L5 Data Preparation(1)

After this exercise, you will learn how to

- Perform data extraction from XML documents
- Perform data extraction from JSON documents

```
from google.colab import drive
drive.mount('/content/drive')
data_dir_path='/content/drive/My Drive/NYPITI02/L5/L5data/'
```

```
    Drive already mounted at /content/drive; to attempt to forcibly remount, call
```

XML and XPath

Recall that we've seen the following XML document in the lecture.

```
<addressbook>
    <contact>
        <name>Kenny</name>
        <phone type="office">65501696</phone>
        <email>kenny_lu@nyp.edu.sg</email>
    </contact>
    <contact>
        <name>Charles</name>
        <phone type="mobile">95501551</phone>
        <email>charles_lee@nyp.edu.sg</email>
    </contact>
</addressbook>
```

To extract sub element using `lxml` and `xpath`.

Get information under the node /addressbook/contact

▼ Click here for answer

```
from lxml import etree

doc = etree.parse(data_dir_path+"p5_addressbook.xml") # the XML file must be wellformed
results = doc.xpath("/addressbook/contact")
```

```
print(results)

for e in results:
    print([c.text for c in e.getchildren()])
```

```
#Add code
```

```
#add code
from lxml import etree

doc = etree.parse(data_dir_path+"p5_addressbook.xml") # the XML file must be wellfo
results = doc.xpath("/addressbook/contact")

print(results)

for e in results:
    print([c.text for c in e.getchildren()])
```

```
[<Element contact at 0x7f481c4920f0>, <Element contact at 0x7f481c492140>]
['Kenny', '65501696', 'kenny_lu@nyp.edu.sg']
['Charles', '95501551', 'charles_lee@nyp.edu.sg']
```

You also can get the node value using /text()

▼ Click here for answer

```
# alternatively
for e in results:
    name = e.xpath("name/text()")
    phone = e.xpath("phone/text()")
    email = e.xpath("email/text()")
    print("name = %s, phone = %s, email = %s" % (name[0],phone[0],email[0]))
```

```
#Add code
```

```
for e in results:
    name = e.xpath("name/text()")
    phone = e.xpath("phone/text()")
    email = e.xpath("email/text()")
    print("name = %s, phone = %s, email = %s" % (name[0],phone[0],email[0]))

     name = Kenny, phone = 65501696, email = kenny_lu@nyp.edu.sg
     name = Charles, phone = 95501551, email = charles_lee@nyp.edu.sg
```

Try using another xpath expression

use // Selects nodes in the document from the current node that match the selection no matter where they are

▼ Click here for answer

```
results = doc.xpath("//contact")
for e in results:
    print([c.text for c in e.getchildren()])
```

```
#Add code
```

```
#add code
results = doc.xpath("//contact")
for e in results:
    print([c.text for c in e.getchildren()])

     ['Kenny', '65501696', 'kenny_lu@nyp.edu.sg']
     ['Charles', '95501551', 'charles_lee@nyp.edu.sg']
```

Try using another xpath expression

//contact/phone[@type='mobile']

▼ Click here for answer

```
results = doc.xpath("//contact/phone[@type='mobile']")
for e in results:
  print(e.text)
```

```
#Add code
```

```
#add code
results = doc.xpath("//contact/phone[@type='mobile']")
for e in results:
  print(e.text)

    95501551
```

```
results = doc.xpath("//contact/phone[@type]")
for e in results:
  print(e.text)


for e in results:
  print([c.text for c in e.getparent().getchildren()])


    65501696
    95501551
    ['Kenny', '65501696', 'kenny_lu@nyp.edu.sg']
    ['Charles', '95501551', 'charles_lee@nyp.edu.sg']
```

```
results = doc.xpath("//contact/phone/@type")
for e in results:
  print(e)

    office
    mobile
```

