



dwave



Links:

- D-Wave Ocean Software Documentation

https://docs.ocean.dwavesys.com/en/stable/getting_started.html

- D-Wave Leap Documentation

<https://docs.dwavesys.com/docs/latest/leap.html>

- D-Wave Solver Documentation

https://docs.dwavesys.com/docs/latest/doc_getting_started.html

▼ Installing and Setting up

⚠ If virtualenv does not exist,

- Macs

```
sudo pip install virtualenv
```

- Windows

```
pip install virtualenv
```

1. Create a new virtual environment of d-wave named quantum

```
virtualenv quantum
```

2. Enter the virtual environment

- Macs

```
source quantum/bin/activate
```

- Windows

```
./quantum/Scripts\activate.ps1
```

3. Confirmed the dwave-ocean sdk is not installed

```
pip uninstall dwave-ocean-sdk
```

4. Update the pip install to the latest version

```
python -m pip install --upgrade pip
```

✓ Type `python -m pip install --upgrade pip` again to check the pip version.
It should be prompted "Requirement already satisfied..."

```
> python -m pip install --upgrade pip
Requirement already satisfied: pip in ./venv/lib/python3.8/
[  🔍  ~/dwave ]
```

5. Install the dwave-ocean-sdk

```
pip install dwave-ocean-sdk
```

✓ If Success, type `pip list` , then these dwave packages will be appeared in the list

✗ If Error, open a new terminal, enter the virtual environment, and install dwave sdk again.

```
dwave-cloud-client 0.11.3
dwave-greedy        0.3.0
dwave-hybrid        0.6.11
dwave-inspector     0.4.4
dwave-neal          0.6.0
dwave-networkx      0.8.14
dwave-ocean-sdk     6.9.0
dwave-preprocessing 0.6.5
dwave-samplers      1.2.0
dwave-system        1.23.0
dwave-tabu          0.5.0
dwavebinarycsp      0.3.0
fasteners           0.19
```

▼ Dwave auth login

1. Create Dwave Account

<https://cloud.dwavesys.com/leap/login/?next=/leap/>

2. Ocean SDK: access your account

```
dwave auth login --oob
```

Press "Authorize" and copy the Authorization code and paste to the terminal

```
(Quantum) C:\Users\User> dwave auth login --oob
Please visit the following URL to authorize Ocean: https://cloud.dwavesys.com/leap/openid/authorize?response_type=code&client_id=805325&redirect_uri=urn%3Aietf%3Awg%3Aoauth%3A2.0%3Aaob&scope=openid+get_token&state=48jkbG0rEQGaUIPC7Hx5BjrnQypN&code_challenge=SvuyufVwUZodJlcb8-U0jhx74IqfFszpiY0MR0ot7-o&code_challenge_method=S256
Authorization code: 
```



```
(Quantum) C:\Users\User> dwave auth login --oob
Please visit the following URL to authorize Ocean: https://cloud.dwavesys.com/leap/openid/auth
lient_id=805325&redirect_uri=urn%3Aietf%3Awg%3Aoauth%3A2.0%3Aaob&scope=openid+get_token&state=
QypN&code_challenge=SvuyufVwUZodJlcb8-U0jhx74IqfFszpiY0MR0ot7-o&code_challenge_method=S256

Authorization code: 
Authorization completed successfully. You can now use "dwave auth get" to fetch your token.
```

3. Fetch your Leap solver API token.

```
dwave config create --auto-token
```

```
(Quantum) C:\Users\User> dwave config create --auto-token
Using the simplified configuration flow.
Try 'dwave config create --full' for more options.

Updating existing configuration file: C:\Users\User\AppData\Local\dwavesystem\dwave\dwave.conf
Available profiles: defaults
Updating existing profile: defaults
Fetched SAPI token for project 'NYCU QA RD Promotion Program' (9KDJ) from Leap API.
Configuration saved.
```

▼ Dwave Cloud Usage website

Links : <https://cloud.dwavesys.com/leap/login/?next=/leap>

Email : 使用 education email, ex: xxx@nccu.edu.tw

Monthly Access Usage Summary

- 可以看到自己的使用情況
- time available: 20min

▲ **Hybrid solver** : 傳統運算+量子運算 CPU + GPU

- 使用此solver會花費較多的時間，並且仍然算在20分鐘以內

System

- 可以看到各個機器使用情況: available or not

Demo

- 入門 : Interact with demo 對初學者十分友善
- 進階 : Code Examples
- Community : 互相討論、提出問題

▼ Dwave Programming Introduction

Sampler : 機器選擇

- 純QPU計算: (算時間)
 - Dwave QPU : `Sampler = dwave.system.DwaveSampler()`
- Hybrid 計算: (算時間)
 - 混合(QPU + CPU), 時間較長, 小心使用!!
 - Hybrid Solver : `Sampler = dwave.system.LeapHybridSampler()`
- 純CPU計算: (不算時間, 用作模擬)
 - Exact Solver
`Sampler = dimod.ExactSolver`
 - Simulated Annealing :
`Sampler = neal.SimulatedAnnealingSampler()`

問題型式 : QUBO

Quadratic	二次函数, ex : $x^2 + 3y^2 + 2x + 5$
Unconstraint	No Constraints
Binary	variables = 0 or 1
Optimization	最佳化問題