



**AMRITA**  
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DEEMED TO BE UNIVERSITY

# 19CSE337 Social Networking Security

Lecture 6



## Topics to Discuss

- Introduction to NetworkX
- Constructing Network Models using NetworkX
- Network visualization using NetworkX



# Introduction

- What is NetworkX?
  - NetworkX is a Python package for the creation, manipulation, and study of the structure, dynamics, and functions of complex networks.
  - It is a free network analysis toolkit widely used by network researchers.
  - It is very simple, flexible, supports many graph algorithms, etc.



# Basics

- What type of graph object to use?
- NetworkX support four basic types.
  - **Graph** For undirected simple graphs (self-loops are allowed).
  - **DiGraph** For directed simple graphs (self-loops are allowed).
  - **MultiGraph** For undirected multigraphs (self-loops and multiple edges are allowed).
  - **MultiDiGraph** For directed multigraphs (self-loops and multiple edges are allowed)
- NetworkX uses a “dictionary of dictionaries of dictionaries” as the basic network data structure.

- NetworkX graph objects can be created in one of three ways:
  - Graph generators: standard algorithms to create network topologies.
  - Importing data from pre-existing (usually file) sources.
  - Adding edges and nodes explicitly.

# Creating graph object



Spyder (Python 3.9)

File Edit Search Source Run Debug Consoles Projects Tools View Help

C:\Users\mails.spyder-py3\temp.py

```
temp.py X
1 import networkx as nx;
2
3 #creating an empty graph object
4 g=nx.Graph()
5
6 #adding a node named Amrita
7 g.add_node('Amrita')
8
```

Source Console Object

Usage

Here you can get help of any object by pressing **Ctrl+H** in front of it, either on the Editor or the Console.

Help can also be shown automatically after writing a left parenthesis next to an object. You can activate this behavior in **Preferences > Help**.

New to Spyder? Read our [tutorial](#)

Console 1/A X

```
In [3]: runfile('C:/Users/mailsp.y3/temp.py', wdir='C:/Users/mailsp.y3')
In [4]: runfile('C:/Users/mailsp.y3/temp.py', wdir='C:/Users/mailsp.y3')
In [5]: g
Out[5]: <networkx.classes.graph.Graph at 0x1eeddf31a60>
In [6]: g.nodes
Out[6]: NodeView(('Amrita',))
In [7]: |
```

LSP Python: ready conda: base (Python 3.9.7) Line 8, Col 1 ASCII CRLF ENG Mem 42% Show desktop

12-01-2022

# Adding nodes



Spyder (Python 3.9)

File Edit Search Source Run Debug Consoles Projects Tools View Help

C:\Users\mails\spyder-py3\temp.py

temp.py X

```
1 import networkx as nx;
2 #creating an empty graph object
3 g=nx.Graph()
4
5 #adding a node named Amrita
6 g.add_node('Amrita')
7
8 #adding more nodes
9 g.add_node('Anna')
10 g.add_node('Bharathiar')
11
12
```

Source Console Object

Usage

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Help Variable Explorer Plots Files

Console 1/A X

```
In [7]: runfile('C:/Users/mail/.spyder-py3/temp.py', wdir='C:/Users/mail/.spyder-py3')
```

```
In [8]: g.nodes
Out[8]: NodeView(('Amrita', 'Anna', 'Bharathiar'))
```

```
In [9]:
```

LSP Python: ready conda: base (Python 3.9.7) Line 1, Col 23 ASCII CRLF ENG IN 22:10 12-01-2022

# Adding more nodes at once



Spyder (Python 3.9)

File Edit Search Source Run Debug Consoles Projects Tools View Help

C:\Users\mails\spyder-py3\temp.py

temp.py X

```
1 import networkx as nx;
2 #creating an empty graph object
3 g=nx.Graph()
4
5 #adding a node named Amrita
6 g.add_node('Amrita')
7
8 #adding more nodes
9 g.add_node('Anna')
10 g.add_node('Bharathiar')
11
12 #adding more nodes at once
13 g.add_nodes_from(['KTU','Calicut','IITPKD'])
14
15
```

Source Console Object C:\Users\mails\spyder-py3

Usage

Here you can get help of any object by pressing **Ctrl+H** in front of it, either on the Editor or the Console.

Help can also be shown automatically after writing a left parenthesis next to an object. You can activate this behavior in Preferences > Help.