XML and Xpath Exercise

Consider another XML data file in `data_dir_path+"p5_menu.xml`, which looks like the following

```
<breakfast_menu>
  <food>
    <name>Belgian Waffles</name>
    <price>5.95</price>
    <description>Two of our famous Belgian Waffles with plenty of real maple syrup</descri
    <calories>650</calories>
  </food>
  <food>
    <name>Strawberry Belgian Waffles</name>
    <price>7.95</price>
    <description>Light Belgian waffles covered with strawberries and whipped cream</descri
    <calories>900</calories>
  </food>
  <food>
    <name>Berry-Berry Belgian Waffles</name>
```

```
      <price>8.95</price>
      <description>Light Belgian waffles covered with an assortment of fresh berries and whi
      <calories>900</calories>
    </food>
    <food>
      <name>French Toast</name>
      <price>4.50</price>
      <description>Thick slices made from our homemade sourdough bread</description>
      <calories>600</calories>
    </food>
    <food>
      <name>Homestyle Breakfast</name>
      <price>6.95</price>
      <description>Two eggs, bacon or sausage, toast, and our ever-popular hash browns</desc
      <calories>950</calories>
    </food>
  </breakfast_menu>
```

Your task is to define a conversion function to convert the above into the following TSV file named `data_dir_path+"p5_menu.tsv`.

```
Belgian Waffles    5.95   Two of our famous Belgian Waffles with plenty of real maple syru
...
Homestyle Breakfast   6.95  Two eggs, bacon or sausage, toast, and our ever-popular hash b
```

▶ Click here for answer

```
#Add code
from lxml import etree

doc = etree.parse(data_dir_path+"p5_menu.xml") # the XML file must be wellformed
results = doc.xpath("//food")

print(results)

for e in results:
    print([c.text for c in e.getchildren()])

with open(data_dir_path+'p5_menu.csv' ,'w') as menu_tsv:
  for e in results:
    child = [c.text for c in e.getchildren()]
    joinStr = '\t'
    toSaveStr = joinStr.join(child)
    menu_tsv.write(toSaveStr + '\n')
```

```
[<Element food at 0x7f481c3b72d0>, <Element food at 0x7f481c3b7320>, <Element
['Belgian Waffles', '5.95', 'Two of our famous Belgian Waffles with plenty of
['Strawberry Belgian Waffles', '7.95', 'Light Belgian waffles covered with str
['Berry-Berry Belgian Waffles', '8.95', 'Light Belgian waffles covered with an
['French Toast', '4.50', 'Thick slices made from our homemade sourdough bread'
['Homestyle Breakfast', '6.95', 'Two eggs, bacon or sausage, toast, and our ev
```

```
from lxml import etree
# todo
def menu_xml_to_tsv():
    menu_xml = etree.parse(data_dir_path+"p5_menu.xml")
    #add code -xpath express
    results = menu_xml.xpath("/breakfast_menu/food")
    print(results)
    for e in results:
      print([c.text for c in e.getchildren()])

    with open(data_dir_path+'p5_menu.tsv' ,'w') as menu_tsv:
      for e in results:
        l=[c.text for c in e.getchildren()]
        # print(l)
        s="\t"
        line=s.join(l)
        print(line)
        menu_tsv.write(line+"\n")
menu_xml_to_tsv()
```

```
[<Element food at 0x7f481c4ad9b0>, <Element food at 0x7f481c4ad960>, <Element
['Belgian Waffles', '5.95', 'Two of our famous Belgian Waffles with plenty of
['Strawberry Belgian Waffles', '7.95', 'Light Belgian waffles covered with str
['Berry-Berry Belgian Waffles', '8.95', 'Light Belgian waffles covered with an
['French Toast', '4.50', 'Thick slices made from our homemade sourdough bread'
['Homestyle Breakfast', '6.95', 'Two eggs, bacon or sausage, toast, and our ev
Belgian Waffles 5.95    Two of our famous Belgian Waffles with plenty of real
Strawberry Belgian Waffles      7.95    Light Belgian waffles covered with str
Berry-Berry Belgian Waffles     8.95    Light Belgian waffles covered with an
French Toast    4.50    Thick slices made from our homemade sourdough bread
Homestyle Breakfast     6.95    Two eggs, bacon or sausage, toast, and our eve
```

