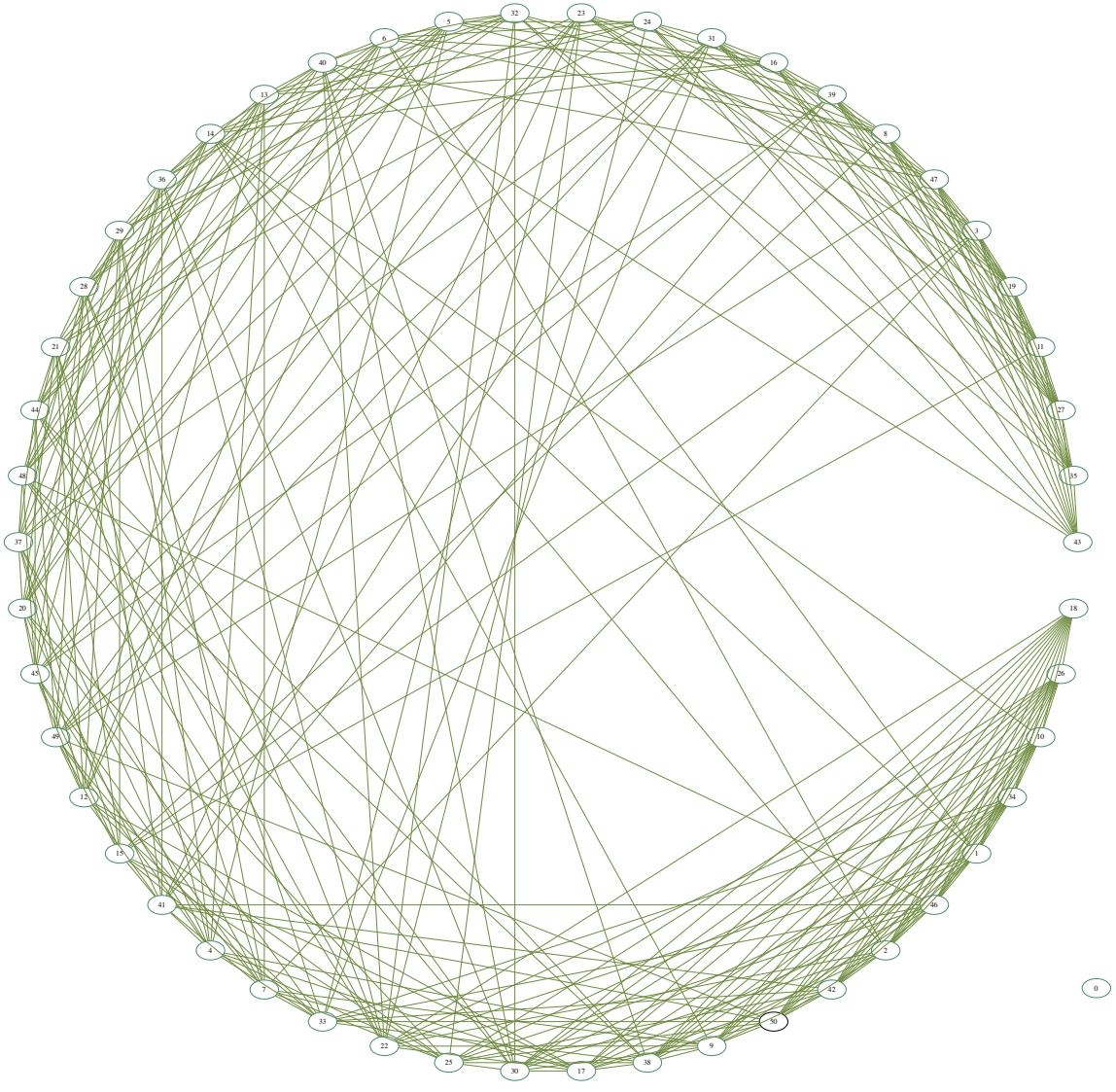
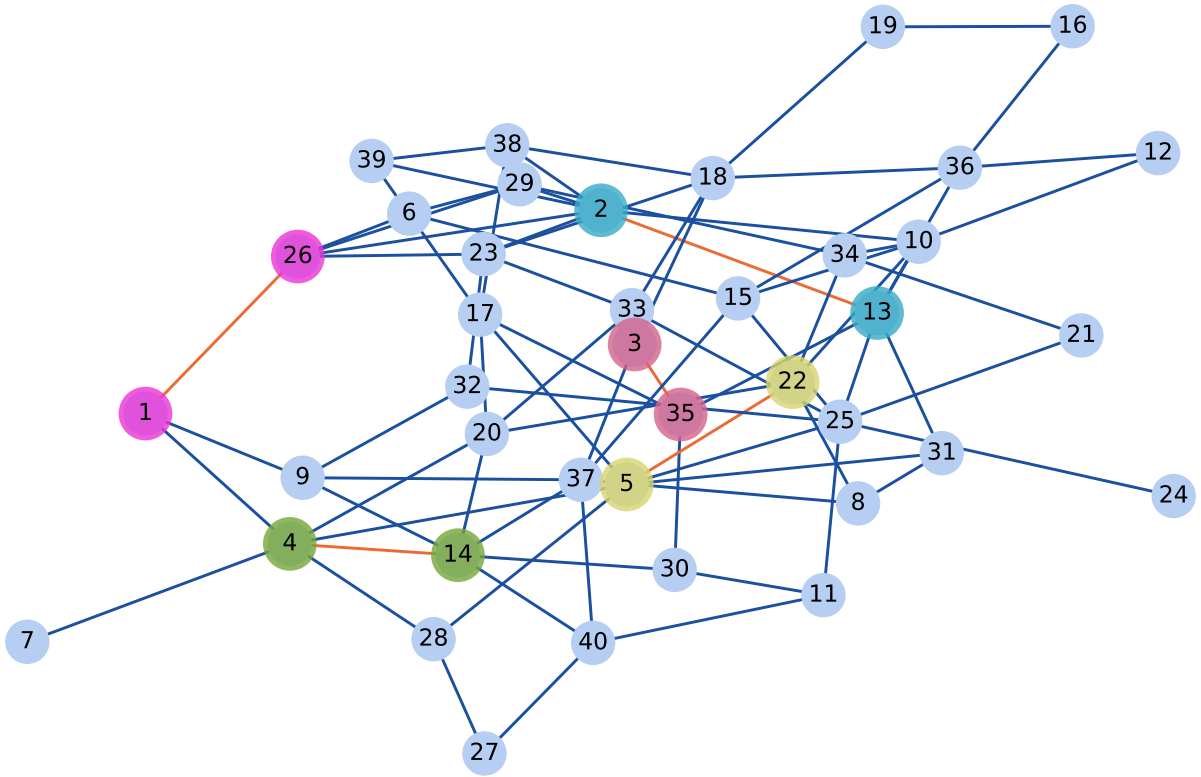
Algorithmic complexity and graphs: overview of the module

