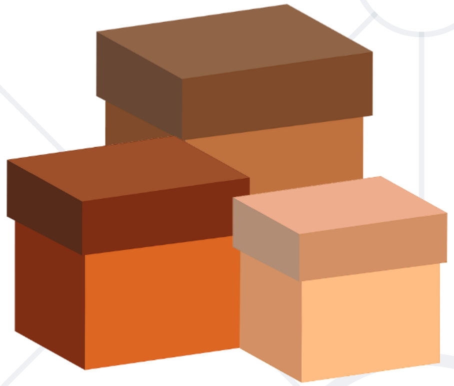
Data Types and Variables

Types of Operators



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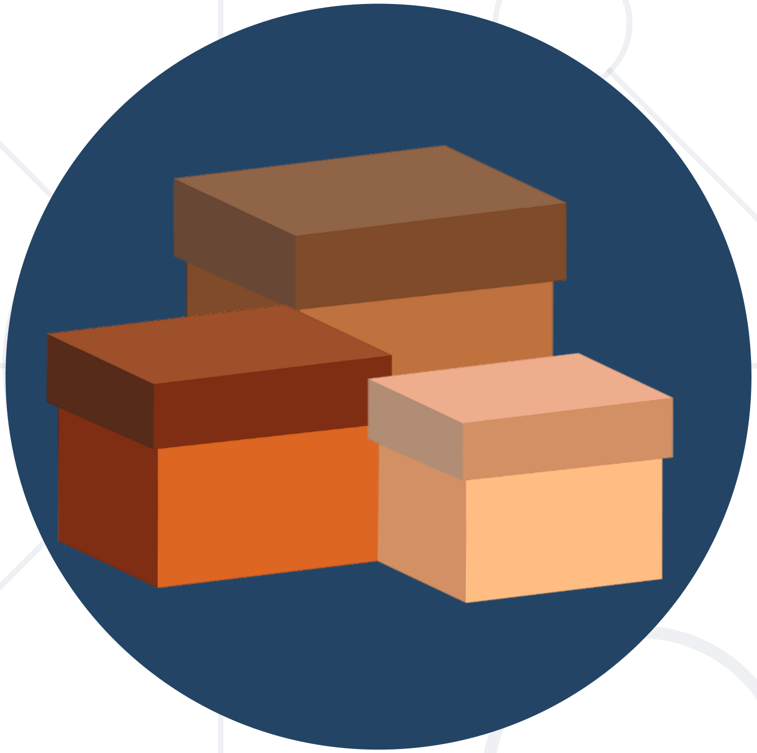
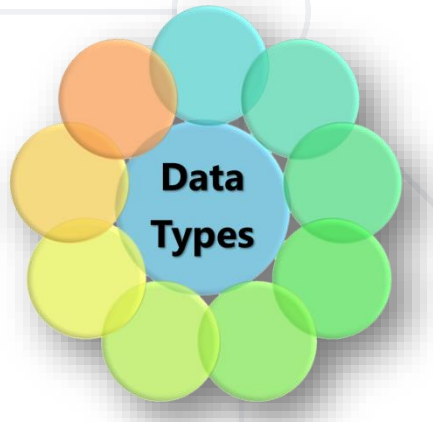


What is Data Type

Definition and Examples

What is Data Type?

- A classification that specifies **which type of value** a variable has and **what type of operations** can be applied to it
- In Python we have the following data types:
  - Numeric Types: int, float, complex, decimal
  - Text Type: str
  - List, Set, Tuple, Dictionary
  - Boolean



Examples

```
int_num = 10                              # int value
float_num = 10.2                          # float value
a_str = 'Hello world'                     # str value
is_true = True                            # bool value
list = [123, 'abcd', 10.2, 'd']          # list
dict = {'name': 'Amy', 'age': 10}        # dictionary
```

Data Types are Dynamic

- Python is a **dynamic** language
- Variables are **not** directly associated with any particular value type
- Any variable can be **assigned** (and **re-assigned**) values of all types

```
variable = 42         # variable is now an int
variable = 'bar'      # variable is now a string
variable = True       # variable is now a boolean
```

Check the Type of a Variable

- The **type()** function helps you find the type of the variable

```
print(type('123'))         # <class 'str'>
print(type(123))           # <class 'int'>
print(type(123==123))      # <class 'bool'>
```

- The **isinstance()** function checks if the specified object is of the specified type

```
print(isinstance('123', str))          # True
print(isinstance(123, str))            # False
print(isinstance(123==123, bool))      # True
```

'ABC'

Strings

Sequence of Characters

What is a String?

