Week 2: Lists and Loops

Unit 1: What Are Lists in Python?

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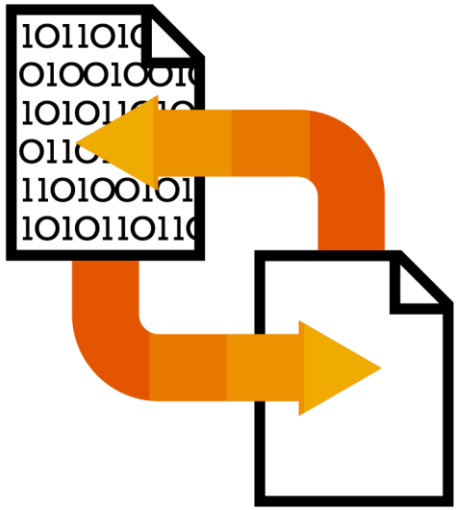
What are lists in Python?

Motivation – The limitation of primitive data types

Programs using only primitive data types are quite limited.



Consider the following situation: You want to collect the names of people showing up at your party.

- You can read the names using `input()`
- Once the user adds no further names:
  – Sort the names alphabetically
  – Print all the names

The program cannot be written using primitive data types.

Problem: It is unknown how many variables are needed to store all the names.

For this situation, the complex data type **list** is helpful.

➔ Lists can be used to store multiple items

What are lists in Python?

Lists require a specific syntax

- List are created using square brackets
- List items are separated by commas
- Lists can contain multiple objects of different data types

```
1 my_string_list = ["Hello", "open", "SAP"]
2 my_float_list = [3.14, -6.63e-34]
3 my_boolean_list = [True, False, False, True]
4
5 print(my_string_list)
```

```
my_mixed_list = [1, 3, 5, True, -23, "a", 3.234, "abc"]
print(my_mixed_list)
```

What are lists in Python?
Showtime

Now it’s time to get hands on and start programming!

If you like, you can open the Jupyter Notebook instructions in parallel to the demo.

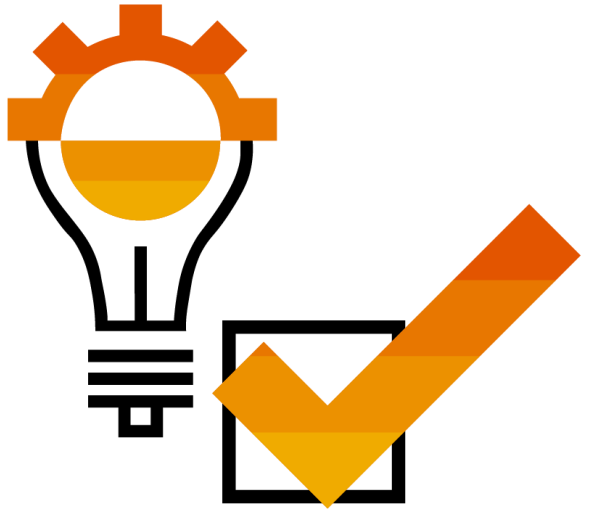
If you haven’t done so yet:

- Download the Notebook
- Start the Jupyter Server
- Open the Notebook

Summary / key takeaways

In this unit you learned ...

- … that lists in Python can handle multiple elements
- … that lists can be initialized like primitive variables
- … that there are basic operations on lists
- … that you can check if a given element is contained in a list



