

# Abstract data type

Computer Systems Lab I

September 15, 2023

## 1 Create a class named Graph which have the following features.

Members:

- Adjacency list of graph → Represents the number graph as an Adjacency list using list of list.
- No of nodes → Integer value stores number of vertices in graph.

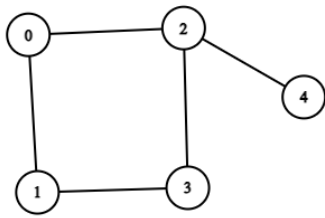
Functions:

- Add Edge.
  - Takes two argument (two nodes connected by edge)
  - Append to the list of neighbours.
- Add Vertex.
  - Add edge to the Adjacency list by appending a new list item.
  - Updates no of nodes.
- Get Adjacency matrix.
  - Convert the adjacency list to matrix
  - return matrix value.
- Print Graph.
  - get the adjacency matrix
  - convert adjacency to networkx graph.
  - print graph using networkx inbuilt function.

## 2 Perform the following operations:

- Create a graph with 6 nodes and print the graph and Adjacency matrix.
- Add two extra nodes and print the graph and adjacency matrix.

## Graph representation and Python syntax:



(a) Graph

0: 1,2  
1: 0,3  
2: 0,3  
3: 1,2  
4: 2

(b) Adjacency List

	0	1	2	3	4
0	0	1	1	0	0
1	1	0	0	1	1
2	1	0	0	1	0
3	0	1	1	0	0
4	0	1	0	0	0

(c) Adjacency matrix

Figure 1: Graph Representation

*#Python code for Adjacency list and matrix*

```
import numpy as np
```

```
import networkx as nx
```

```
import matplotlib.pyplot as plt
```

```
Adjacency_List=[[0,1,2], #First value of each list denotes the vertex number  
                [1,0,3],  
                [2,0,3],  
                [3,1,2],  
                [4,2]]
```

```
Adjacency_Matrix = np.matrix( [[0, 1, 1, 0, 0],  
                               [1, 0, 0, 1, 1],  
                               [1, 0, 0, 1, 0],  
                               [0, 1, 1, 0, 0],  
                               [0, 1, 0, 0, 0]])
```

*#Displaying Graph*

```
Graph = nx.from_numpy_matrix(Adjacency_Matrix) #convert to networkx object
```

```
plt.figure()  
nx.draw(Graph, with_labels=True) #display graph  
plt.show()
```

*#Add node 5 connecting to node 3*

```
Adjacency_list.append([5]) #add node 5
```

```
Adjacency_list[5].append(3) #add edge 3-5. note that number '3' is added not '[3]'
```

```
No_of_nodes=len(Adjacency_list)
```

Note: if python packages are not available install as follows,

```
pip install numpy
```

```
pip install networkx
```

```
pip install matplotlib
```

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