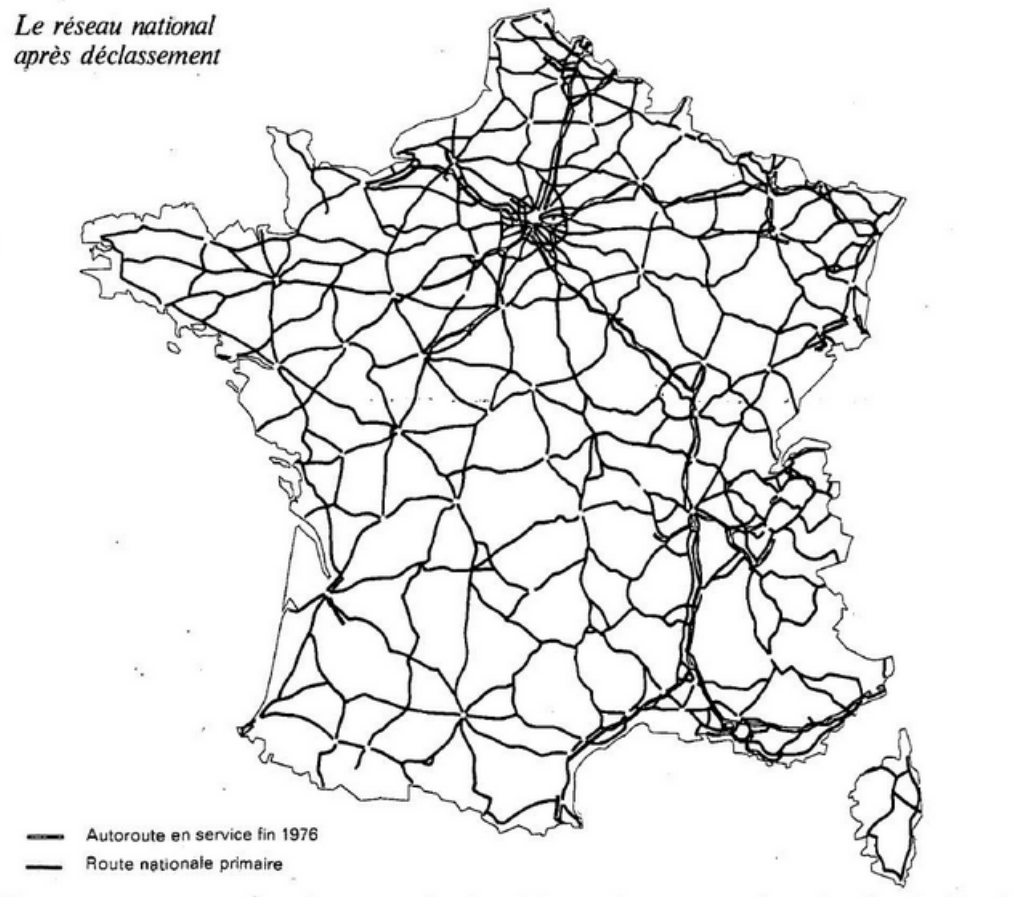
26 septembre 2022

Overview

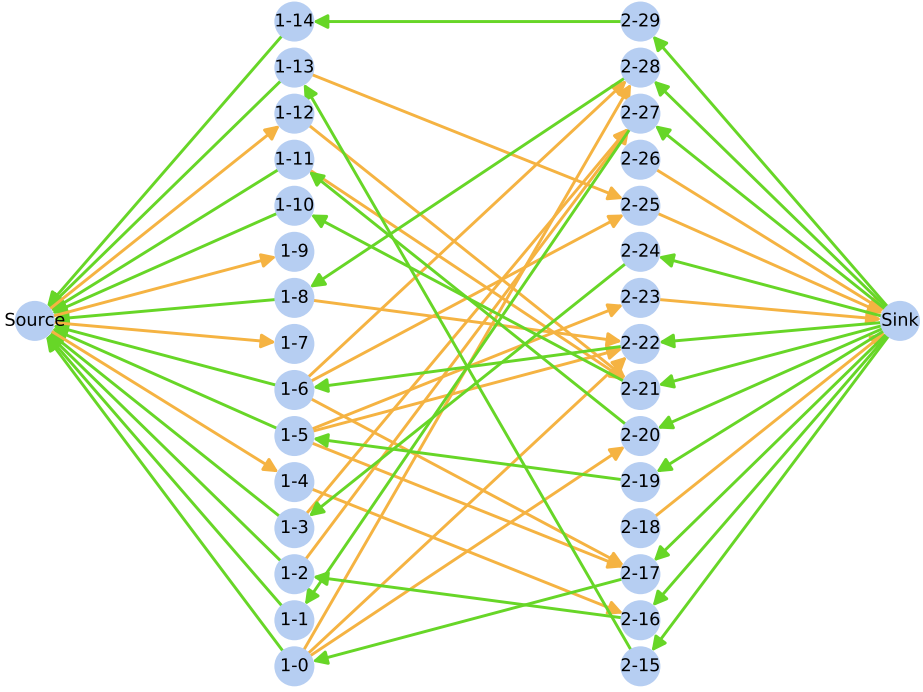

32
23
5
24
6
31
40
16
13
39
14
8
36
47
29
2
28
19
21
11
44
27
48
15
37
43
20
18
45
26
49
10
12
34
15
1
41
46
4
2
7
42
0
33
50
22
9
25
38
30
17