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Week 2: Lists and Loops

Unit 2: Using an Index to Access Lists

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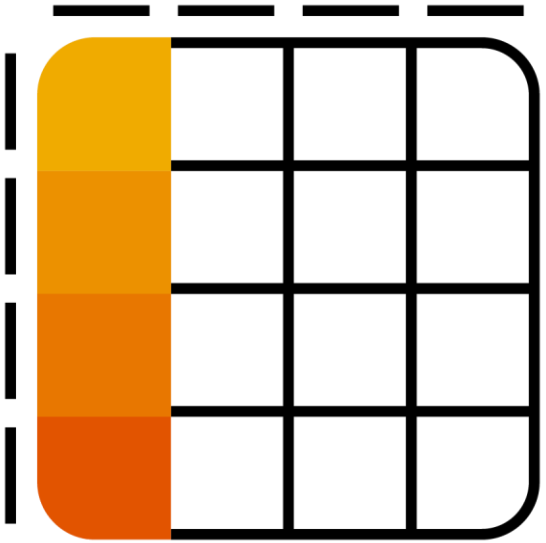
Using an index to access lists

Each element in the list has a unique index

- Individual list elements can be accessed using the corresponding index
- The index count starts at 0
  - i.e. the first element has the index 0, the second one has the index 1, etc.

- Strings have similarities with lists. A string can be regarded as a “list of characters”.
  - Thus, some of the characteristics of lists work on strings as well.
  - Example: You can use indices on strings to access single characters.



Using an index to access lists

Nested lists

- Lists can contain other lists
- Access single elements with double indices

```
records = [
    ["Ramones", "Leave Home", "Rocket to Russia", "Road to Ruin"],
    ["Never Mind the Bollocks", "Flogging a Dead Horse", "Anarchy in the UK"],
]
print(records[1])
print(records[0][-1])
```

- Individual letters from a *string* can be accessed in the same way

```
course_name = "Python Introduction"
print(course_name[1])
print(course_name[-2])

if "Python" in course_name:
    print("Happy Python 🐍 Programming!")
```

Using an index to access lists
Showtime

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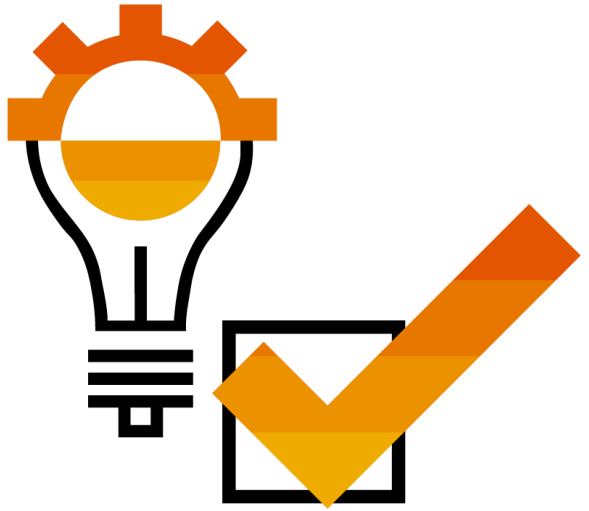
Summary / key takeaways

In this unit you learned ...

- … that single elements of a list can be accessed using the index
- … that indices start with 0
- … that accessing an index outside the list leads to an error
- … that strings and lists are similar in a list



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Week 2: Lists and Loops

Unit 3: Important Functions and Methods for Lists

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Important functions and methods for lists

There are various functions and methods with respect to lists

There are many things you can do with lists:

- Sort a list
- Append an element at the end of the list
- Find the list's maximum or minimum
- Delete an element from the list
- Delete a value from the list
- …

These are offered by functions and methods.

Important functions and methods for lists
Showtime

Now it’s time to get hands on and start programming!

If you like, you can open the Jupyter Notebook instructions in parallel to the demo.