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Help Variable Explorer Plots Files

Console 1/A X

```
In [7]: runfile('C:/Users/mail/.spyder-py3/temp.py', wdir='C:/Users/mail/.spyder-py3')
In [8]: g.nodes
Out[8]: NodeView(('Amrita', 'Anna', 'Bharathiar'))
In [9]: runfile('C:/Users/mail/.spyder-py3/temp.py', wdir='C:/Users/mail/.spyder-py3')
In [10]: g.nodes
Out[10]: NodeView(('Amrita', 'Anna', 'Bharathiar', 'KTU', 'Calicut', 'IITPKD'))
In [11]:
```

LSP Python: ready conda: base (Python 3.9.7) Line 15, Col 1 ASCII CRLF RW Mem 43%

Speaker (Realtek(R) Audio): 42%

22:13 12-01-2022

# Adding edges



Spyder (Python 3.9)

File Edit Search Source Run Debug Consoles Projects Tools View Help

C:\Users\malls\spyder-py3\temp.py

temp.py X

```
1 import networkx as nx;
2 #creating an empty graph object
3 g=nx.Graph()
4
5 #adding a node named Amrita
6 g.add_node('Amrita')
7
8 #adding more nodes
9 g.add_node('Anna')
10 g.add_node('Bharathiar')
11
12 #adding more nodes at once
13 g.add_nodes_from(['KTU','Calicut','IITPKD'])
14
15 #adding an edge between Amrita and Anna
16 g.add_edge('Amrita', 'Anna')
```

Source Console Object

Usage

Here you can get help of any object by pressing **Ctrl+H** in front of it, either on the Editor or the Console.

Help can also be shown automatically after writing a left parenthesis next to an object. You can activate this behavior in **Preferences > Help**.

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Help Variable Explorer Plots Files

Console 1/A X

```
In [12]: g.edges
Out[12]: EdgeView([('Amrita', 'Anna'))]

In [13]: |
```

LSP Python: ready conda: base (Python 3.9.7) Line 18, Col 1 ASCII CRLF RW Mem 43%

ENG IN 22:16 12-01-2022

# Adding more edges at once

Spyder (Python 3.9)

File Edit Search Source Run Debug Consoles Projects Tools View Help

C:\Users\malls\spyder-py3\temp.py

temp.py X

```
1 import networkx as nx;
2 #creating an empty graph object
3 g=nx.Graph()
4
5 #adding a node named Amrita
6 g.add_node('Amrita')
7
8 #adding more nodes
9 g.add_node('Anna')
10 g.add_node('Bharathiar')
11
12 #adding more nodes at once
13 g.add_nodes_from(['KTU','Calicut','IITPKD'])
14
15 #adding an edge between Amrita and Anna
16 g.add_edge('Amrita', 'Anna')
17
18 #adding more edges at once
19 g.add_edges_from([('Anna','Bharathiar'),('KTU','IITPKD'),('Calicut','KTU')])
20
21
```

Source Console Object

Usage

Here you can get help of any object by pressing **Ctrl+H** in front of it, either on the Editor or the Console.

Help can also be shown automatically after writing a left parenthesis next to an object. You can activate this behavior in **Preferences > Help**.

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Help Variable Explorer Plots Files

Console 1/A X

```
In [15]: g.edges
Out[15]: EdgeView([(('Amrita', 'Anna'), ('Anna', 'Bharathiar'), ('KTU', 'IITPKD'), ('KTU', 'Calicut'))])

In [16]:
```

LSP Python: ready conda: base (Python 3.9.7) Line 21, Col 18 ASCII CRLF RW Mem 43%

ENG IN 22:21 12-01-2022

# Adding edges for uncreated nodes



Spyder (Python 3.9)

File Edit Search Source Run Debug Consoles Projects Tools View Help

C:\Users\mails\spyder-py3\temp.py

```
temp.py X
1 import networkx as nx;
2
3 #creating an empty graph object
4 g=nx.Graph()
5
6 #adding a node named Amrita
7 g.add_node('Amrita')
8
9 #adding more nodes
10 g.add_node('Anna')
11 g.add_node('Bharathiar')
12
13 #adding more nodes at once
14 g.add_nodes_from(['KTU','Calicut','IITPKD'])
15
16 #adding an edge between Amrita and Anna
17 g.add_edge('Amrita','Anna')
18
19 #adding more edges at once
20 g.add_edges_from([('Anna','Bharathiar'),('KTU','IITPKD'),('Calicut','KTU')])
21
22 #we can create edges between initially undefined nodes also
23 g.add_edge('Calicut','NITC')
24
```

Source Console Object

**Usage**

Here you can get help of any object by pressing **Ctrl+I** in front of it, either on the Editor or the Console.

Help can also be shown automatically after writing a left parenthesis next to an object. You can activate this behavior in **Preferences > Help**.

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Help Variable Explorer Plots Files

Console 1/A X

```
In [17]: g.edges
Out[17]: EdgeView([('Amrita', 'Anna'), ('Anna', 'Bharathiar'), ('KTU', 'IITPKD'), ('KTU', 'Calicut'), ('Calicut', 'NITC')])

In [18]:
```

LSP Python: ready conda: base (Python 3.9.7) Line 24, Col 1 ASCII CRLF RW Mem 43%

ENG IN 2223 12-01-2022

# Removing an edge



Spyder (Python 3.9)

File Edit Search Source Run Debug Consoles Projects Tools View Help

C:\Users\mails.spyder-py3\temp.py

temp.py X

```
1 import networkx as nx;
2 #creating an empty graph object
3 g=nx.Graph()
4
5 #adding a node named Amrita
6 g.add_node('Amrita')
7
8 #adding more nodes
9 g.add_node('Anna')
10 g.add_node('Bharathiar')
11
12 #adding more nodes at once
13 g.add_nodes_from(['KTU', 'Calicut', 'IITPKD'])
14
15 #adding an edge between Amrita and Anna
16 g.add_edge('Amrita', 'Anna')
17
18 #adding more edges at once
19 g.add_edges_from([('Anna', 'Bharathiar'), ('KTU', 'IITPKD'), ('Calicut', 'KTU')])
20
21 #we can create edges between initially undefined nodes also
22 g.add_edge('Calicut', 'NITC')
23
24 #removing edges
25 g.remove_edge('Calicut', 'NITC')
26
27
```

Source Console Object

Usage

Here you can get help of any object by pressing **Ctrl+I** in front of it, either on the Editor or the Console.

