Python Prep

D-Wave
The Quantum Computing Company™

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Introduction

The Ocean SDK is a Python tool suite, so your programs will be written in Python.

A few standard things we'll be using:

- Importing packages
- Dictionaries
- Lists
- For loops

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Importing Packages

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Importing Packages

To use any packages, we need to import them first.

```
import dwave_networkx
…
dwave_networkx.maximum_independent_set( … )
```

```
import numpy as np
…
a = np.zeros((2,2))
```

```
from dimod import BinaryQuadraticModel
…
bqm = BinaryQuadraticModel( … )
```

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Dictionaries (Hashes)

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What is a dictionary in Python?

A dictionary is a collection of Key/Value pairs

An example:

A Days dictionary might tell us how many days are in each month of the year

Python lingo is as follows:

The key is the name of the month (the input)

The value is the number of days for that month (the output)

A lookup is performed on the dictionary: Given a key, then output the value

Example: input is “Jan”: output is 31

Example: input is “Apr”: output is 30

(Just for fun: for this dictionary, is the month a suitable key? (Leap years))

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Dictionaries in Python

- Days might be written this way: Days = { ”Jan”: 31, “Feb”: 28, “Mar”: 31 …}
- Key/Value pairs don’t have to be numbers

  Example: EN_SP = { “red”: “rojo”, … }

- Key/Value pairs don’t have to all be the same type

- (Later in course) In Ocean, the methods `sample_qubo` and `sample_ising` return samples dictionaries.
  - We will see the response/samples objects and how to access the data.

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Dictionaries in Python

To define a dictionary:

Empty dictionary:

```
Q = { }
```

Dictionary with entries:

```
Q = { (0,0): 5.2, (0,1): -2.0 }
```

To update a dictionary entry:

Directly:

```
Q [ (0, 0) ] = 5.2
```

Use this to adjust single entries

Update:

```
Q.update( { (0, 0): 5.2 } )
```

Use this to update/add multiple entries

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We will see:

QUBO

Input: Q (matrix)

Format: Dictionary

```
Q = { (0,0): 5.2, (0,1): -2.0, … }
```

Ising

Input: h (vector), J (matrix)

Format: Dictionaries

```
h = { 0: 5.2, 1: 3.0, … }
J = { (0,1): -2.0, (0, 2): 3.1, … }
```

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Lists (Arrays)

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What is a list in Python?

A list is an ordered collection of items

An example:

A Months list might tell us the names of the months of the year

Months might be written this way:

Months = [“Jan”, “Feb”, “Mar”, “Apr” …]

In Python, Months[0] = “Jan”, Months[1] = “Feb”…

(Later in course) A bit string response from a solver might look like this:

[0, 1, 1, 0, 1…]

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Lists in Python

To define a list:

Empty list:

```
y = [ ]
```

List with entries:

```
Q = [ 22, 17, 48, 'lockdown']
```

To update a list entry:

Directly:

```
y [2] = 37
```

Use this to adjust single entries

Append:

```
y.append([15, -9.2])
```

Use this to update/add multiple entries (but that appends a new list)

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Loops

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For-Loops in Python

General structure:

```
for ____ in ____ :
    <what to do>
```

Example:

```
for node in list_of_nodes:
    Q [ (node, node) ] = 1
```

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More For-Loops in Python

```
for i in range(7):
    print(i)
```

This will produce the numbers 0, 1… 6

```
n = 7
for i in range(n):
    for j in range(i + 1, n):
        print(i, j)
```

This will produce a double sum over *i* and *j*, including only “upper triangular” items

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References for Python

Books

Zed Shaw, Learn Python The Hard Way

Paul Barry, Head-First Python

Eric Matthes, Python Crash Course

Courses…

https://www.coursera.org/learn/python

Google…

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