- Used to represent **textual data**
- Each element in the String occupies a **position** in the String
- The **first** element is at **index 0**, the next at index 1, and so on
- The **length** of a String is the number of elements in it

```
name = 'George'
print(name[0])  #'G'
```

Accessing element at index

String Literal

- String literals in Python are surrounded by either single quotation marks or double quotation marks: 'hello' is the same as "hello"
- The len() method returns the length of a string

```
a = "Hello, World!"
print(len(a)) # 13
```

Strings are Immutable

- Unlike in languages like C, Python strings are **immutable**
  - This means that once a string is created, it is **not** possible to **modify** it

```
name = 'George'
name[0] = 'P' # Error
```

String Interpolation

- From Python 3.6+ we can use **string interpolation**
  - These are string literals that allow **embedded** expressions

```
name = 'Rick'
age = 18
print(f'{name} = {age}') # Rick = 18
```

Place your variables inside {}

Problem: Concatenate Names

- Receive two **names** as **string parameters** and a **delimiter**
- Print the names **joined** by the delimiter

```
John
Smith
->
```

→

```
John->Smith
```

```
Jan
White
<->
```

→

```
Jan<->White
```

```
first_name = input()
second_name = input()
delimiter = input()
print(f'{first_name}{delimiter}{second_name}')
```

123

Numbers

Integer, Float

Integer

- Int or integer is a whole number, positive or negative, without decimals, of unlimited length
- Python integers are immutable

```
x = 1               # int
y = 231223423352    # int
z = -2312312        # int
```

Float

- **Float** is a floating-point real number, positive or negative, written with a decimal point dividing the integer and fractional parts, of unlimited length
- Python floats are **immutable**

```
x = 1.1               # float
y = 231223423352.24   # float
z = -2312312.689      # float
```

Problem: Meters to Kilometers

- Write a program that converts meters to kilometers formatted to the second decimal point.

$$\begin{tikzcd} \boxed{1852} \arrow[r] & \boxed{1.85} \end{tikzcd}$$

$$\begin{tikzcd} \boxed{798} \arrow[r] & \boxed{0.80} \end{tikzcd}$$

Solution: Meters to Kilometers

```
meters = int(input())
kilometers = meters/1000
print(f'{kilometers:.2f}')
```

Problem: Pounds to Dollars

- Write a program that converts British pounds to US dollars formatted to the 3rd decimal point
  - 1 British Pound = 1.31 Dollars

```
80  →  104.800
```

```
39  →  51.090
```

Solution: Pounds to Dollars

```python
pounds = int(input())
dollars = pounds * 1.31
print(f'{dollars:.3f}')
```

Problem: Centuries to Minutes

- Write a program to enter an integer number of centuries and convert it to years, days, hours, and minutes

```
Centuries = 1
```

```
1 centuries = 100 years = 36524 days = 876576 hours = 52594560 minutes
```

Solution: Centuries to Minutes

```python
centuries = int(input())
years = centuries * 100
days = int(years * 365.2422)
hours = 24 * days
minutes = 60 * hours
print(f"{centuries} centuries = {years} years = {days} days =
{hours} hours = {minutes} minutes")
```

Tropical year has **365.2422** days

int() converts float to int

True

False

Booleans

Conditions

What is a Boolean?

- Boolean represents a logical entity and can have two values: **True** and **False**
- You can use the **bool()** function to find out if an expression (or a variable) is true:

```
print(bool(10 > 9))  # True
```

- Or even easier:

```
print(10 > 9)         # True
```

Comparisons and Conditions

Operator	Description	Example
==	equal	if (day == 'Monday')
>	greater than	if (salary > 9000)
<	less than	if (age < 18)
>=	greater than or equal	if (6 >= 6)
!=	not equal	if (5 != 5)
in	item is in sequence	'a' **in** 'abc' ***# True***

Booleans Examples

- Everything with a "value" is **True**

```
number = 1
if (number):
  print(number)    # 1
```