Help can also be shown automatically after writing a left parenthesis next to an object. You can activate this behavior in *Preferences > Help*.

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Console 1/A

In [17]: g.edges  
Out[17]: EdgeView([(('Amrita', 'Anna'), ('Anna', 'Bharathiar'), ('KTU', 'IITPKD'), ('KTU', 'Calicut'), ('Calicut', 'NITC'))])

In [18]: runfile('C:/Users/mail...spyder-py3.py', wdir='C:/Users/mail...spyder-py3')

In [19]: g.edges  
Out[19]: EdgeView([(('Amrita', 'Anna'), ('Anna', 'Bharathiar'), ('KTU', 'IITPKD'), ('KTU', 'Calicut'))])

In [20]:

LSP Python: ready conda: base (Python 3.9.7) Line 27, Col 1 ASCII CRLF RW Mem 43%

Windows taskbar icons: File Explorer, Task View, Start, Taskbar settings, Edge browser, Google Chrome, File History, Taskbar settings, Spyder icon.

System tray icons: Battery, ENG IN, WiFi, Volume, Date/Time (12-01-2022), 22:25.

# Removing a node

Spyder (Python 3.9)

File Edit Search Source Run Debug Consoles Projects Tools View Help

C:\Users\mails\spyder-py3\temp.py

temp.py\* X

```
1 import networkx as nx;
2 #creating an empty graph object
3 g=nx.Graph()
4
5 #adding a node named Amrita
6 g.add_node('Amrita')
7
8 #adding more nodes
9 g.add_node('Anna')
10 g.add_node('Bharathiar')
11
12 #adding more nodes at once
13 g.add_nodes_from(['KTU','Calicut','IITPKD'])
14
15 #adding an edge between Amrita and Anna
16 g.add_edge('Amrita','Anna')
17
18 #adding more edges at once
19 g.add_edges_from([('Anna','Bharathiar'),('KTU','IITPKD'),('Calicut','KTU')])
20
21 #we can create edges between initially undefined nodes also
22 g.add_edge('Calicut','NITC')
23
24 #removing edges
25 g.remove_edge('Calicut','NITC')
26
27 #removing node, it will remove all edges to that node
28 g.remove_node('Calicut')
29
30
```

Source Console Object

Usage

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Help Variable Explorer Plots Files

Console 1/A

```
In [21]: g.nodes
Out[21]: NodeView(['Amrita', 'Anna', 'Bharathiar', 'KTU', 'IITPKD', 'NITC'])

In [22]: g.edges
Out[22]: EdgeView([('Amrita', 'Anna'), ('Anna', 'Bharathiar'), ('KTU', 'IITPKD')])

In [23]:
```

LSP Python: ready conda: base (Python 3.9.7) Line 30, Col 1 ASCII CRLF RW Mem 43%

ENG IN 22:27 12-01-2022

# Printing adjacency

Spyder (Python 3.9)

File Edit Search Source Run Debug Consoles Projects Tools View Help

C:\Users\mails.spyder-py3\temp.py

temp.py\* X

```
3 #creating an empty graph object
4 g=nx.Graph()
5
6 #adding a node named Amrita
7 g.add_node('Amrita')
8
9 #adding more nodes
10 g.add_node('Anna')
11 g.add_node('Bharathiar')
12
13 #adding more nodes at once
14 g.add_nodes_from(['KTU','Calicut','IITPKD'])
15
16 #adding an edge between Amrita and Anna
17 g.add_edge('Amrita','Anna')
18
19 #adding more edges at once
20 g.add_edges_from([('Anna','Bharathiar'),('KTU','IITPKD'),('Calicut','KTU')])
21
22 #we can create edges between initially undefined nodes also
23 g.add_edge('Calicut','NITC')
24
25 #removing edges
26 g.remove_edge('Calicut','NITC')
27
28 #removing node, it will remove all edges to that node
29 g.remove_node('Calicut')
30
31 #print adjacency of nodes
32 print(g.adj)
33
34
35
```

Source Console Object

Usage

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Help can also be shown automatically after writing a left parenthesis next to an object. You can activate this behavior in **Preferences > Help**.

