NPRG065: Programming in Python
Lecture 3

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Department of Distributed and Dependable Systems

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Lists

- Dynamic arrays
  - mutable

```
   squares = [1, 4, 9, 12, 25]
   squares[3] = 16
   print(squares)   # ->  [1, 4, 9, 16, 25]
```

- Indexing and slicing like with strings

```
   squares[-1]      # -> 25
   squares[-3:]     # -> [9, 16, 25]
```

  - warning: slicing returns a new list

```
   squares[:]      # -> [1, 4, 9, 16, 25]
                   #     a copy of the whole list
```

Lists

- Concatenation via +
  - returns a new list

```
squares + [36, 49, 64, 81, 100]      # ->
                #  [1, 4, 9, 16, 25, 36, 49, 64, 81, 100]
```

- append() method
  - adding at the end of the list
    - modifying the list

```
squares.append(36)
print(squares)           # -> [1, 4, 9, 16, 25, 36]
```

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Lists

- Assignment to slices

```
letters = ['a', 'b', 'c', 'd', 'e', 'f', 'g']
letters[2:5] = ['C', 'D', 'E']
           # -> ['a', 'b', 'C', 'D', 'E', 'f', 'g']
letters[2:5] = []   # -> ['a', 'b', 'f', 'g']
letters[:] = []     # -> []
```

- Length

```
len(letters) # -> 0
```

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Lists

- Lists in lists

```
a = ['a', 'b', 'c']
n = [1, 2, 3]
x = [a, n]
print(x)          # ->   [['a', 'b', 'c'], [1, 2, 3]]
print(x[0][1])    # ->  'b'
```

Lists

- **`del`** statement

```
a = [-1, 1, 66.25, 333, 333, 1234.5]
del a[0]
print(a)  # -> [1, 66.25, 333, 333, 1234.5]
del a[2:4]
print(a)  # -> [1, 66.25, 1234.5]
del a[:]
print(a)  # -> []
```

  - **`del`** can do more

```
del a
print(a)  # -> error
```

Tuples

- Similar to lists
- But immutable
- Literals in round parentheses

```
alist = ['a', 'b', 'c']
atuple = ('a', 'b', 'c')
alist[0] = 'A'     # -> ['A', 'b', 'c']
atuple[0] = 'A'    # -> error
```

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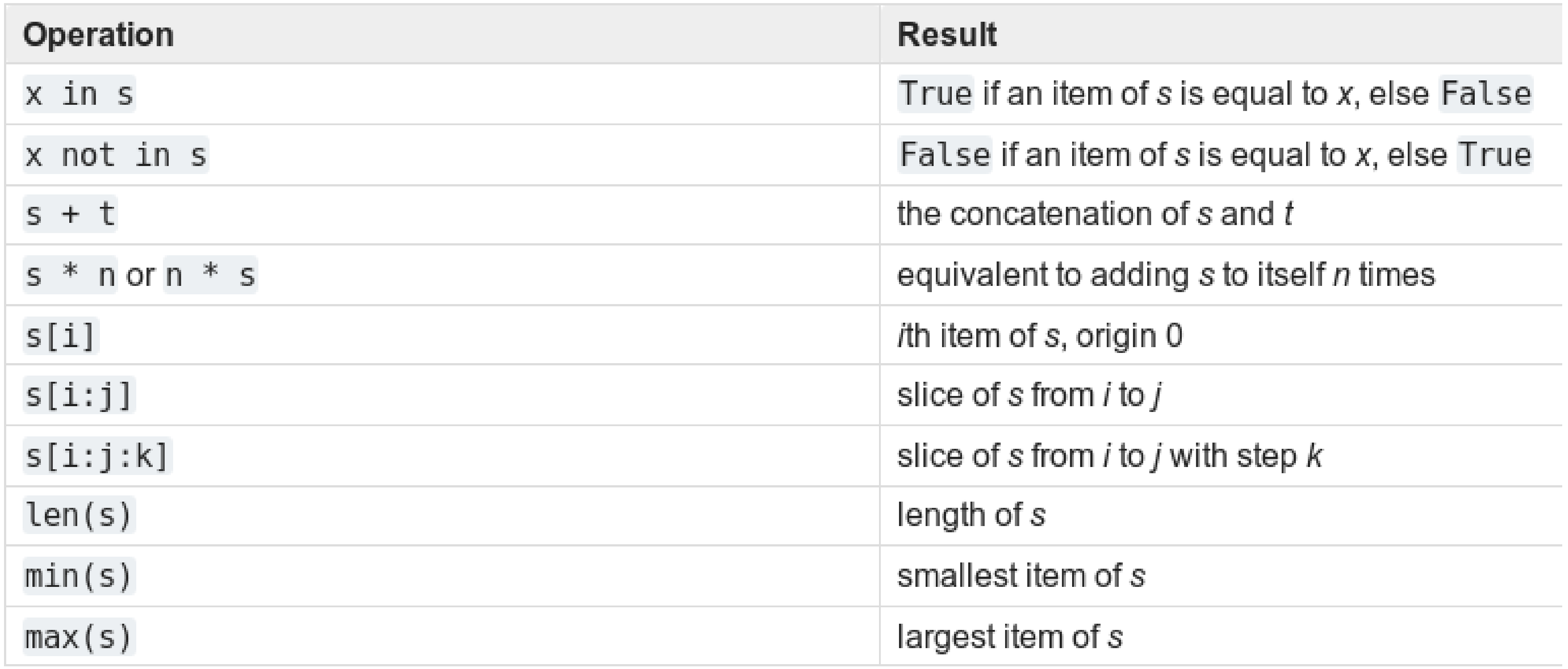
Operations over sequences

