Lecture 01

Lect. PhD. Arthur Molnar

to Python
Data in Python
Simple Data
Types
Compound Data
Types
Variables,
expressions and

Introduction to Python

Lect. PhD. Arthur Molnar

Babes-Bolyai University arthur@cs.ubbcluj.ro

Overview

Lecture 01

Lect. PhD. Arthur Molna

Introduction to Python Data in Python Simple Data Types Compound Dat Types Variables, expressions and

1 Introduction to Python

- Data in Python
- Simple Data Types
- Compound Data Types
- Variables, expressions and statements

Hardware and software

Lecture 01

Lect. PhD. Arthur Molna

Introduction to Python

Data in Python
Simple Data
Types
Compound Data
Types
Variables,
expressions and
statements

- Hardware -computers (desktop, mobile, etc) and related devices
- **Software** -programs or systems which run on hardware
- Programming language notation that defines syntax and semantics of programs

What computers do

Lecture 01

Lect. PhD. Arthur Molna

Introduction to Python

Simple Data Types Compound Data Types Variables, expressions and

Storage and retrieval

- Internal memory
- Hard disk, memory stick
- Operations
 - Processor
- Communication
 - Keyboard, mouse, display
 - Network connector

Lecture 01

Lect. PhD. Arthur Molna

Introduction to Python

Simple Data Types Compound Data Types Variables, expressions and statements

- **Python** a high level programming language. It is a great language for beginner programmers!
- **Python interpreter** a program which allow us to run/interpret new programs.
- Python standard library: built-in functions and types

Lecture 01

Lect. PhD. Arthur Molna

Introduction to Python

Data in Python Simple Data Types Compound Data Types Variables, expressions and statements

Python is:

- A modern programming language
- Simple to write and understand
- An interpreted language
- A garbage collected language
- A language that support multiple paradigms: structured, object-oriented, functional and aspect oriented programming are all on the menu!
- A language with great support and many available libraries

Lecture 01

Lect. PhD. Arthur Molna

Introduction to Python

Data in Python Simple Data Types Compound Data Types Variables, expressions and

Python is...

Simple to write and understand

```
myList = []
while True:
    x = int(input("Enter item (-1 to finish):"))
    if x == -1:
        break
    myList.append(x)
return myList
```

Lecture 01

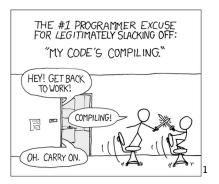
– Lect. PhD. Arthur Molnai

Introduction to Python

Simple Data Types Compound Data Types Variables, expressions and

Python is...

An interpreted language



¹https://xkcd.com/303/

Lecture 01

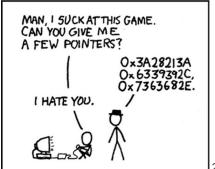
Lect. PhD. Arthur Molna

Introduction to Python

Simple Data Types Compound Data Types Variables, expressions and

Python is...

A garbage collected language



2

Lecture 01

Lect. PhD. Arthur Molna

Introduction to Python

Simple Data Types Compound Data Types Variables, expressions and

Python mantra³:

- Beautiful is better than ugly
- Explicit is better than implicit
- Simple is better than complex
- Flat is better than nested
- Sparse is better than dense
- Readability counts

What do you need?

Lecture 01

Lect. PhD. Arthur Molna

Introduction to Python

Data in Python
Simple Data
Types
Compound Data
Types
Variables,
expressions and

We propose three ways of working in Python 3.x:

- Install Python 3 and the IDLE integrated environment (first couple of weeks)
- Install Python 3 and Eclipse + PyDev (once comfortable with Python), OR VS Code OR PyCharm
- Use the PythonBox a virtual machine we've prepared as a backup solution, but you can use it at home and during the exam

Basic elements of a Python program

Lecture 01

Lect. PhD. Arthur Molna

Introduction to Python

Data in Python
Simple Data
Types
Compound Data
Types
Variables,
expressions and
statements

- Lexical elements a Python program is divided into a number of lines.
- Comments start with a hash (#) character and ends at the end of the line.
- **Identifiers** (or **names**) are sequences of characters which start with a letter (a..z, A..Z) or an underscore (_) followed by zero or more letters, underscores, and digits (0..9).
- Literals are notations for constant values of some built-in types.

Demo

Lecture 01

Lect. PhD. Arthur Molna

Introduction to Python

Simple Data Types Compound Data Types Variables, expressions and

Basic elements of a Python program

 $ex01_BasicSyntax.py$

Data vs. Information

Lecture 01

Lect. PhD. Arthur Molna

Introduction
to Python
Data in Python
Simple Data
Types
Compound Data
Types
Variables,
expressions and
statements

- Data collection of symbols stored in a computer (e.g. 123 decimal number or 'abc' string are stored using binary representations)
- **Information** interpretation of data for human purposes (e.g. 123, 'abc')

Python data model

Lecture 01

Lect. PhD. Arthur Molna

Introduction to Python Data in Python Simple Data Types Compound Data Types Variables, expressions and statements **All data** in Python programs is represented by objects, an **object** being Python's abstraction for data.

An **object** has:

- an identity we may think of of it as the object's address in memory.
- a type which determines the operations that the object supports and also defines the possible values.
- a value.

Types

Lecture 01

Lect. PhD. Arthur Moln:

Introduction to Python

Data in Python
Simple Data
Types
Compound Data
Types
Variables,
expressions and
statements

- **Types** classify values. A type denotes a **domain** (a set of possible values) and **operations** on those values.
- **Numbers** are immutable, so once created, their values cannot be changed.