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Help Variable Explorer Plots Files

Console 1/A X

In [4]: runfile('C:/Users/mail...py3', wdir='C:/Users/mail...py3')
{'Amrita': {'Anna': {}}, 'Anna': {'Amrita': {}}, 'Bharathiar': {}, 'Bharathiar': {'Anna': {}}, 'KTU': {'IITPKD': {}}, 'IITPKD': {'KTU': {}}, 'NITC': {}}

In [5]:

LSP Python: ready conda: base (Python 3.9.7) Line 31, Col 1 ASCII CRLF RW Mem 41% Python console History Battery status: 78% remaining ENG IN 09:25 14-01-2022

# Remove multiple nodes at once



Spyder (Python 3.9)

File Edit Search Source Run Debug Consoles Projects Tools View Help

C:\Users\mails\spyder-py3\temp.py

temp.py X

```
5 #adding a node named Amrita
6 g.add_node('Amrita')
7
8 #adding more nodes
9 g.add_node('Anna')
10 g.add_node('Bharathiar')
11
12 #adding more nodes at once
13 g.add_nodes_from(['KTU','Calicut','IITPKD'])
14
15 #adding an edge between Amrita and Anna
16 g.add_edge('Amrita','Anna')
17
18 #adding more edges at once
19 g.add_edges_from([('Anna','Bharathiar'),('KTU','IITPKD'),('Calicut','KTU')])
20
21 #we can create edges between initially undefined nodes also
22 g.add_edge('Calicut','NITC')
23
24 #removing edges
25 g.remove_edge('Calicut','NITC')
26
27 #removing node, it will remove all edges to that node
28 g.remove_node('Calicut')
29
30 #removing two or more nodes
31 n=['NITC','IITPKD']
32 g.remove_nodes_from(n)
33
34
```

Source Console Object C:\Users\mails\spyder-py3

Usage

Here you can get help of any object by pressing **Ctrl+H** in front of it, either on the Editor or the Console.

Help can also be shown automatically after writing a left parenthesis next to an object. You can activate this behavior in Preferences > Help.

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Help Variable Explorer Plots Files

Console 1/A X

In [28]: g.nodes  
Out[28]: NodeView(('Amrita', 'Anna', 'Bharathiar', 'KTU', 'IITPKD', 'NITC'))

In [29]: runfile('C:/Users/mail.../temp.py', wdir='C:/Users/mail.../spyder-py3')

In [30]: g.nodes  
Out[30]: NodeView(('Amrita', 'Anna', 'Bharathiar', 'KTU'))

In [31]: |

LSP Python: ready conda: base (Python 3.9.7) Line 34, Col 1 ASCII CRLF RW Mem 44%

ENG IN 10:08 14-01-2022

# Removing multiple edges

Spyder (Python 3.9)

File Edit Search Source Run Debug Consoles Projects Tools View Help

C:\Users\mails\spyder-py3\temp.py

```
temp.py*  
 9  #adding more nodes  
10 g.add_node('Anna')  
11 g.add_node('Bharathiar')  
12  
13 #adding more nodes at once  
14 g.add_nodes_from(['KTU','Calicut','IITPKD'])  
15  
16 #adding an edge between Amrita and Anna  
17 g.add_edge('Amrita','Anna')  
18  
19 #adding more edges at once  
20 g.add_edges_from([('Anna','Bharathiar'),('KTU','IITPKD'),('Calicut','KTU')])  
21  
22 #we can create edges between initially undefined nodes also  
23 g.add_edge('Calicut','NITC')  
24  
25 #removing edges  
26 g.remove_edge('Calicut','NITC')  
27  
28 #removing node, it will remove all edges to that node  
29 g.remove_node('Calicut')  
30  
31 #removing two or more nodes  
32 g.remove_nodes_from(['NITC','IITPKD'])  
33  
34 #removing two or more edges  
35 g.remove_edges_from([('Amrita','Anna'),('Anna','Bharathiar')])  
36  
37  
38  
39  
40
```

Source Console Object

C:\Users\mails\spyder-py3

Usage

Here you can get help of any object by pressing **Ctrl+I** in front of it, either on the Editor or the Console.

Help can also be shown automatically after writing a left parenthesis next to an object. You can activate this behavior in **Preferences > Help**.

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Console 1/A

In [34]: g.nodes  
Out[34]: NodeView({'Amrita', 'Anna', 'Bharathiar', 'KTU'})

In [35]: g.edges  
Out[35]: EdgeView([('Amrita', 'Anna'), ('Anna', 'Bharathiar')])

In [36]: runfile('C:/Users/mail/.spyder-py3/temp.py', wdir='C:/Users/mail/.spyder-py3')

In [37]: g.edges  
Out[37]: EdgeView([])

In [38]:

LSP Python: ready conda: base (Python 3.9.7) Line 31, Col 1 ASCII CRLF RW Mem 45%

10:13 14-01-2022

# Removing all edges



Spyder (Python 3.9)