HTML and CSS Selector

CSS is a power language for decorating our HTML web pages

it turns out to be very useful in extracting information from HTML document too. Consider the following HTML document we've seen during the lecture.

```
<html> <head> <title> Address Book </title> </head>
<body>
```

```
    <ul>
        <li>
            <div class="name">Kenny</div>
            <div class="phone">65501696</div>
            <div class="email">kenny_lu@nyp.edu.sg</div>
        </li>
        <li>
            <div class="name">Charles</div>
            <div class="mobile">95501551</div>
            <div class="email">charles_lee@nyp.edu.sg</div>
        </li>
    </ul>
</body>
</html>
```

With the following code, we are able to use the css selector to extract a particular portion of the HTML document.

We want to extract all the mobile phone

```
div_selector = CSSSelector("div[class='mobile']")
for e in div_selector(doc):
    print(e.text)
```

Install the library

```
!pip install cssselect
```

```
#Add code
```

```
!pip install cssselect

     Collecting cssselect
       Downloading cssselect-1.1.0-py2.py3-none-any.whl (16 kB)
     Installing collected packages: cssselect
     Successfully installed cssselect-1.1.0
```

```
from lxml import etree
from lxml.cssselect import CSSSelector
htmlparser = etree.HTMLParser()
doc = etree.parse(data_dir_path+"p5_addressbook.html", htmlparser)
#to extract all the mobile number
```

```
#add code
```

```
from lxml import etree
from lxml.cssselect import CSSSelector
htmlparser = etree.HTMLParser()
doc = etree.parse(data_dir_path+"p5_addressbook.html", htmlparser)
#to extract all the mobile number
#add code
div_selector = CSSSelector("div[class='mobile']")
for e in div_selector(doc):
    print(e.text)
```

```
95501551
```

Using BeautifulSoup as an alternative

There are situations which the `HTMLParser` in `etree` fails to perform the parsing job due to some malformed HTML document. BeaultifulSoup come in handy, in the expense a bit of performance overhead.

Install the library

```
!pip install beautifulsoup4
!pip install lxml
!pip install future
```

```
#Add code
```

```
!pip install beautifulsoup4
!pip install lxml
!pip install future
```

```
Requirement already satisfied: beautifulsoup4 in /usr/local/lib/python3.7/dist
Requirement already satisfied: lxml in /usr/local/lib/python3.7/dist-packages
Requirement already satisfied: future in /usr/local/lib/python3.7/dist-package
```

Open the html file

```
from bs4 import BeautifulSoup
import csv
```

```
soup = BeautifulSoup (open(data_dir_path+"p5_addressbook.html"),"html.parser")
```

```
#Add code


from bs4 import BeautifulSoup
import csv

soup = BeautifulSoup (open(data_dir_path+"p5_addressbook.html"),"html.parser")
```

Use function find_all()

The find_all() method looks through a tag's descendants and retrieves all descendants that match your filters.

```
links = soup.find_all('div', attrs={'class':'name'})
for link in links:
  print(link)
  names = link.contents[0]
  print(names)
```

```
#Add code


links = soup.find_all('div', attrs={'class':'name'})
for link in links:
  print(link)
  names = link.contents[0]
  print(names)
```

```
    <div class="name">Belgian Waffles</div>
    Belgian Waffles
    <div class="name">Strawberry Belgian Waffles</div>
    Strawberry Belgian Waffles
    <div class="name">Berry-Berry Belgian Waffles</div>
    Berry-Berry Belgian Waffles
    <div class="name">French Toast</div>
    French Toast
    <div class="name">Homestyle Breakfast</div>
    Homestyle Breakfast
```

