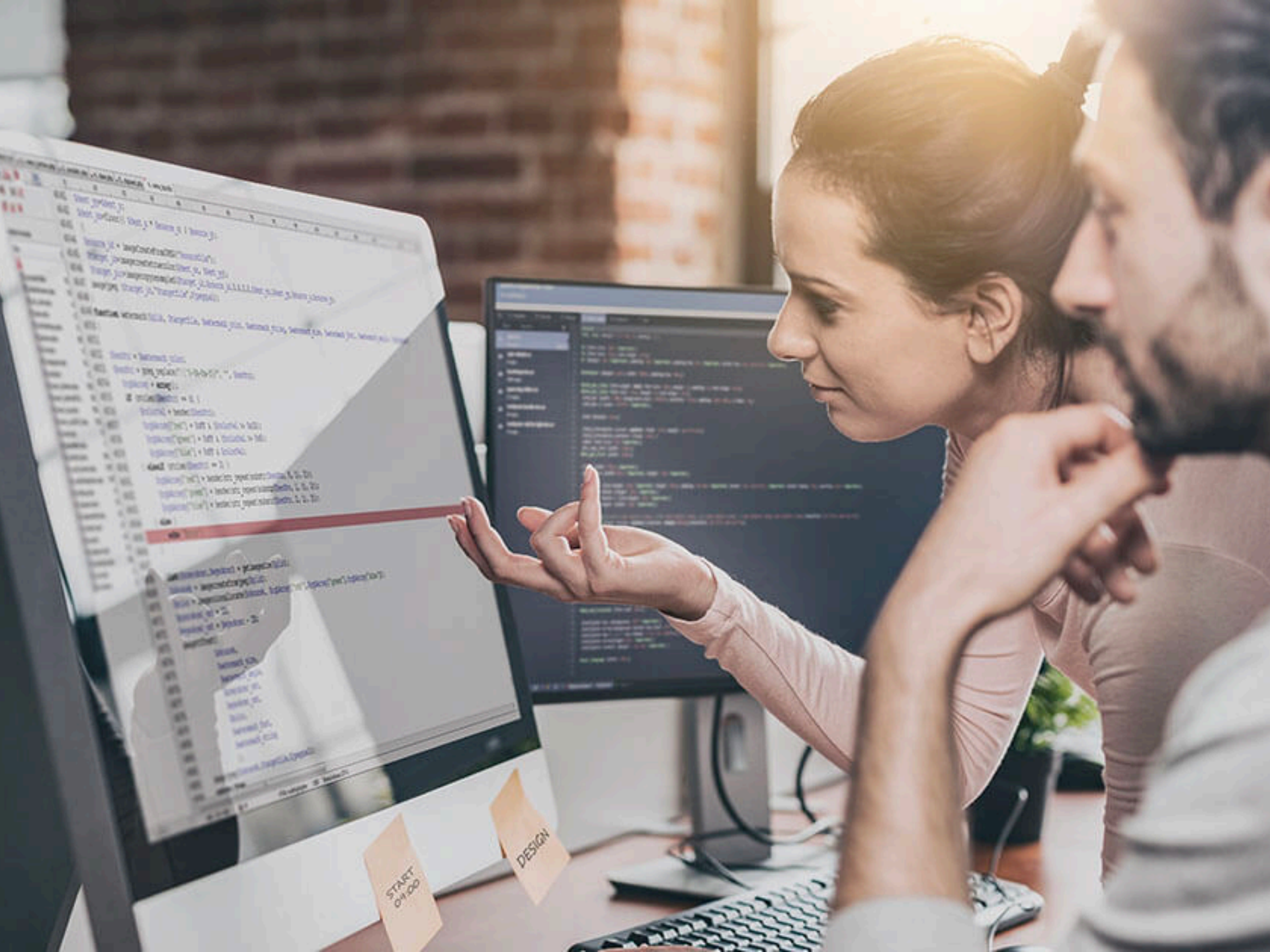
False True

Today's Route

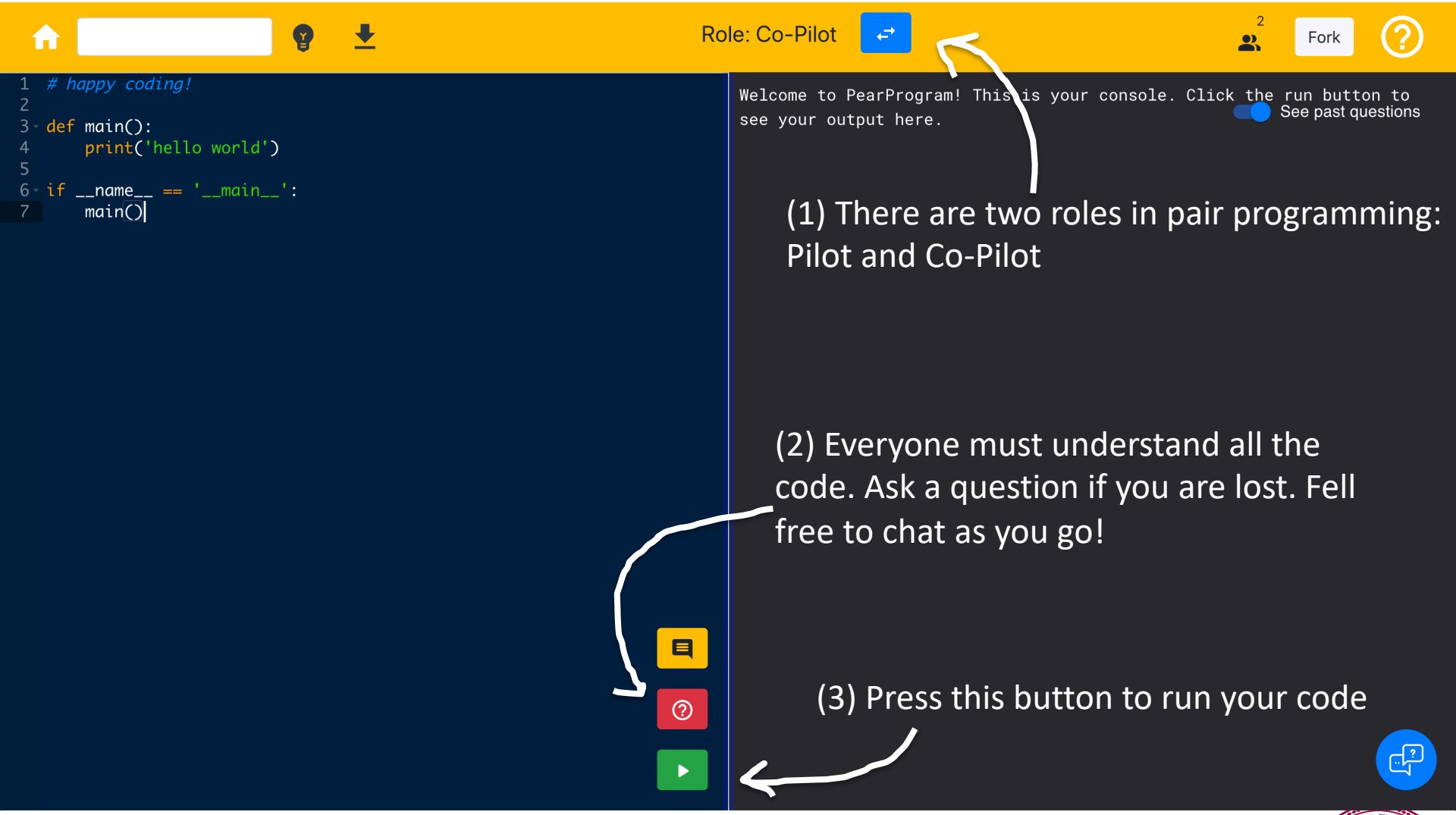


Today's Route




START
DESIGN

Learning to pair program



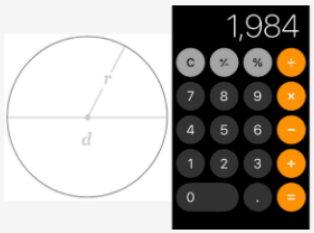
Truly important afternoon

This is hard! Learn a little each day.

Today's Goal

1. Be able to use While and If in Python
2. Combine loops and variables

Evening Project [here]



Area Calculator

Quickstart

SL Notes

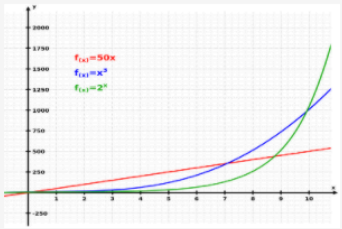
Variables

8 Ball

Section

SL Notes

Conditionals



Viral Video

Section

SL Notes

Conditionals

Khansole Academy

Project

SL Notes

Conditionals