Identity, value and type

Lecture 01

Lect. PhD. Arthur Molna

to Python

Data in Python

Simple Data
Types

Compound Data
Types

Variables,
expressions and
statements

Recall what is a name and an object (identity, type, value).

- mutable objects: lists, dictionaries, sets
- immutable: numbers, strings, tuples

We determine the identity and the type of an object using the built-in functions:

- id(object)
- type(object), isinstance(object, type)

Standard types in Python (1/3)

Lecture 01

Lect. PhD. Arthur Molna

Introduction to Python Data in Python Simple Data Types Compound Dat Types Variables, expressions and statements

int⁴:

 Represents the mathematical set of integers (positive and negative, unlimited precision)

bool:

Represents the the truth values True and False.

float:

Represents the mathematical set of double precision floating point numbers.

⁴https://docs.python.org/3/library/stdtypes.html → ⟨ ≥ →

Standard types in Python (2/3)

Lecture 01

Lect. PhD. Arthur Molna

Introduction
to Python
Data in Python
Simple Data
Types
Compound Data
Types
Variables,
expressions and
statements

Sequence types⁵

- Finite ordered sets indexed by non-negative numbers
- Let a be a sequence.
 - len(a) returns the number of items
 - a[0], a[1], ..., a[len(a)-1] represent the set of items
- Examples: [1, 'a']

string

- A string is an immutable sequence
- The items of a string are Unicode characters

⁵https://docs.python.org/3/library/stdtypes.html#sequence-types-list-tuple-range

Standard types in Python (3/3)

Lecture 01

Lect. PhD. Arthur Molna

co Python

Data in Python

Simple Data
Types

Compound Data
Types

Variables,

list⁶

- Mutable sequence of elements
- Typically used to store collections of homogeneous items
- Every item has a predecessor and successor

tuple⁷

- Immutable sequence
- Typically used to store collections of homogeneous items

dict⁸

Mapping between unique keys and values

⁶https://docs.python.org/3/library/stdtypes.html#list

⁷https://docs.python.org/3/library/stdtypes.html#tuple

Demo

Lecture 01

Lect. PhD. Arthur Molna

to Python

Data in Pytho

Simple Data
Types

Compound Data Types

Variables, expressions and statements

Basic compound types

 $ex02_BasicCompoundTypes.py$

List

Lecture 01

Lect. PhD. Arthur Molnai

Data in Python Simple Data Types Compound Data Types Variables, expressions and **Lists** represent finite ordered sets indexed by non-negative numbers.

Operations:

- Creation
- Accessing values (index, len), changing values (lists are mutable)
- Removing items (pop), inserting items (insert)
- Slicing
- Nesting
- Generate list using range(), list in a for loop
- Lists as stacks (append, pop)

Tuple

Lecture 01

Lect. PhD. Arthur Molna

Data in Python Simple Data Types Compound Data Types Variables, Tuples are immutable sequences. A **tuple** consists of a number of values separated by commas. Operations:

- Packing values (creation)
- Nesting
- Empty tuple
- Tuple with one item
- Sequence unpacking

Dictionary

Lecture 01

Lect. PhD. Arthur Molna

Data in Python
Simple Data
Types
Compound Data
Types
Variables,
expressions and

A **dictionary** is an unordered set of (key, value) pairs with unique keys. The keys must be immutable. Operations:

- Creation
- Getting the value associated to a given key
- Adding/updating a (key, value) pair
- Removing an existing (key, value) pair
- Checking whether a key exists

Variables and expressions

Lecture 01

Lect. PhD. Arthur Molna

ntroduction
to Python
Data in Python
Simple Data
Types
Compound Data
Types

Types Variables, expressions and

NB!

Variables are reserved memory locations to store values

- A variable has:
 - Name
 - Type
 - Domain
 - Operations

A variable is introduced in a program using a name binding operation - assignment.

Variables and expressions

Lecture 01

Variables. expressions and **Expression** - a combination of explicit *values*, *constants*, variables, operators, and functions that are interpreted according to the particular rules of precedence, which computes and then *produces/returns* another value.

Examples:

numeric expression: 1 + 2

■ boolean expression 1 < 2</p>

string expression: '1' + '2'

Statements

Lecture 01

Lect. PhD. Arthur Molna

to Python

Data in Python

Simple Data
Types

Compound Dat

Variables, expressions and

NB!

Statements are the basic operations of a program. A program is a sequence of statements

Statements

Lecture 01

Lect. PhD. Arthur Molna

Data in Python Simple Data Types Compound Data Types

Variables, expressions and

Assignment

- Assignments are used to (re)bind names to values
- Bind name:
 - $\mathbf{x} = 1$ #is a variable (of type int)
- Rebind name:
 - $\mathbf{x} = \mathbf{x} + 2 \ \#$ a new value is assigned to \mathbf{x}
- Rebind name of mutable sequences:
 - y = [1, 2] # mutable sequence
 - y[0] = -1 #the first item is bound to -1

Block

- A block is a section of a program that is executed as a unit
- A sequence of statements is a block
- Blocks of code are denoted by line indentation

Demo

Lecture 01

Lect. PhD. Arthur Molna

to Python

Data in Pythor

Simple Data

Types

Compound Data

Variables, expressions and statements Controlling program flow

 $ex03_ProgramFlow.py$