Exercise CSSSelector

Consider another HTML file in data_dir_path/p5_menu.html, which looks like the following

```
<html> <head>
<title>Breakfast Menu</title>
</head>


<body>
```

```
<h1>Breakfast Menu</h1>

<ol class="breakfast_menu">
  <li class="food">
    <div class="name">Belgian Waffles</div>
    <div class="price">5.95</div>
    <div class="description">Two of our famous Belgian Waffles with plenty of real maple s
    <div class="calories">650</div>
  </li>
  <li class="food">
    <div class="name">Strawberry Belgian Waffles</div>
    <div class="price">7.95</div>
    <div class="description">Light Belgian waffles covered with strawberries and whipped c
    <div class="calories">900</div>
  </li>
  <li class="food">
    <div class="name">Berry-Berry Belgian Waffles</div>
    <div class="price">8.95</div>
    <div class="description">Light Belgian waffles covered with an assortment of fresh ber
    <div class="calories">900</div>
  </li>
  <li class="food">
    <div class="name">French Toast</div>
    <div class="price">4.50</div>
    <div class="description">Thick slices made from our homemade sourdough bread</div>
    <div class="calories">600</div>
  </li>
  <li class="food">
    <div class="name">Homestyle Breakfast</div>
    <div class="price">6.95</div>
    <div class="description">Two eggs, bacon or sausage, toast, and our ever-popular hash
    <div class="calories">950</div>
  </li>
</ol>

</body> </html>
```

Task

Your task is to define a function `menu_html_to_tsv` similar to the last exercise to extract the menu data into a tsv file named `p5_menu2.tsv`. But we will use the CSSSelector.

```
Belgian Waffles    5.95    Two of our famous Belgian Waffles with plenty of real maple syr
Strawberry Belgian Waffles    7.95    Light Belgian waffles covered with strawberries and
Berry-Berry Belgian Waffles    8.95    Light Belgian waffles covered with an assortment of
```

```
 French Toast    4.50    Thick slices made from our homemade sourdough bread    600
 Homestyle Breakfast    6.95    Two eggs, bacon or sausage, toast, and our ever-popular has
```

Extract data using CSSSelector

▶ Click here for answer

```
#Add code
from bs4 import BeautifulSoup
import csv

soup = BeautifulSoup (open(data_dir_path+"p5_menu.html"),"html.parser")
links = soup.find_all('li', attrs={'class':'food'})

with open(data_dir_path+'/p5_menu2.csv' ,'w') as menu_tsv:
  for link in links:
    print(link.find_all('div', attr={'class':'name'}))
    # name = link.find_all('div', attr={'class':'name'})[0].text
    # price = link.contents[3].text
    # desc = link.contents[5].text
    # cal = link.contents[7].text
    # menu_tsv.write("\t".join([name,price,desc,cal]) + "\n")
```

```
     []
     []
     []
     []
     []
```

```
from lxml import etree
from lxml.cssselect import CSSSelector
def menu_html_to_tsv():
    htmlparser = etree.HTMLParser()
    menu_html = etree.parse(data_dir_path+"p5_menu.html", htmlparser)
    food_selector = CSSSelector("li[class='food']")
    name_selector = CSSSelector("div[class='name']")
    price_selector = CSSSelector("div[class='price']")
    desc_selector = CSSSelector("div[class='description']")
    cal_selector = CSSSelector("div[class='calories']")
    with open(data_dir_path+'/p5_menu2.tsv' ,'w') as menu_tsv:
        foods = food_selector(menu_html)
        for e in foods:
            name = name_selector(e)[0].text
            price = price_selector(e)[0].text
            desc = desc_selector(e)[0].text
            cal  = cal_selector(e)[0].text
            menu_tsv.write("\t".join([name,price,desc,cal]) + "\n")
menu_html_to_tsv()
```

Handling JSON data

Handling JSON data is relatively easier in Python. Consider the following JSON address book document we've seen in the lecture.

```
[  { "name" : "kenny",
     "phone_type" : "office",
     "phone_num" : "65501696",
     "email" : "kenny_lu@nyp.edu.sg"
   },
   { "name" : "charles",
     "phone_type" : "mobile",
     "phone_num" : "95501551",
     "email" : "charles_lee@nyp.edu.sg"
   }
]
```

We use the builtin `json` library in Python, which allows us to converts JSON data (as string) to Python data structure such as dictionary and list.