Matching size: 5
Algo step: 19
Nb nodes: 40

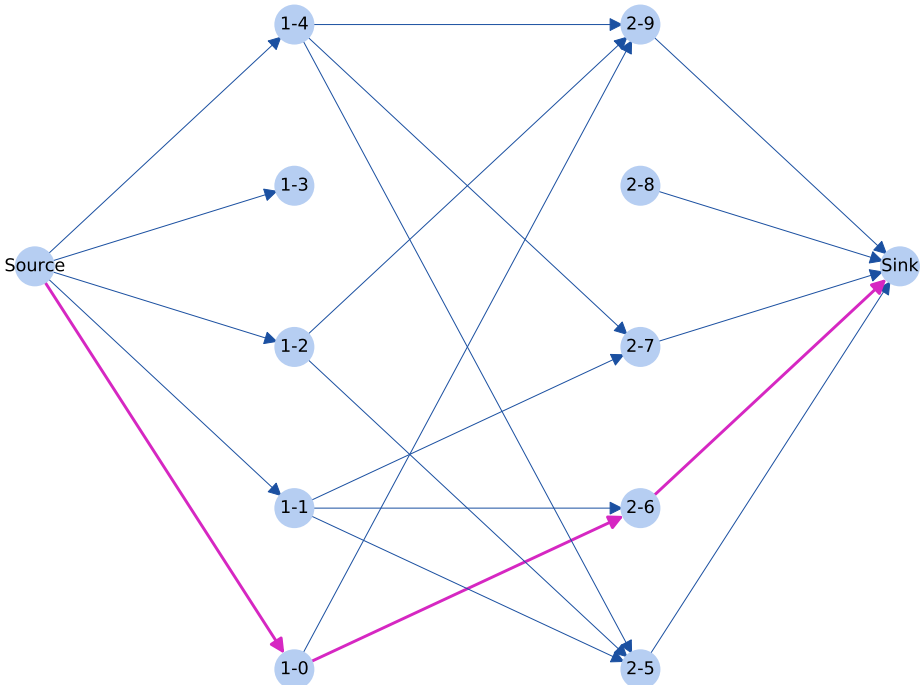



Le réseau national
après déclassement
Autoroute en service fin 1976
Route nationale primaire