File Edit Search Source Run Debug Consoles Projects Tools View Help

C:\Users\mails\spyder-py3\temp.py

temp.py\* X

```
12 #adding more nodes at once
13 g.add_nodes_from(['KTU','Calicut','IITPKD'])
14
15 #adding an edge between Amrita and Anna
16 g.add_edge('Amrita','Anna')
17
18 #adding more edges at once
19 g.add_edges_from([('Anna','Bharathiar'),('KTU','IITPKD'),('Calicut','KTU')])
20
21 #we can create edges between initially undefined nodes also
22 g.add_edge('Calicut','NITC')
23
24 #removing edges
25 g.remove_edge('Calicut','NITC')
26
27 #removing node, it will remove all edges to that node
28 g.remove_node('Calicut')
29
30 #removing two or more nodes
31 g.remove_nodes_from(['NITC','IITPKD'])
32
33 #removing two or more edges
34 g.remove_edges_from([('Amrita','Anna'),('Anna','Bharathiar')])
35
36 #add weighted edges
37 g.add_weighted_edges_from([(1,2,2.5),(2,3,1.5)])
38
39 #remove all edges
40 g.clear_edges()
41
42
43
```

Source Console Object

Usage

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Console 1/A X

py3

```
In [45]: g.nodes
Out[45]: NodeView((1, 2, 3))

In [46]: g.edges
Out[46]: EdgeView([])

In [47]: |
```

LSP Python: ready conda: base (Python 3.9.7) Line 42, Col 1 ASCII CRLF RW Mem 45%

10:38 ENG IN 14-01-2022

# Removing all nodes and edges



Spyder (Python 3.9)

File Edit Search Source Run Debug Consoles Projects Tools View Help

C:\Users\malls\spyder-py3\temp.py

temp.py X

```
16 #adding an edge between Amrita and Anna
17 g.add_edge('Amrita', 'Anna')
18
19 #adding more edges at once
20 g.add_edges_from([('Anna', 'Bharathiar'), ('KTU', 'IITPKD'), ('Calicut', 'KTU')])
21
22 #we can create edges between initially undefined nodes also
23 g.add_edge('Calicut', 'NITC')
24
25 #removing edges
26 g.remove_edge('Calicut', 'NITC')
27
28 #removing node, it will remove all edges to that node
29 g.remove_node('Calicut')
30
31 #removing two or more nodes
32 g.remove_nodes_from(['NITC', 'IITPKD'])
33
34 #removing two or more edges
35 g.remove_edges_from([('Amrita', 'Anna'), ('Anna', 'Bharathiar')])
36
37 #add weighted edges
38 g.add_weighted_edges_from([(1,2,2.5), (2,3,1.5)])
39
40 #remove all edges
41 g.clear_edges()
42
43 #remove all nodes and edges
44 g.clear()
```

Source Console Object

Usage

Here you can get help of any object by pressing **Ctrl+H** in front of it, either on the Editor or the Console.

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Console 1/A X

In [48]: g.edges  
Out[48]: EdgeView([])

In [49]: g.nodes  
Out[49]: NodeView()

In [50]:

LSP Python: ready conda: base (Python 3.9.7) Line 46, Col 1 ASCII CRLF RW Mem 45%

ENG IN 10:39 14-01-2022

# Adding node attributes

Spyder (Python 3.9)

File Edit Search Source Run Debug Consoles Projects Tools View Help

C:\Users\malls\spyder-py3\untitled2.py

temp.py X untitled2.py\*

```
1 import networkx as nx
2 g=nx.Graph()
3 g.add_nodes_from([('Student',{'Name': 'Appu'}),('Teacher',{'Name': "Raju"}),
4 ('College',{'Name': 'Amrita'})])
5
```

Source Console Object

C:\Users\malls\spyder-py3

Usage

Here you can get help of any object by pressing **Ctrl+H** in front of it, either on the Editor or the Console.

Help can also be shown automatically after writing a left parenthesis next to an object. You can activate this behavior in Preferences > Help.

New to Spyder? Read our [tutorial](#)

Help Variable Explorer Plots Files

Console 1/A X

```
In [60]: list(g.nodes)
Out[60]: ['Student', 'Teacher', 'College']

In [61]: list(g.nodes(data=True))
Out[61]:
[{'Student': {'Name': 'Appu'}},
 {'Teacher': {'Name': 'Raju'}},
 {'College': {'Name': 'Amrita'}}]

In [62]: list(g)
Out[62]: ['Student', 'Teacher', 'College']

In [63]:
```

LSP Python: ready conda: base (Python 3.9.7) Line 5, Col 1 UTF-8 CRLF RW Mem 46%

11:20 ENG IN 14-01-2022

# Adding node attributes



Spyder (Python 3.9)

File Edit Search Source Run Debug Consoles Projects Tools View Help

C:\Users\mails\spyder-py3\untitled2.py

temp.py X untitled2.py\* X

```
1 import networkx as nx
2 g=nx.Graph()
3 g.add_nodes_from([('Student',{'Name':'Appu'},{'Teacher','Name':'Raju'}),
4 ('College',{'Name':'Amrita'})])
5 g.nodes['Student'][‘Age’]=20
6 g.nodes[‘Teacher’][‘Age’]=30
7
```

Source Console Object

Usage

Here you can get help of any object by pressing **Ctrl+I** in front of it, either on the Editor or the Console.