If you haven’t done so yet:

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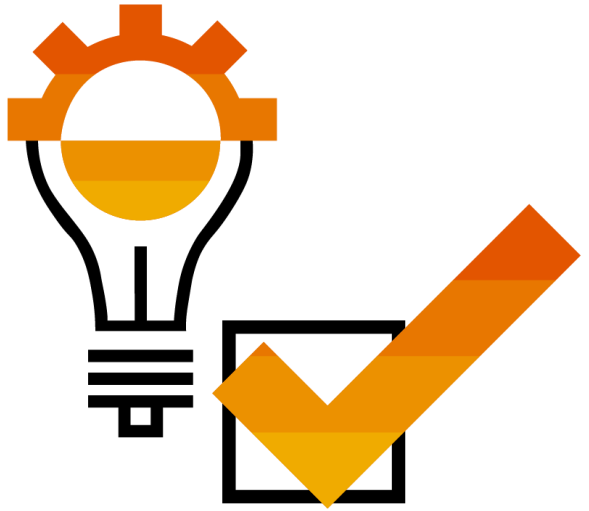
Summary / key takeaways

In this unit you learned ...

- … how to manipulate lists with a variety of functions and methods



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Week 2: Lists and Loops

Unit 4: Iterating Using the For Loop

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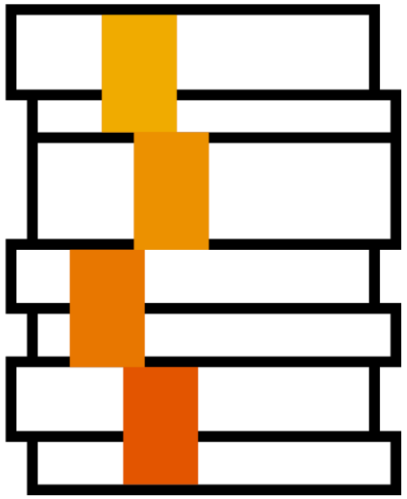
Iterating using the for loop

Accessing the complete list vs. accessing each individual element of the list

- In real life, you often have a collection of objects e.g. stamps, a group of students, a pile of books.
- Some operations cannot be done with the complete set, but only with individual elements.
  - For example, you cannot read the pile, you can only read an individual book!
- To access each individual element of this collection, group, or pile, another control structure is required: a loop.
- In Python there are two different loops: the for loop and the while loop.
- The for loop is used for iterating over lists.



Iterating using the for loop
Showtime

Now it’s time to get hands on and start programming!

If you like, you can open the Jupyter Notebook instructions in parallel to the demo.

If you haven’t done so yet:

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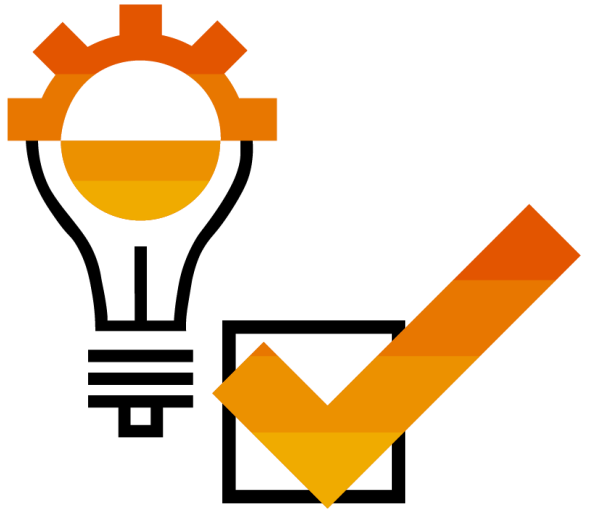
Summary / key takeaways

In this unit you learned ...

- … how to handle the for loop
- … how to iterate over the elements of a list
- … how to iterate over the characters of a string



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Week 2: Lists and Loops

Unit 5: Using Ranges to Create Sequences of Numbers

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Using ranges to create sequences of numbers

Programming often requires sequences of numbers

- You want to count some people in a group? Then you need the sequence 1, 2, 3, …
- These kind of sequences of numbers are used again and again, in real life, in mathematics, and in programming.
- `range()` can be used to easily create sequences of numbers.
- And `range()` and the `for` loop live in perfect harmony.

Using ranges to create sequences of numbers
Showtime

Now it’s time to get hands on and start programming!