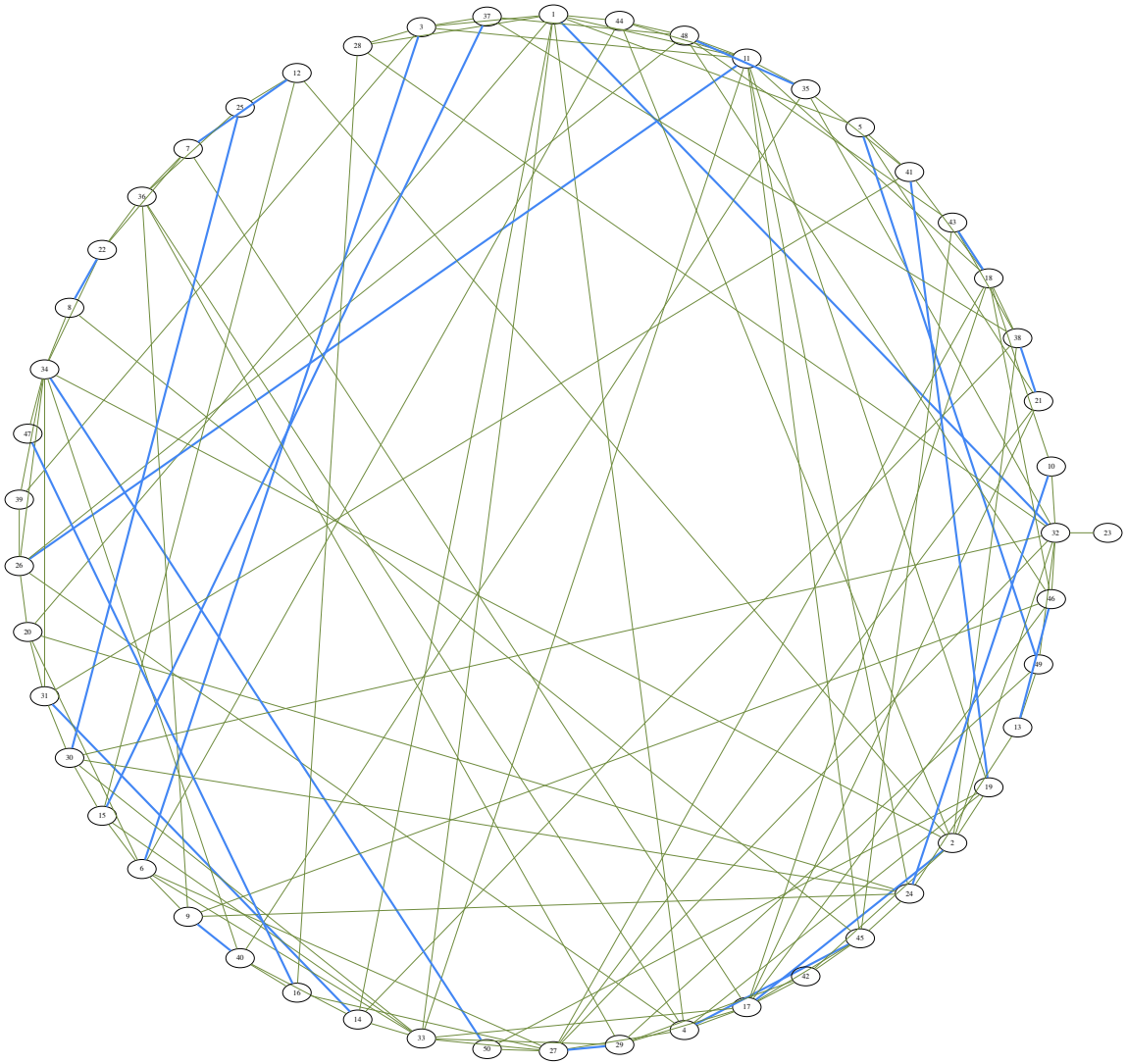
residual graph step 12



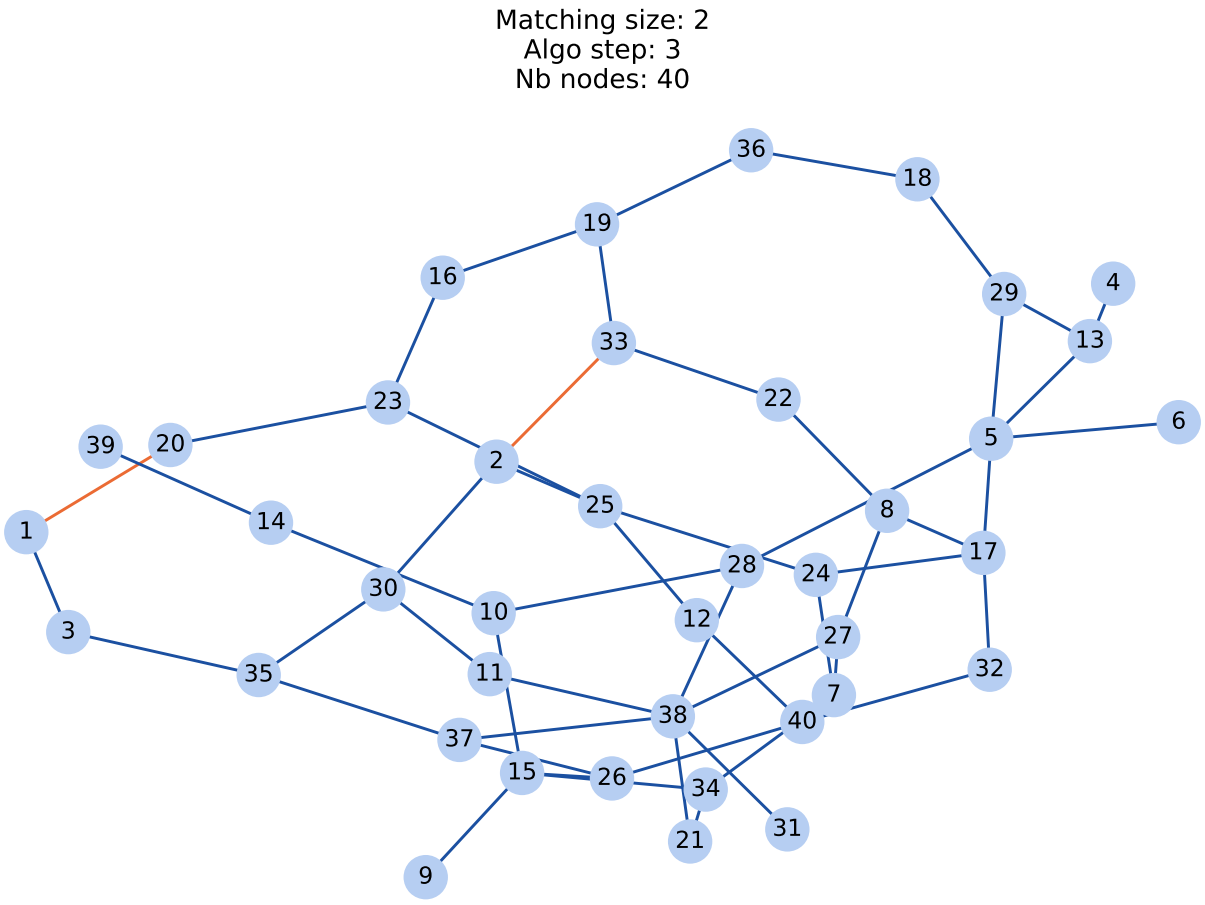
augmenting path step 1

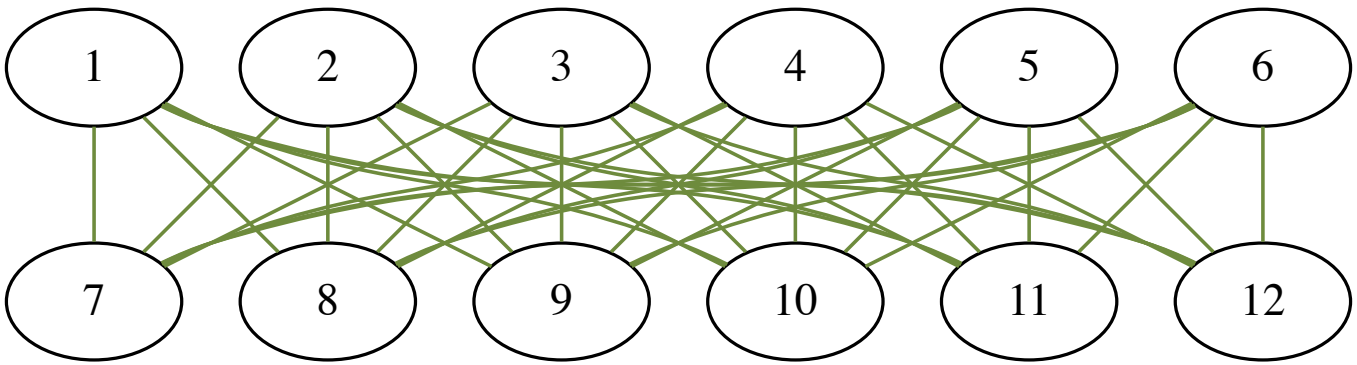


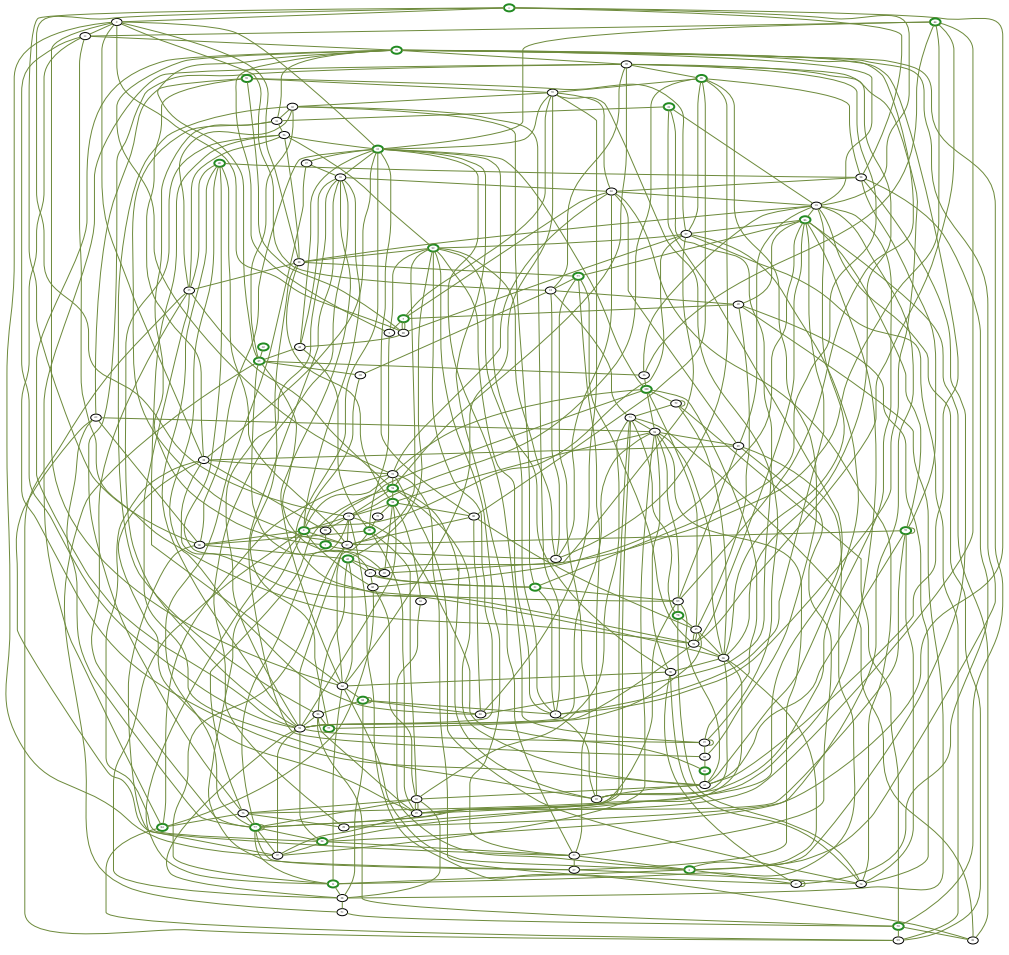
Overview



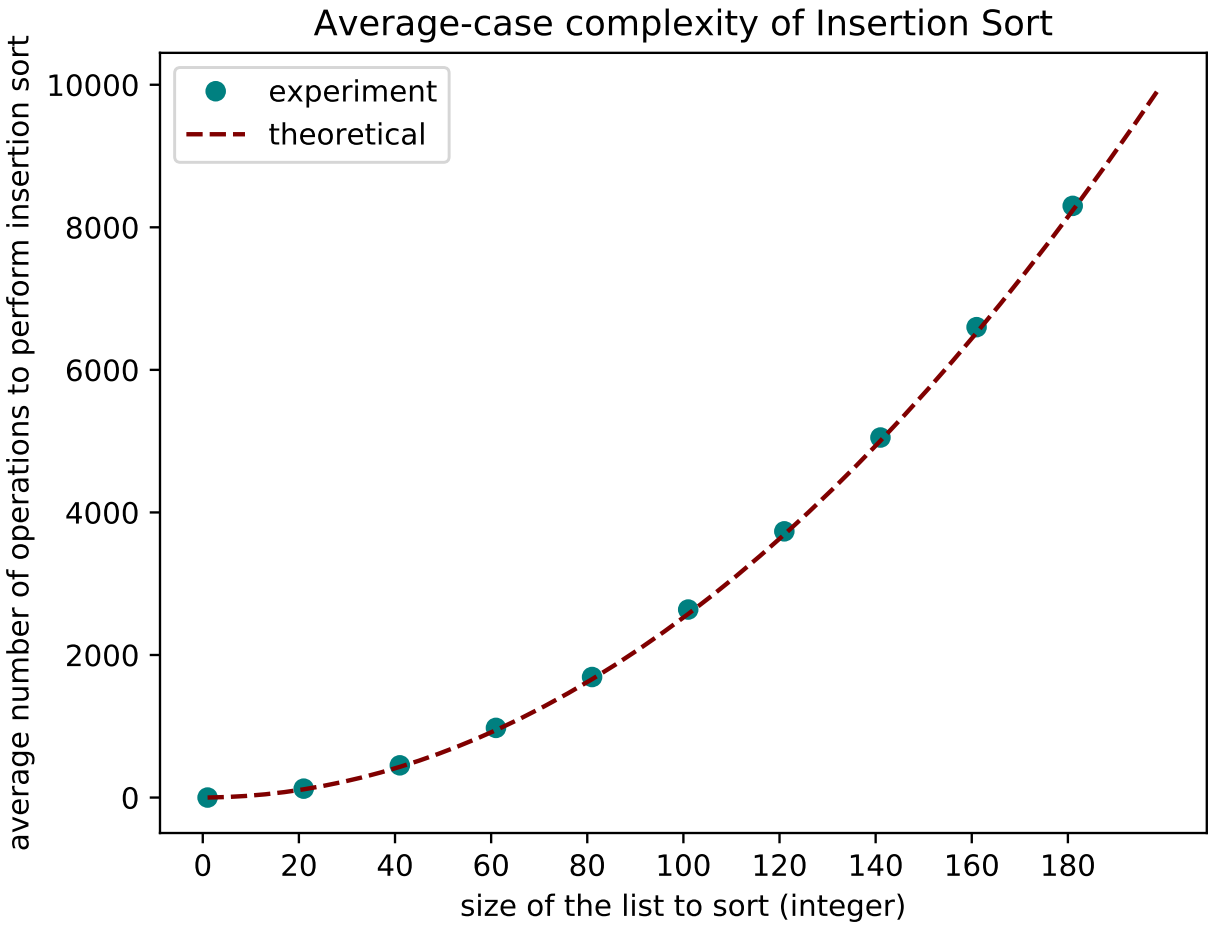
Matching size: 21
Algo step: 128
Nb nodes: 50


Matching size: 2
Algo step: 3
Nb nodes: 40
36
18
19
16
29
4
33
13
23
22
6
39
20
2
5
25
8
1
14
28
24
17
30
10
12
27
3
35
11
32
7
38
40
37
15
26
34
31
21
9


1
2
3
4
5
6
7
8
9
10
11
12



```
➜  rsa git:(correction) ✗ pp cipher_rsa.py
public key : (187, 153)
private key : 137
keys are ok : b is the inverse of a modulo phi
cipher rsa
a (97) becomes 124
l (108) becomes 113
g (103) becomes 86
o (111) becomes 111
r (114) becomes 141
i (105) becomes 150
t (116) becomes 139
h (104) becomes 70
m (109) becomes 10
  (32) becomes 32
c (99) becomes 88
o (111) becomes 111
u (117) becomes 134
r (114) becomes 141
s (115) becomes 81
e (101) becomes 118
code : 124,113,86,111,141,150,139,70,10,32,88,111,134,141,81,118
```