Help can also be shown automatically after writing a left parenthesis next to an object. You can activate this behavior in [Preferences > Help](#).

New to Spyder? Read our [tutorial](#)

Help Variable Explorer Plots Files

Console 1/A X

```
In [68]: list(g.nodes(data=True))
Out[68]:
[('Student', {'Name': 'Appu', 'Age': 20}),
 ('Teacher', {'Name': 'Raju', 'Age': 30}),
 ('College', {'Name': 'Amrita'})]

In [69]: list(g.nodes(data='Age'))
Out[69]: [('Student', 20), ('Teacher', 30), ('College', None)]

In [70]: |
```

LSP Python: ready conda: base (Python 3.9.7) Line 7, Col 1 UTF-8 CRLF RW Mem 46%

11:24 ENG IN 14-01-2022

# Adding edge attributes

Spyder (Python 3.9)

File Edit Search Source Run Debug Consoles Projects Tools View Help

C:\Users\mails\spyder-py3\untitled2.py

temp.py X untitled2.py\* X

```
1 import networkx as nx
2 g=nx.DiGraph()
3 g.add_nodes_from([('Student',{'Name':'Appu'}),('Teacher',{'Name':'Raju'}),
4 ('College',{'Name':'Amritा'})])
5 g.nodes['Student'][‘Age’]=20
6 g.nodes['Teacher'][‘Age’]=30
7
8 g.add_edges_from([('Student','Teacher',{'RelationType':'Academic'}),
9 {'Teacher','College',{'RelationType':'WorksFor'}},
10 {'Student','College',{'RelationType':'StudiesAt'}}])
```

Source Console Object

Usage

Here you can get help of any object by pressing **Ctrl+I** in front of it, either on the Editor or the Console.

Help can also be shown automatically after writing a left parenthesis next to an object. You can activate this behavior in **Preferences > Help**.

New to Spyder? Read our [tutorial](#)

Help Variable Explorer Plots Files

Console 1/A X

```
In [75]: list(g.edges(data=True))
Out[75]:
[('Student', 'Teacher', {'RelationType': 'Academic'}),
 ('Student', 'College', {'RelationType': 'StudiesAt'}),
 ('Teacher', 'College', {'RelationType': 'WorksFor'})]

In [76]: g.edges(data='RelationType')
Out[76]: OutEdgeDataView([('Student', 'Teacher', 'Academic'), ('Student', 'College', 'StudiesAt'), ('Teacher', 'College', 'WorksFor')])

In [77]:
```

LSP Python: ready conda: base (Python 3.9.7) Line 11, Col 1 UTF-8 CRLF RW Mem 45%

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# Network visualization using NetworkX

- NetworkX also provides functions for visualizing networks.
- They are not as powerful as other more specialized software, but still quite handy and useful, especially for small- to mid-sized network visualization.
- Those visualization functions depend on the functions defined in matplotlib (pylab), so we need to import it before visualizing networks.

# Complete graph visualization

Spyder (Python 3.9)

File Edit Search Source Run Debug Consoles Projects Tools View Help

C:\Users\mails\.spyder-py3\untitled3.py

```
temp.py X untitled3.py* X
1 from pylab import *
2 import networkx as nx
3 g=nx.complete_graph(5)
4 nx.draw(g)
5 show()
```

temp.py X untitled3.py\* X

Help Variable Explorer Plots Files

Console 2/A X

```
(2, 4), (3, 4))
```

In [4]: runfile('C:/Users-mails/.spyder-py3/untitled3.py', wdir='C:/Users-mails/.spyder-py3')

