





Programming with Python 37. Set und Dictionary Comprehension

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Programming with Python



Dies ist ein Kurs über das Programmieren mit der Programmiersprache Python an der Universität Hefei (合肥大学).

Die Webseite mit dem Lehrmaterial dieses Kurses ist https://thomasweise.github.io/programmingWithPython (siehe auch den QR-Kode unten rechts). Dort können Sie das Kursbuch (in Englisch) und diese Slides finden. Das Repository mit den Beispielprogrammen in Python finden Sie unter https://github.com/thomasWeise/programmingWithPythonCode.

Outline 1. Einleitung 2. Set Comprehension 3. Dictionary Comprehension 4. Zusammenfassung





Comprehension: Nur für Listen? • Wir haben bereits List Comprehension gelernt. • Das ist ein sehr elegantes und mächtiges Werkzeug um, nun ja, Listen zu erstellen.



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- Tatsächlich gibt es das auch für Mengen und Dictionaries.
- Wir schauen uns jetzt Ersteres an und danach dann Letzteres. . .



Set Comprehension

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"""Set Comprehension in Python."""

# Create a set from all the items in a sequence.

# 'expression' is usually an expression whose result depends on item'.

{expression for item in sequence}

Create a set from those items in a sequence for which condition'

# evaluates to True.

# 'expression' and condition' are usually expressions whose results

depend on item'.

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- Mengen können mit Set Comprehension erstellt werden.
- Set Comprehension funktioniert genau so wie List Comprehension.
- Die Syntax ist im Grunde gleich und unterscheidet sich nur in der Verwendung von geschweiften Klammern an Stelle von eckigen Klammern.

• Schauen wir uns ein paar Beispiele als Programm

simple_set_comprehension.py an.

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from math import isgrt # computes the integer parts of square roots
roots_1: set[int] = set() # We can start with an empty set.
for i in range (100): # Then we use a for-loop over the numbers 0 to 99.
    roots_1.add(isqrt(i)) # Add the integer part of sqrt to the set.
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roots 2: set[int] = {isgrt(i) for i in range(100)}
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# Compute the set of numbers in 2...99 which are not prime.
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# The set of numbers in 2..99 which are not in not_primes are primes.
primes: set[int] = {n for n in range(2, 100) if n not in not primes}
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print(f"prime numbers 2: {set(range(2, 100)), difference(not_primes)}")
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- In dem Programm erstellen wir erst eine Menge mit den Ergebnissen der isqrt-Funktion aus dem Modul math
- Diese Funktion liefert den ganzzahligen Teil der Quadratwurzel, also isqrt(i) = |√i|.

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- In dem Programm erstellen wir erst eine Menge mit den Ergebnissen der isqrt-Funktion aus dem Modul math
- Diese Funktion liefert den ganzzahligen Teil der Quadratwurzel, also | isqrt(i) = [√i].
- Wir wollen eine Menge erstellen mit allen Ergebnissen dieser Funktion für die Werte i von 0 bis 99.

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- In dem Programm erstellen wir erst eine Menge mit den Ergebnissen der isqrt-Funktion aus dem Modul math
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- In dem Programm erstellen wir erst eine Menge mit den Ergebnissen der isqrt-Funktion aus dem Modul math.
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- Die Menge roots_2 wird durch {isqrt(j)for j in range(100)} erstellt