True

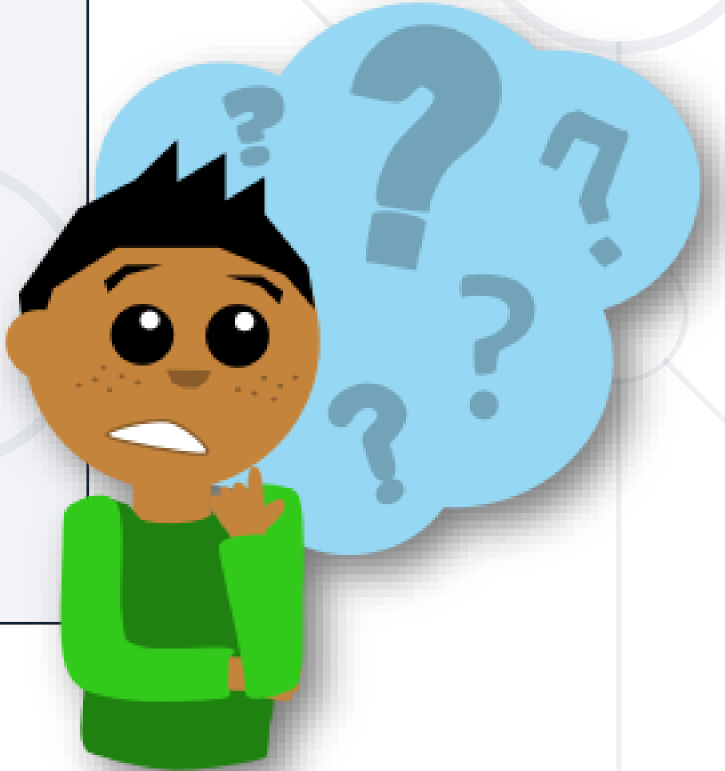
- Everything without a "value" is **False**

```
number = None
if (number):
  print(number)
else:
  print('false')  # False
```

False

Booleans Examples

```
x = 0
bool(x)    # False
x = -0
bool(x)    # False
x = ''
bool(x)    # False
x = False
bool(x)    # False
x = None
bool(x)    # False
```



Problem: Special Numbers

- Write a program that reads an integer **n**. For all numbers in the range **1…n** print the number and if it is special or not (**True** / **False**)
  - A number is **special** when the **sum** of its digits **is 5**, **7**, or **11**

```
20
```

```
1 -> False
2 -> False
3 -> False
4 -> False
5 -> True
6 -> False
7 -> True
8 -> False
9 -> False
10 -> False
11 -> False
12 -> False
13 -> False
14 -> True
15 -> False
16 -> True
17 -> False
18 -> False
19 -> False
20 -> False
```

Solution: Special Numbers

```python
n = int(input())

for num in range(1, n + 1):
    sum_of_digits = 0
    digits = num

    while digits > 0:
        sum_of_digits += digits % 10
        digits = int(digits / 10)

# TODO: check whether the sum is special
```

Problem: Next Happy Year

- Happy Year is the year with **only distinct digits**
  - for example, **2018**
- Write a program that receives an **integer** number and **finds the next happy year**

```
8989
```

→

```
9012
```

```
1001
```

→

```
1023
```

Additional Datatypes

List, Tuple, Set, Dict

Definition and Examples

- A **list** contains items separated by commas and enclosed within square brackets

```
cars = ["Saab", "Volvo", "BMW"]
```

- A **tuple** is a collection which is ordered and **unchangeable**. In Python, tuples are written with round brackets

```
example_tuple =("apple", "banana", "cherry")
print(example_tuple)
```

Definition and Examples

- A **set** is a collection which is unordered and unindexed. Sets are written with curly brackets.

```
example_set = {"apple", "banana", "cherry"}
print(example_set)
```

- A **dictionary** is a collection that is **ordered** (python 3.7+), changeable, and indexed
  - They have keys and values

```
example_dict = {"brand": "Ford", "model": "Mustang"}
print(example_dict)
```

None

None Keyword

What is None?

- The None keyword is used to define a null value or no value at all
- There are two ways to check if a variable is None
  - One way can be performed by using the is keyword
  - Another is using the == syntax

```
if null_variable is None:
    print('null_variable is None')
```

```
if null_variable == None:
    print('null_variable is None')
```

Summary

- Python supports the following data types:
  - String
  - Bool
  - Int
  - Float
  - List, Tuple, Set, Dict
- None is nothing

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