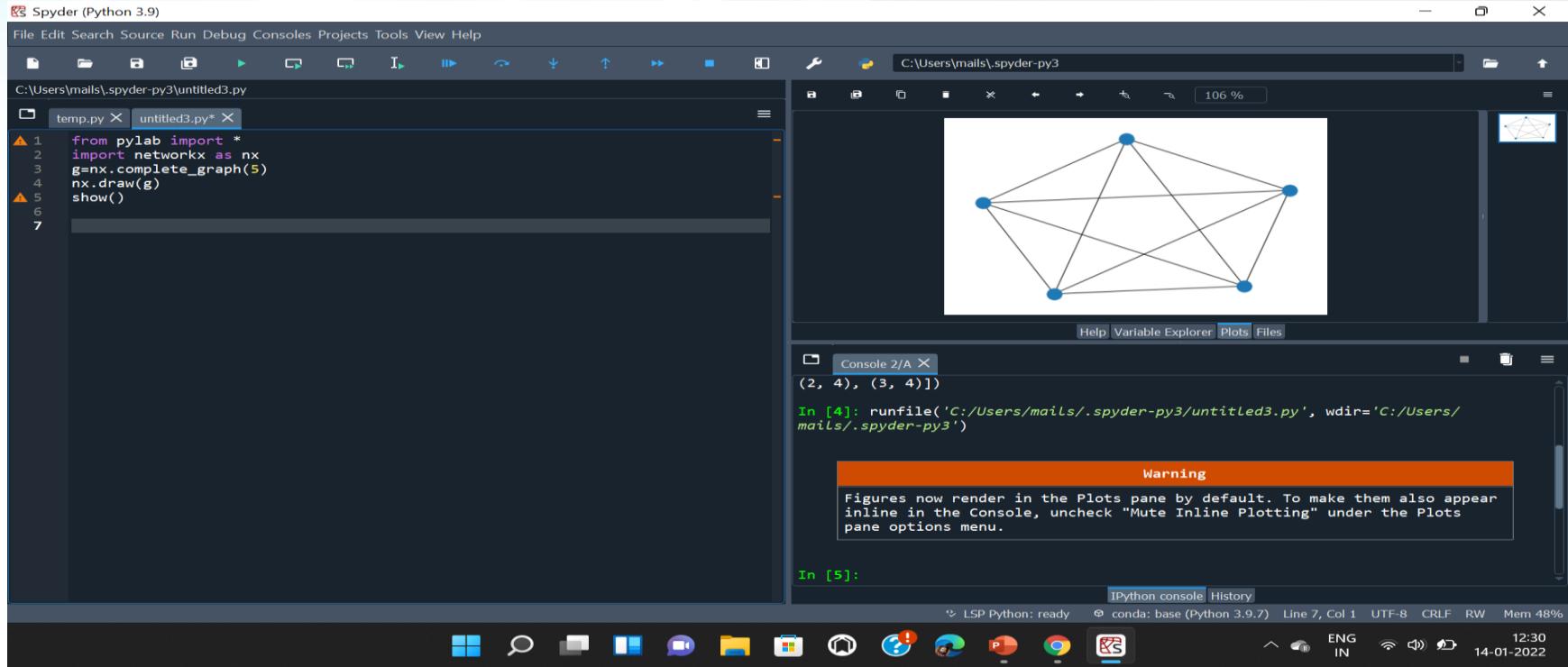
Warning

Figures now render in the Plots pane by default. To make them also appear inline in the Console, uncheck "Mute Inline Plotting" under the Plots pane options menu.

In [5]:

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12:30 ENG IN 14-01-2022



# Null graph visualization

Spyder (Python 3.9)

File Edit Search Source Run Debug Consoles Projects Tools View Help

C:\Users\mails\spyder-py3\untitled3.py

```
temp.py X untitled3.py* X
1 from pylab import *
2 import networkx as nx
#null graph return graphs without nodes and edges
3 gnx=null_graph()
4 nx.draw(g)
5 show()
```

C:\Users\mails\spyder-py3

Help Variable Explorer Plots Files

Console 2/A X

```
argmap_empty_graph_5
from pathlib import Path

File "C:\Users\mails\anaconda3\lib\site-packages\networkx\generators\classic.py",
line 491, in empty_graph
    G = create_using()

TypeError: 'int' object is not callable
```

In [8]: runfile('C:/Users/mail.../spyder-py3/untitled3.py', wdir='C:/Users/mail.../spyder-py3')

In [9]:

LSP Python: ready conda: base (Python 3.9.7) Line 8, Col 1 UTF-8 CRLF RW Mem 47%

12:34 ENG IN 14-01-2022

# Null graph visualization

Spyder (Python 3.9)

File Edit Search Source Run Debug Consoles Projects Tools View Help

C:\Users\mails\spyder-py3\untitled3.py

temp.py X untitled3.py\* X

```
1 from pylab import *
2 import networkx as nx
3 #empty graph return graphs with specified number of nodes and no edges
4 g=nx.empty_graph(5)
5 nx.draw(g)
6 show()
7
8
```

Help Variable Explorer Plots Files

Console 2/A X

```
File "C:\Users\mails\anaconda3\lib\site-packages\networkx\generators\classic.py",
line 491, in empty_graph
    G = create_using()

TypeError: 'int' object is not callable

In [8]: runfile('C:/Users/mailz/.spyder-py3/untitled3.py', wdir='C:/Users/
mailz/.spyder-py3')

In [9]: runfile('C:/Users/mailz/.spyder-py3/untitled3.py', wdir='C:/Users/
mailz/.spyder-py3')

In [10]:
```

LSP Python: ready conda: base (Python 3.9.7) Line 8, Col 1 UTF-8 CRLF RW Mem 48%

12:36 ENG IN 14-01-2022

# Network visualization using file import

The screenshot shows a Microsoft Excel spreadsheet titled "Sample". The data is as follows:

|    | A       | B      | C      | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S |
|----|---------|--------|--------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1  | Arjun   | Anoop  | Aneesh |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 2  | Anoop   | Anju   | Anu    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 3  | Basheer | John   |        |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 4  | John    | Arya   |        |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 5  | Basheer | Aneesh |        |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 6  |         |        |        |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 7  |         |        |        |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 8  |         |        |        |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 9  |         |        |        |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 10 |         |        |        |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 11 |         |        |        |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 12 |         |        |        |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 13 |         |        |        |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 14 |         |        |        |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 15 |         |        |        |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 16 |         |        |        |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 17 |         |        |        |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 18 |         |        |        |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 19 |         |        |        |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |

The ribbon menu is visible at the top, showing tabs like File, Home, Insert, etc. A message bar at the top indicates "POSSIBLE DATA LOSS" regarding saving the workbook as CSV. The status bar at the bottom shows the date and time as 15-01-2022 09:26.