Read a json format as string, store them in list of dictionaries

▼ Click here for answer

```
import json

f = open(data_dir_path+"p5_addressbook.json",'r')
l = json.loads(f.read())
f.close()
print(l) # l is a list of dictionaries
```

Open a text file to store the json data format

▼ Click here for answer

```
g = open(data_dir_path+"output.json", "w")
g.write(json.dumps(l))
g.close()
```

```
#Add code
```

```
#Add code
```

```
import json

f = open(data_dir_path+"p5_addressbook.json",'r')
l = json.loads(f.read())
f.close()
print(l) # l is a list of dictionaries

g = open(data_dir_path+"output.json", "w")
g.write(json.dumps(l))
g.close()
```

```
    [{'name': 'kenny', 'phone_type': 'office', 'phone_num': '65501696', 'email': '
```

Exercise Json

Convert data in `data_dir_path/p5_menu.xml` into a json file named `data_dir_path/p5_menu.json`, which should look like the following

```
[{"price": "5.95",
  "calories": "650",
  "name":
  "Belgian Waffles",
  "description": "Two of our famous Belgian Waffles with plenty of real maple syrup"
 },
 {"price": "7.95",
  "calories": "900",
  "name": "Strawberry Belgian Waffles",
  "description": "Light Belgian waffles covered with strawberries and whipped cream"
 },
 {"price": "8.95",
  "calories": "900",
  "name": "Berry-Berry Belgian Waffles",
  "description": "Light Belgian waffles covered with an assortment of fresh berries and wh
 },
 {"price": "4.50",
  "calories": "600",
  "name": "French Toast",
  "description": "Thick slices made from our homemade sourdough bread"
 },
 {"price": "6.95",
  "calories": "950",
  "name": "Homestyle Breakfast",
  "description": "Two eggs, bacon or sausage, toast, and our ever-popular hash browns"
 }]
```

Extract XML data into list of dictionaries

Store the list of dictionary into the Json text file

▼ Click here for answer

```
def menu_xml_to_json():
    menu = []
    menu_xml = etree.parse(data_dir_path+"p5_menu.xml")
    foods = menu_xml.xpath("//food")
    for e in foods:
        food={}
        food["name"] = e.xpath("name")[0].text
        food["price"] = e.xpath("price")[0].text
        food["description"] =e.xpath("description")[0].text
        food["calories"]  = e.xpath("calories")[0].text
        menu.append(food)

    #Add code to store the list of dictionary into Json text file
    with open(data_dir_path+'p5_menu.json' ,'w') as menu_json:
        menu_json.write(json.dumps(menu))
    menu_json.close()
```

```
#Add code
```

```
menu_xml_to_json()
```

```
---------------------------------------------------------------------------
NameError                                 Traceback (most recent call last)
<ipython-input-56-8a74aa3d4cc6> in <module>()
      2 
      3 
----> 4 menu_xml_to_json()

NameError: name 'menu_xml_to_json' is not defined
```

SEARCH STACK OVERFLOW

```
# todo
def menu_xml_to_json():
    menu = []
    menu_xml = etree.parse(data_dir_path+"p5_menu.xml")
    foods = menu_xml.xpath("//food")
    for e in foods:
        food={}
        food["name"] = e.xpath("name")[0].text
        food["price"] = e.xpath("price")[0].text
        food["description"] =e.xpath("description")[0].text
        food["calories"]  = e.xpath("calories")[0].text
        menu.append(food)

    with open(data_dir_path+'p5_menu.json' ,'w') as menu_json:
        menu_json.write(json.dumps(menu))
    menu_json.close()

menu_xml_to_json()
```

Pandas and JSON

There is a good news. Pandas dataframe can be loaded directly from JSON file too.

```
import pandas as pd
df = pd.read_json(data_dir_path+"p5_addressbook.json")
df.head()
```

	name	phone_type	phone_num	email
0	kenny	office	65501696	kenny_lu@nyp.edu.sg
1	charles	mobile	95501551	charles_lee@nyp.edu.sg