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- Die Menge enthält danach die Zahlen von 0 bis 9.
- Jeder Wert taucht genau einmal auf, denn so funktionieren Mengen nunmal.
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                  ↓ python3 simple_set_comprehension.py ↓
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- Für jede einzelne resultierende k-m
 Kombination fügen wir den Wert k in
 die Menge ein wenn die Bedingung
 k % m == 0 zutrifft.
- Jedesmal wenn wir eine Zahl m finden, die k ohne Rest teilt, dann fügen wir k in die Menge ein.
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"""Simple examples for set comprehension."""
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roots_1: set[int] = set() # We can start with an empty set.
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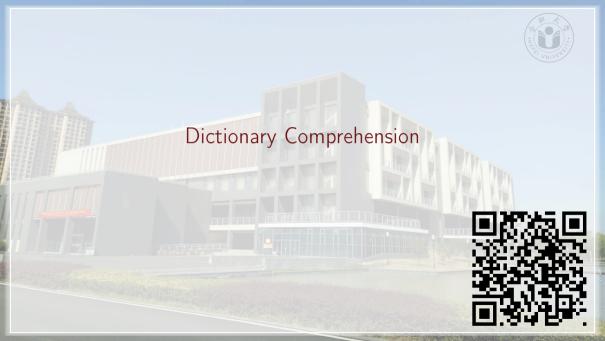
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- So könnte man also das Gleiche erreichen, zumindest wenn man schon die Menge not_primes gebaut hat.

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roots 2: set[int] = {isgrt(i) for i in range(100)}
print(f"result of comprehension: {roots_2}") # Print the result.
# Compute the set of numbers in 2..99 which are not prime.
not primes: set[int] = {k for k in range(2, 100)
                        for m in range(2, isgrt(k) + 1) if k \% m == 0}
# The set of numbers in 2..99 which are not in not_primes are primes.
primes: set[int] = {n for n in range(2, 100) if n not in not primes}
print(f"prime numbers 1: {primes}")
# We could also use this method that creates a set from a range and uses
# the set difference operator.
print(f"prime numbers 2: {set(range(2, 100)), difference(not_primes)}")
                  ↓ python3 simple_set_comprehension.py ↓
 result of construction: {0, 1, 2, 3, 4, 5, 6, 7, 8, 9}
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- {i: i ** 2 for i in range(11)} produziert das gleiche Ergebnis.
- Machen wir nun etwas Spannenderes.
- Wir wollen ein Dictionary maxdiv bauen, dass den größten Divisor m < k für jede Zahl k aus 2..20 hält.
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          \rightarrow 3, 10: 5, 11: 1, 12: 6, 13: 1, 14: 7, 15: 5, 16: 8, 17: 1,
          \hookrightarrow 18: 9, 19: 1, 20: 10}
```

squares_1: dict[int, int] = {} # We can start with an empty dictionary.
for i in range(11): # Then we use a for-loop over the numbers 0 to 9.







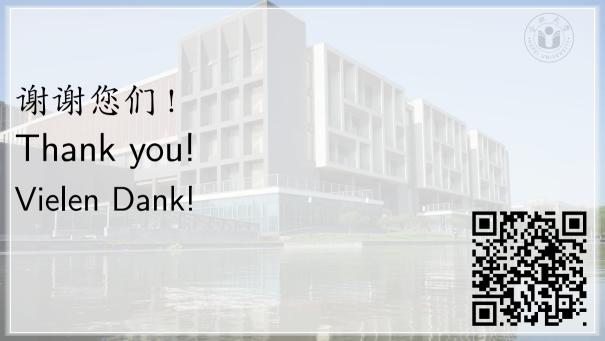
 Nun haben wir das Konzept von List Comprehension also auf Mengen und Dictionaries ausgeweitet.



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- Sie sind nützliche Konzepte, die uns helfen, besseren Kode zu schreiben.



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Glossary (in English) I

Python The Python programming language^{2-4,7}, i.e., what you will learn about in our book⁷. Learn more at https://python.org.

- i...j with $i,j\in\mathbb{Z}$ and $i\leq j$ is the set that contains all integer numbers in the inclusive range from i to j. For example, 5..9 is equivalent to $\{5,6,7,8,9\}$
- $\mathbb R$ the set of the real numbers.
- \mathbb{Z} the set of the integers numbers including positive and negative numbers and 0, i.e., ..., -3, -2, -1, 0, 1, 2, 3, ..., and so on. It holds that $\mathbb{Z} \subset \mathbb{R}$.