# Network visualization using file import

Spyder (Python 3.9)

File Edit Search Source Run Debug Consoles Projects Tools View Help

C:/Users/mails/.spyder-py3/NetworkDraw.py

NetworkDraw.py X

```
1 from pylab import *
2 import networkx as nx
3 #empty graph return graphs with specified number of nodes and no edges
4 g=nx.read_adjlist('Sample.csv',
5                   delimiter=',')
6 nx.draw(g,with_labels=True)
7 show()
```

10

Console 1/A X

In [6]: runfile('C:/Users-mails/.spyder-py3/NetworkDraw.py', wdir='C:/Users-mails/.spyder-py3')

In [7]: runfile('C:/Users-mails/.spyder-py3/NetworkDraw.py', wdir='C:/Users-mails/.spyder-py3')

In [8]: runfile('C:/Users-mails/.spyder-py3/NetworkDraw.py', wdir='C:/Users-mails/.spyder-py3')

In [9]: runfile('C:/Users-mails/.spyder-py3/NetworkDraw.py', wdir='C:/Users-mails/.spyder-py3')

In [10]:

LSP Python: ready conda: base (Python 3.9.7) Line 10, Col 1 ASCII CRLF RW Mem 43%

106 %

Anil

Anup

Anur

Anush

Babbar

Binn

Help Variable Explorer Plots Files

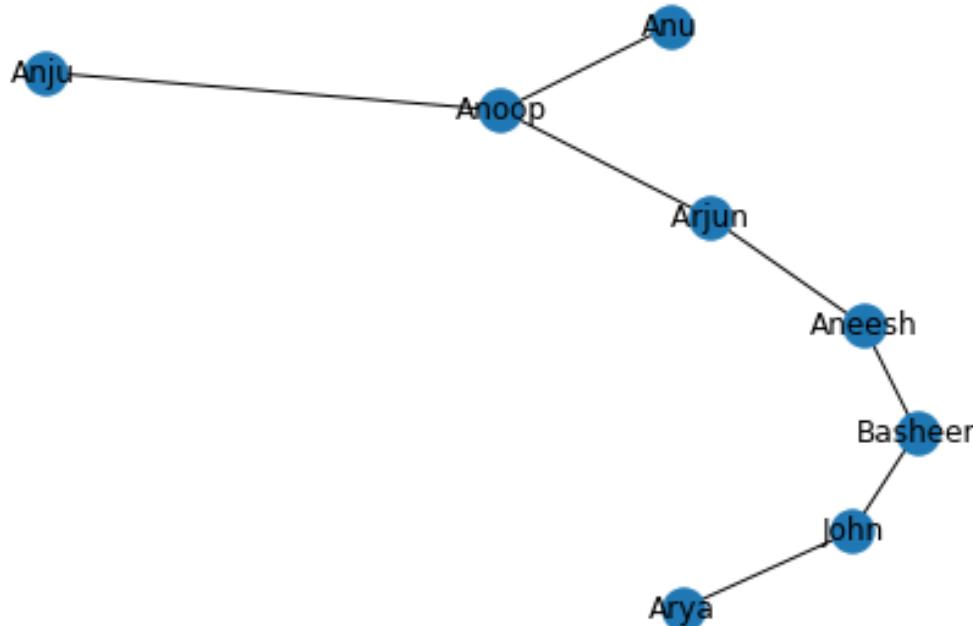
IPython console History

ENG IN

09:26

15-01-2022

# Network visualization using file import



# Changing Properties

Spyder (Python 3.9)

File Edit Search Source Run Debug Consoles Projects Tools View Help

C:\Users\mails\spyder-py3\NetworkDraw.py

```
1  from pylab import *
2  import networkx as nx
3  #empty graph return graphs with specified number of nodes and no edges
4  g=nx.read_adjlist('Sample.csv',
5                    delimiter=',',create_using=nx.DiGraph())
6  nx.draw(g,with_labels=True,node_color='green',edge_color='red')
7  show()
```

NetworkDraw.py X

106 %

Ampip  
Ampo  
Batter  
Anish

Help Variable Explorer Plots Files

Console 1/A X

```
In [10]: runfile('C:/Users/mail...py3/NetworkDraw.py', wdir='C:/Users/mail...py3')
In [11]: runfile('C:/Users/mail...py3/NetworkDraw.py', wdir='C:/Users/mail...py3')
In [12]: runfile('C:/Users/mail...py3/NetworkDraw.py', wdir='C:/Users/mail...py3')
In [13]: runfile('C:/Users/mail...py3/NetworkDraw.py', wdir='C:/Users/mail...py3')
In [14]:
```

LSP Python: ready conda: base (Python 3.9.7) Line 10, Col 1 ASCII CRLF RW Mem 44%

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Thanks.....