Semi-structured data(Graph)(Optional)

```
import networkx as nx           # For making graphs,manipulation etc
import matplotlib.pyplot as plt # For plotting the graphs
import numpy as np # Matrix manipulation
import seaborn as sns # plotting
```

```
#If you want to make an undirected graph, this is what you do
gf=nx.Graph()
#If you want to make a directed graph
gfd=nx.DiGraph()
```

That’s all you need to do. But We will mostly deal with Undirected Graphs. Our graph is empty, let quickly add some nodes and establish relationships.

```
gf.add_node(1)
gf.add_node(2)
gf.add_node(3)
gf.add_node(4)
gf.add_node(5)
gf.add_node(6)
```

Quickly check number of nodes in our graph by the command

```
gf.number_of_nodes()
```

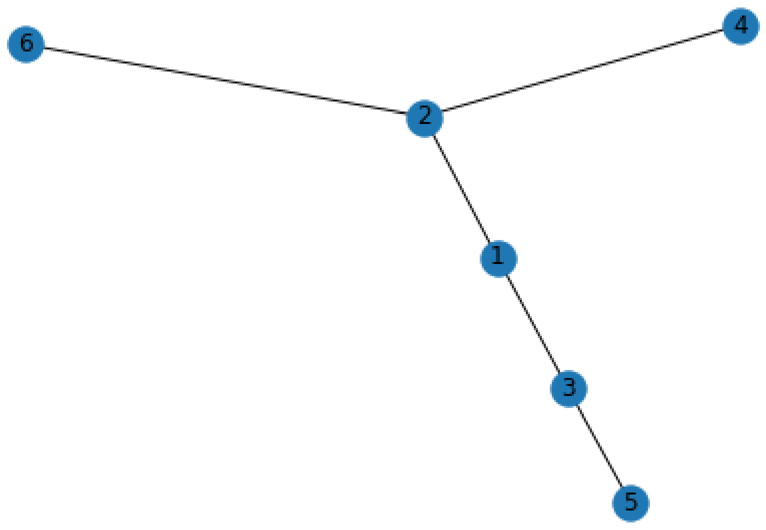
```
    6
```

We have added 6 nodes in our graph, now lets add relationship i.e edges between them and this how we do this.

```
gf.add_edge(1,2)
gf.add_edge(1,3)
gf.add_edge(2,6)
gf.add_edge(2,4)
gf.add_edge(3,5)
```

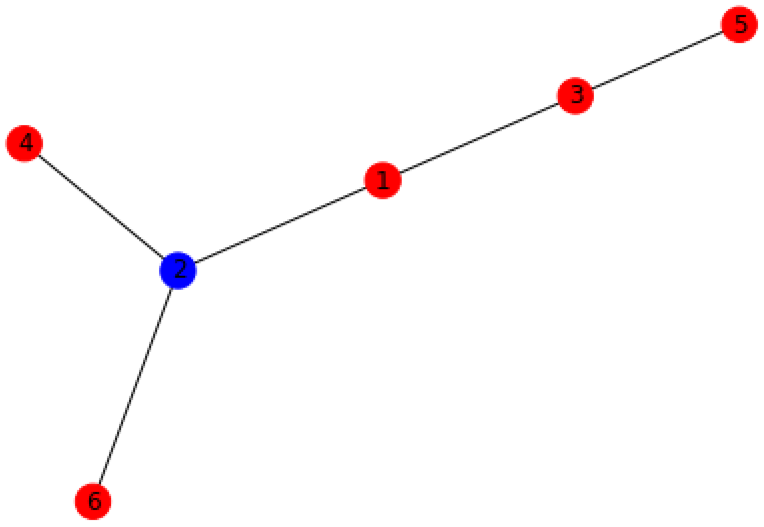
We have now added relationship between nodes and this is how our graph looks like.

