Code in Place 2024

Stanford CS106A

Section - Week 3

Programming with the Python Console

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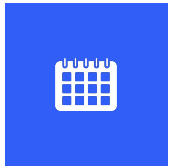
Today's Agenda



1. Check-In

How are we all doing?

2. Concepts Review

Console Programming, Expressions

3. Practice Problem #1

"Mars Weight"

4. Practice Problem #2

"Planetary Weight"

Check-In

How is everyone doing?
Hopefully your second week of CIP went well!

- If you could have Karel know a 5th default command, what would it be?

Concepts Review

Intro to Console Programming

Welcome to real-life Python world!
No longer restricted to Karel's world with only 4 commands!

Basic commands for today's Exercise:

`print()`

- Prints text or value to console.
- Example:
  - `print("Hello, world!")`
  - `print(42)`

`input()`

- Requests the user to type in an input, which can be stored as a string.
- Example:
  - `user_height = input("Please enter your height: ")`
  - `print(user_height)`

Variables

- A **variable** is a place to store information in a program.

- Creating and assigning a new variable:
  - `variable_name = value or expression`

```
x = 10                  # Assign the value 10 to the variable named “x”
x = 5                   # The value of “x” is now 5
x = 5 + 7               # The value of “x” is now 12
```

Variables: Assignment (=) vs Comparison (==)

Spot the difference

```
x = 64
```

- Assigns the value 64 to a variable named `x`.
- Creates the variable if it didn't already exist.

```
x == 64
```

- Checks if a variable named `x` has the value 64.
- Returns either `true` or `false`.
- Used in `if` statements and `while` loops.

Variables: Python Naming Conventions

- Variable name must:
  - Start with a letter or an underscore (_)
  - Contain only letters, digits, or underscores
  - Cannot be one of the "built-in" Python commands (e.g. `for`)

- Variable names are **case sensitive**
  - `User_height` is not the same as `user_height`

- Use "snake case" for variable names.
  - **Do:** `user_height`
  - **Don't:** `userheight, userHeight`

Variables: Constants

- **Constants** are variables that you think should be a fixed value.
  - Constant names use capital SNAKE_CASE.
  - Examples:
    - `PI = 3.14159`
    - `MINUTES_PER_HOUR = 60`
    - `CAPITAL_OF_FRANCE = “Paris”`

Variables: Data Types

- Each variable needs to know what **Type** of information it's carrying.
- **Some Types in Python:**
  - `int`: integer value (no decimal point)
    - `-2, -1, 0, 1, 2, 3, 4`
  - `float`: real number value (has decimal point)
    - `2.0, -0.39, 3.14159`
  - `string`: text characters (surrounded by single/double quotes)
    - `“Hello CIP!”, ‘Hello CIP!’, “10”, ‘10’`
  - `bool`: Boolean logical values (True or False)
    - `True, False`

Type Casting (aka Converting)

- You can **cast** (aka convert) a variable from one Type to another.
- Python has several built-in functions for type casting. Here are a few you might find helpful:
  - `x = int(y)` `# y is cast to an int`
  - `x = float(y)` `# y is cast to a float`
  - `x = str(y)` `# y is cast to a string`
- Examples:
  - `user_input = int("75")` `# user_input: 75 [Type: int]`
  - `height = float("5.3")` `# height: 5.3 [Type: float]`
  - `total = str(42.9)` `# total: "42.9" [Type: str]`

Combining `strings`

- Different ways of **concatenating** a string:
  - Using plus sign (+) to combine strings.

```
print(“Hello Chris Piech!”)
print(“Hello ” + “Chris ” + “Piech!”)
print(“Hello” + “ ” + “Chris” + “ ” + “Piech!”)
```

  - Using comma (,) to combine multiple arguments.
    - Each argument will be separated by a space.

```
print(“Hello”, “Chris”, “Piech!”)
```


  - There are other ways, such as f-strings! We’ll cover in the future!

Be mindful of Types when using `print()`

- `print(`*`argument`*`)`: **The argument can be any Type.**

```
print(“42”) # string
print(42)   # int
print(42.0) # float
print(True) # bool
```

- You **can’t mix-and-match** Types for the argument.

```
print(“My age is ” + 42)          # Error; you can’t mix a string with an int
print(“My age is ” + str(42))     # This will work; argument is entirely of type string
```


- You can print variables, but remember the above rule!

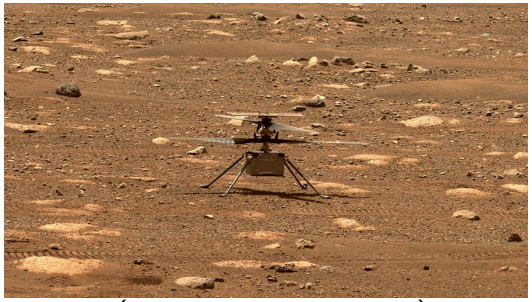
```
student_name = “Chris”                # Type: string
student_age = 25                      # Type: int
print(“My name is ” + student_name + “ and I am ” + str(student_age))
```

Be mindful of Types when using `input()`

- `input(`*`argument`*`)`: **Will return a result of Type string.**
  - If the result is a number and you want to do calculations with it, remember to cast the result to an `int` or `float`.


```
user_weight = input("Enter your weight (kg): ")

new_weight = user_weight + 5              # Error; can't add a string with an int
new_weight = int(user_weight) + 5         # This will work; adding two ints
```

Section Exercise: “Mars Weight Calculator”



(Image source: NASA)

Gravitational constant for Mars compared to Earth’s:

- Mars: 37.6%

Milestone #1: Ask the user their weight on Earth. Output the equivalent weight on Mars (rounded to two decimal places)!

Input

Enter a weight on Earth: 120

Output

The equivalent weight on Mars: 45.36

How to Round a Number

- **Number Rounding:**
  - `round(float, num_decimals)`

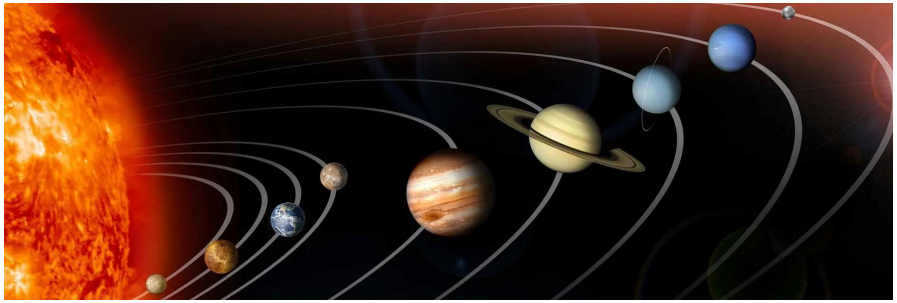
```
x = 3.1415926
rounded_x = round(x, 2)       # Rounds x to 2 decimal places
print(rounded_x)              # Prints: 3.14


y = 2.71828
print(round(y, 4))            # Prints: 2.7183
```

Section Exercise: “Planetary Weight Calculator”

Milestone #2: Make the calculator work for any planet in solar system.

Gravitational constants for each planet compared to Earth’s:

- Mercury: 37.6%
- Venus: 88.9%
- Earth: 100.0%
- Mars: 37.8%
- Jupiter: 236.0%
- Saturn: 108.1%
- Uranus: 81.5%
- Neptune: 114.0%



(Image source: https://science.nasa.gov/solar-system/)

Input

Enter a weight on Earth: 150
Enter a planet: Jupiter

Output

The equivalent weight on Jupiter: 354.0