Average-case complexity of Insertion Sort
experiment
theoretical
average number of operations to perform insertion sort
size of the list to sort (integer)
0
2000
4000
6000
8000
10000
0
20
40
60
80
100
120
140
160
180

```
for i in range(n):
    for j in range(i):
        l = [i+j+k for k in range(n)]
```

Overview of the module

Day 1 Reminders on algorithms, cryptography, recursion, knapsack, shortest path

Day 2 Computation of complexities, graph problems (dominating set and others), notion of classes of complexity

Day 3 Networks, the matching problem and the maximum flow problem

Organization

- Presentations / discussions
- Coding exercises / paper+pen exercises
- Project : explained saturday
- QCMs : one each afternoon and morning (except for AM1)
- **questions :** please feel free to ask questions :
  - you can ask directly
  - or write them in the chat

more questions = more interesting / fun course !

Organization

- Please clone the following repository : `https://github.com/nlehir/AlgoGraph.git`, that contains :
  - slides
  - exercises
  - other useful information

Practical aspects

- Python 3 `https://www.python.org/`
- Third-party libraries : see **requirements.txt**
- For installation, several options are available :
  - create a folder for the course and install libraries in a virtual environment (using e.g. pip) `https://docs.python.org/3/tutorial/venv.html`
  - install libraries globally on your machine, using e.g. pip (not recommended in the python community for production projects)
  - use docker (please see the README.md)

Virtual environment

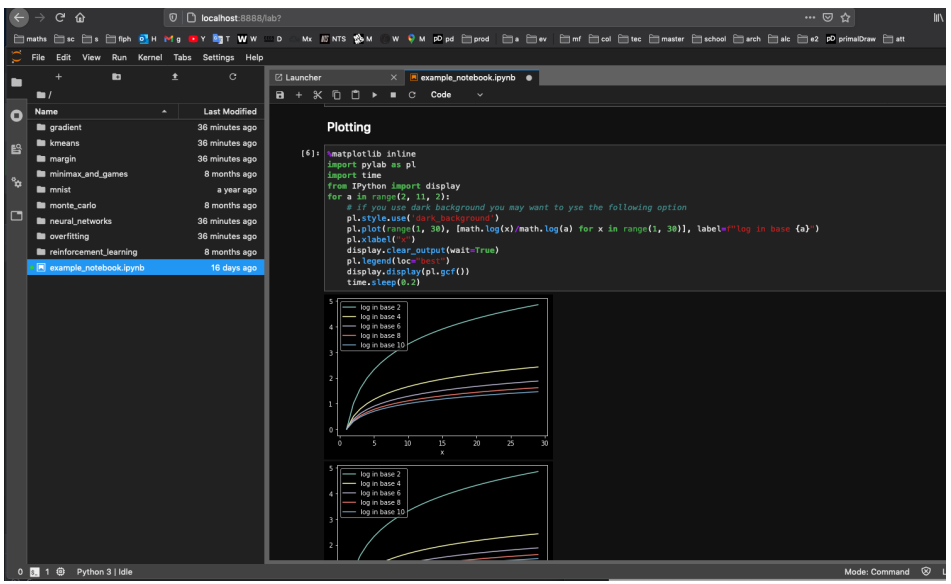
..aph/AlgoGraph (-zsh)

..aph/AlgoGraph (-zsh)

```
(env) ➜  AlgoGraph git:(master) ✗ which python
/Users/nico/Desktop/enseignement/epitech/AlgoGraph/AlgoGraph/env/bin/python
(env) ➜  AlgoGraph git:(master) ✗ python --version
Python 3.9.0
(env) ➜  AlgoGraph git:(master) ✗ pip list
Package              Version
-------------------- -----------
anyio                3.6.1
appnope              0.1.3
argon2-cffi          21.3.0
argon2-cffi-bindings 21.2.0
asttokens            2.0.8
attrs                22.1.0
Babel                2.10.3
backcall             0.2.0
beautifulsoup4       4.11.1
bleach               5.0.1
certifi              2022.9.24
cffi                 1.15.1
charset-normalizer   2.1.1
contourpy            1.0.5
cycler               0.11.0
debugpy              1.6.3
decorator            5.1.1
defusedxml           0.7.1
entrypoints          0.4
executing            1.1.0
```

Organization

- **jupyter notebooks** are convenient python interpreters. Depending on your preference, you may use them or mere python scripts (I tend to prefer scripts but by copying and pasting, you are able to turn a script into a notebook and vice versa)



Contact

firstname lehir @ gmail.com