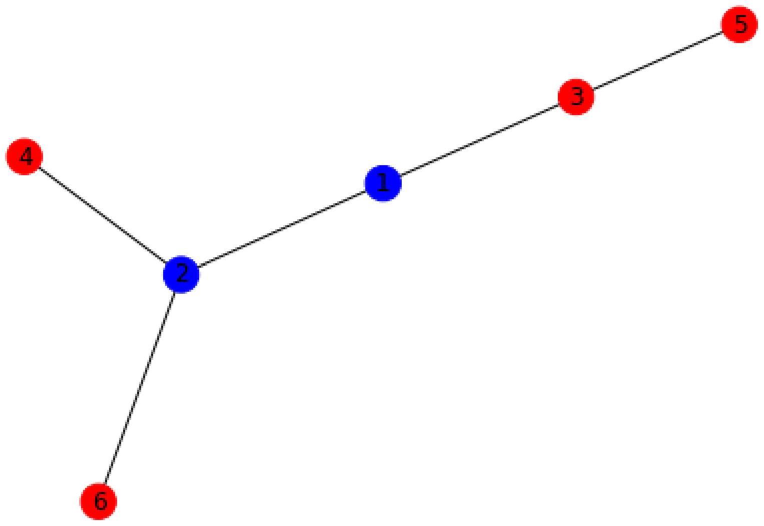
```
nx.draw(gf, with_labels=True)
plt.show()
```

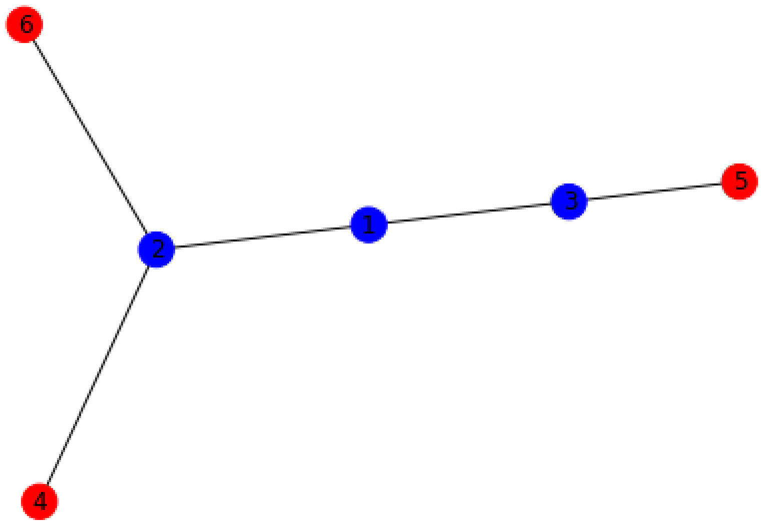


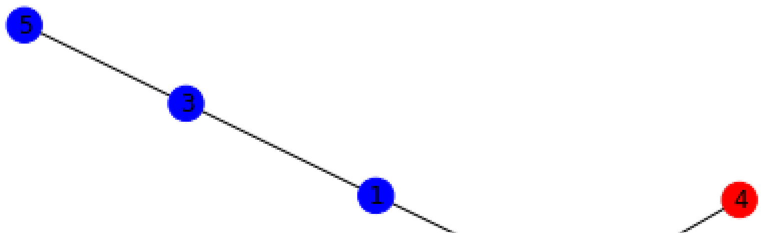
Okay, so now we can get our hands dirty. Let’s implement some algorithms on it, how about a Depth First Search ? Here’s an Implementation of DFS, each time we visit a vertex we color them blue(initially red)

```
visited=[]
color_map=['red']*(gf.number_of_nodes()+0) #Coloring them red.
def dfs(x):
    if(x not in visited): #If node is not yet visited,pay a visit.
        color_map[x-1]='blue' # Color them blue once visited.
        nx.draw(gf,node_color=color_map,with_labels=True)
        plt.show()
        visited.append(x)
        all_n=nx.neighbors(gf,x)
        for x_o in all_n:
            dfs(x_o)
dfs(2)
```


5
3
4
1
2
6


5
3
4
1
2
6


6
5
3
1
2
4


5
3
1
4