- Sequence = list, tuple, string, … and many more



Operation	Result
`x in s`	`True` if an item of *s* is equal to *x*, else `False`
`x not in s`	`False` if an item of *s* is equal to *x*, else `True`
`s + t`	the concatenation of *s* and *t*
`s * n` or `n * s`	equivalent to adding *s* to itself *n* times
`s[i]`	*i*th item of *s*, origin 0
`s[i:j]`	slice of *s* from *i* to *j*
`s[i:j:k]`	slice of *s* from *i* to *j* with step *k*
`len(s)`	length of *s*
`min(s)`	smallest item of *s*
`max(s)`	largest item of *s*

See
sequences.py

Comparing sequences

- Lexicographically
  - following comparisons are true

```
(1, 2, 3)               < (1, 2, 4)
[1, 2, 3]               < [1, 2, 4]
'ABC' < 'C' < 'Pascal' < 'Python'
(1, 2, 3, 4)            < (1, 2, 4)
(1, 2)                  < (1, 2, -1)
(1, 2, 3)              == (1.0, 2.0, 3.0)
(1, 2, ('aa', 'ab'))    < (1, 2, ('abc', 'a'), 4)
```

Conditions in general

- Non-zero number -> true
- Non-empty sequence -> true

```
a = [1, 2, 3]
print('yes' if a else 'no')    # -> yes
a = []
print('yes' if a else 'no')    # -> no
```

- **`and`** and **`or`** – short-circuit evaluation
- assignment inside expressions (like in C, Java,…)

```
if (a := get_value()) == 0:     # -> syntax error
  print('zero')
```

set, dict

- `set` – unordered collection of distinct objects
  - literals – `{'one', 'two'}`
- `frozenset` – immutable set
- `dict` – associative array (hashtable)
  - literals – `{'one': 1, 'two': 2, 'three': 3}`

See
sets_and_dicts.py

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dict

- Indexing by anything

```
adict = {'one': 1, 'two': 2, 'three': 3}
print(adict['one'])    # -> 1
adict['four'] = 4
print(adict)
    # -> {'one': 1, 'two': 2, 'three': 3, 'four': 4}
```

- Iterating

```
for k, v in adict.items():
  print(k, v)
```

```
for k in adict.keys():
  print(k, adict[k])
```

Comprehensions

- a concise way to create lists, sets, dicts
  - this works

```
squares = []
for x in range(10):
  squares.append(x**2)
```

  - but comprehension is better
    - and shorter, more readable, …, more Pythonic

```
squares = [x**2 for x in range(10)]
```

- list comprehension
  brackets containing an expression followed by a **`for`** clause, then zero or more **`for`** or **`if`** clauses

Comprehensions

```
[(x, y) for x in [1,2,3] for y in [3,1,4] if x != y]

# -> [(1, 3), (1, 4), (2, 3), (2, 1), (2, 4),
#     (3, 1), (3, 4)]
```

- Can be nested

```
# a matrix
m = [[1, 2, 3, 4], [5, 6, 7, 8], [9, 10, 11, 12]]
# and a transposed matrix
tm = [[row[i] for row in m] for i in range(4)]
```

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Comprehensions

See
comprehensions.py

- set comprehensions
  - like for lists but in curly braces

```
word = 'Hello'
letters = {c for c in word}
# another example
a = {x for x in 'abracadabra' if x not in 'abc'}
```

- dict comprehensions
  - also in curly braces but we need to specify both the key and value
    - separated by :

```
word = 'Hello'
letters = {c: c.swapcase() for c in word}
    # -> {'H': 'h', 'e': 'E', 'l': 'L', 'o': 'O'}
```

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More collection types

- `bytes`
  - immutable sequences of single bytes

```
b'bytes literals are like strings but only with ASCII chars'
b'escape sequences can be used too\x00'
```

- `bytearray`
  - mutable counterpart to bytes

See
strings_vs_bytes.py

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More collection types

namedtuple	a factory function for creating tuple subclasses with named fields
deque	a list-like container with fast appends and pops on either end
ChainMap	a dict-like class for creating a single view of multiple mappings
Counter	a dict subclass for counting hashable objects
OrderedDict	a dict subclass that remembers the order entries were added
defaultdict	a dict subclass that calls a factory function to supply missing values
heapq	an implementation of the heap queue algorithm

See
other_collections.py

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Naming conventions

- PEP 8, PEP 423

PEP = Python Enhancement Proposals

- Classes – camel case
  - **`MyBeautifulClass`**
- Functions, methods, variables – snake case
  - **`my_beautiful_function`**, **`local_variable`**
- "Constants" – capitalized snake case
  - **`MAX_VALUE`**
- Packages, modules
  - lower case, underscore can be used (discouraged for packages)
  - no conventions as in Java (i.e., like reversed internet name)
  - "pick memorable, meaningful names that aren't already used on PyPI"
  - The Zen of Python says "Flat is better than nested".
    - two levels is almost always enough
- The Zen of Python
  - **`import this`**

Try **`import this`** in the interactive shell

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Special variables/methods of objects

- Many special variables/methods
  - not all objects have all of them
- Naming schema
  - surrounded by double underscores
  - **`__name_of_the_special_variable_or_method__`**
- **`__name__`**
  - name of the object
- Others later

```
import sys
sys.__name__          # ->   'sys'
```

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