If you like, you can open the Jupyter Notebook instructions in parallel to the demo.

If you haven’t done so yet:

- Download the Notebook
- Start the Jupyter Server
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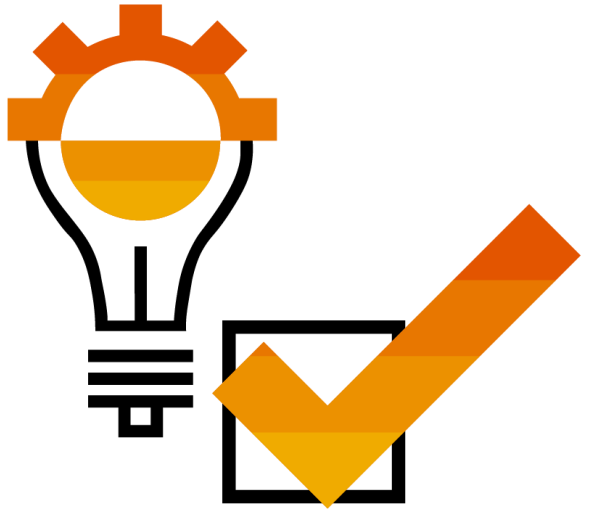
Using ranges to create sequences of numbers
Summary / key takeaways

In this unit you learned ...

- … how to create sequences of numbers
- … how to combine a `range()` with a `for` loop



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Week 2: Lists and Loops

Unit 6: Sequences

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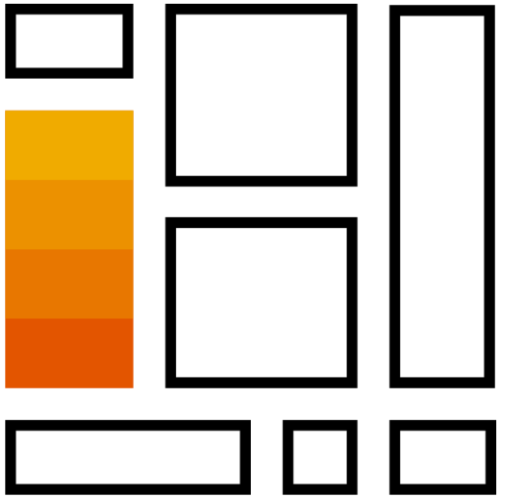
Sequence types share common characteristics

- There are several different sequence types like list, range, tuple, or string.
  - Tuples will be introduced next week
- Sequence types share common characteristics:
  - Each sequence type contains several elements
  - The elements are ordered (i.e. there is a first element, a second element, …)
  - The elements can be accessed using an index
  - The sequences have a length, the function len() can be used.
- Not all functions work on all sequences.



Sequences
Showtime

Now it’s time to get hands on and start programming!

If you like, you can open the Jupyter Notebook instructions in parallel to the demo.

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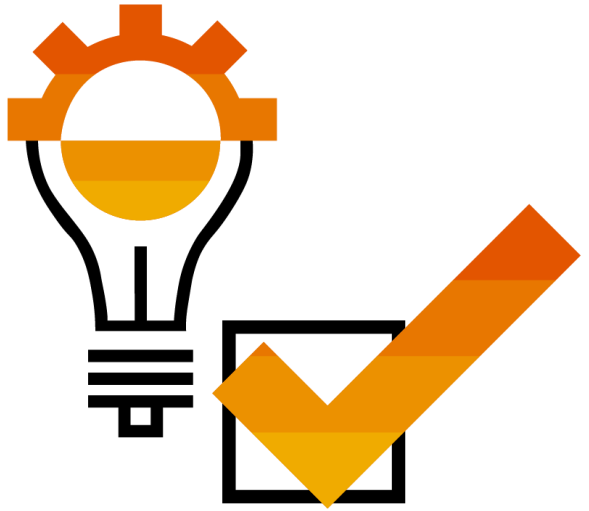
Summary / key takeaways

In this unit you learned ...

- … the basics of sequence types once again
- … common operations on sequences
- … that some operations will not work on all sequence types



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Week 2: Lists and Loops

Unit 7: Slicing

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Slicing

Accessing not single elements but parts of sequences

- Accessing parts of sequences is called slicing
- You can specify parts of a sequence using
  - start and end index
  - every n’th element

```
list1 = [0, 2, 4, 6, 8, 10]
print(list1[2:4])
print(list1[:3])
print(list1[3:])
print(list1[:])

string1 = "Hello World!"
print(string1[3:8])
```

```
[4, 6]
[0, 2, 4]
[6, 8, 10]
[0, 2, 4, 6, 8, 10]
lo Wo
```

Slicing
Showtime

Now it’s time to get hands on and start programming!

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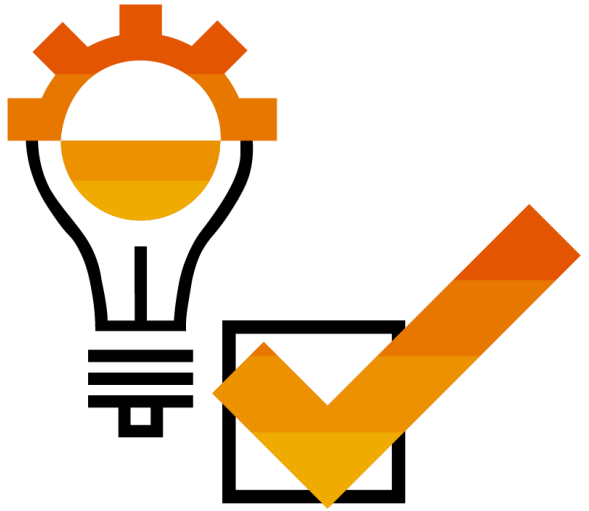
Summary / key takeaways

In this unit you learned ...

- … how to create sub-sequences from existing sequences



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Week 2: Lists and Loops

Unit 8: List Comprehension

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List comprehension
Simple list editing

- “A compact way to process all or part of the elements in a sequence and return a list with the results.”
- Build lists with more comprehensible syntax
- Combine multiple lists
- Filter lists

```
numbers = list(range(1, 21))
squares = [x * x for x in numbers]

print("The list of squares is:", squares)
```

```
The list of squares is: [1, 4, 9, 16, 25, 36, 49, 64, 81, 100, 121, 144, 169, 196, 225, 25
6, 289, 324, 361, 400]
```

List comprehension
Showtime

Now it’s time to get hands on and start programming!

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If you haven’t done so yet:

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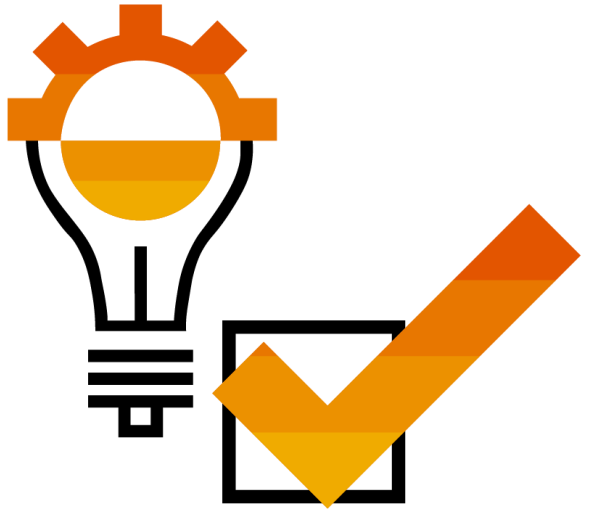
- Open the Notebook

List comprehension
Summary / key takeaways

In this unit you learned ...

- … how to create lists in a more readable way
- … how to use list comprehension to replace nested loops



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