NPTEL

NPTEL ONLINE CERTIFICATION COURSE
Discrete Mathematics
Graph Theory – 3 &
Generating Functions

NetworkX - Digraphs

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Till now we have seen creating of simple graphs, we will move ahead to see how to create digraphs and multi-graphs, what do I have to do first, I import NetworkX as nx,
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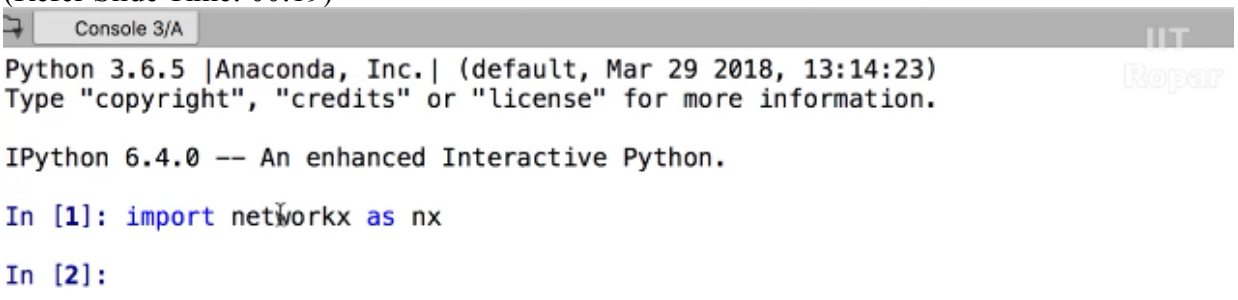

NetworkX has got loaded, now let me create the graph G as nx.digraph you see now the digraph G has got loaded,
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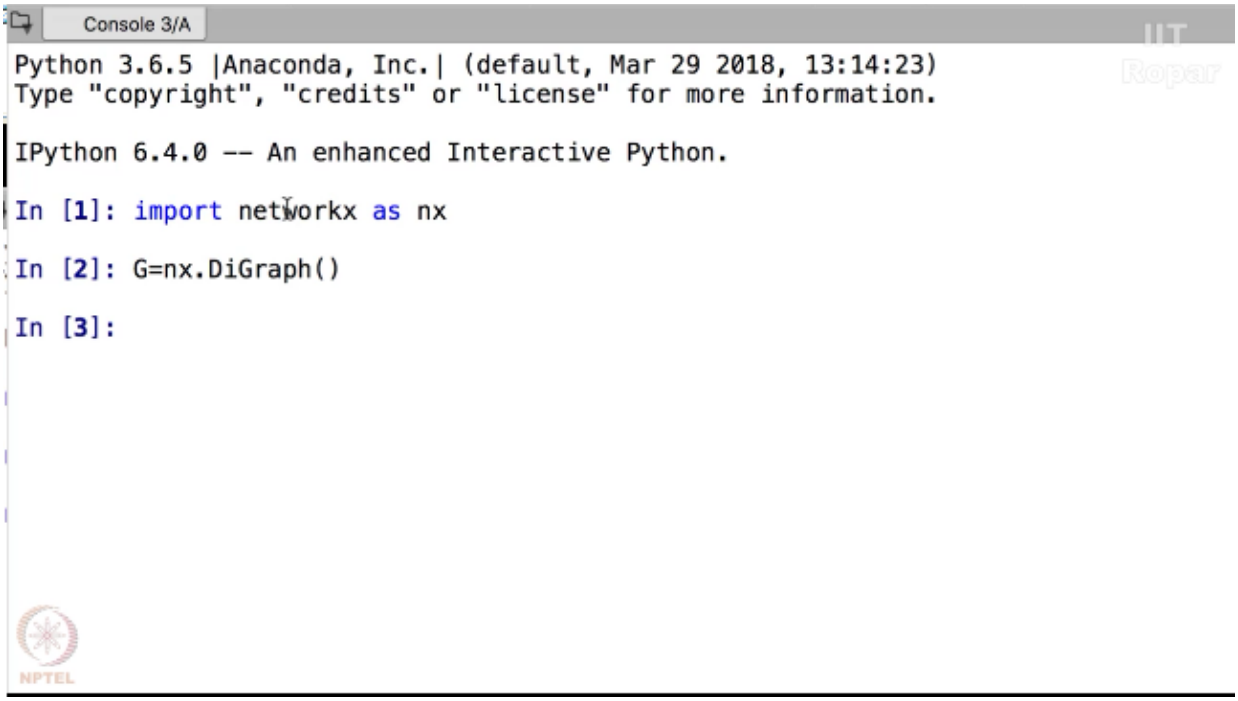

we have created it, now let us add some random nodes and edges to it G.add_node 5 and let me give another one G.add_note let me say 8, you see I'm giving random nodes,
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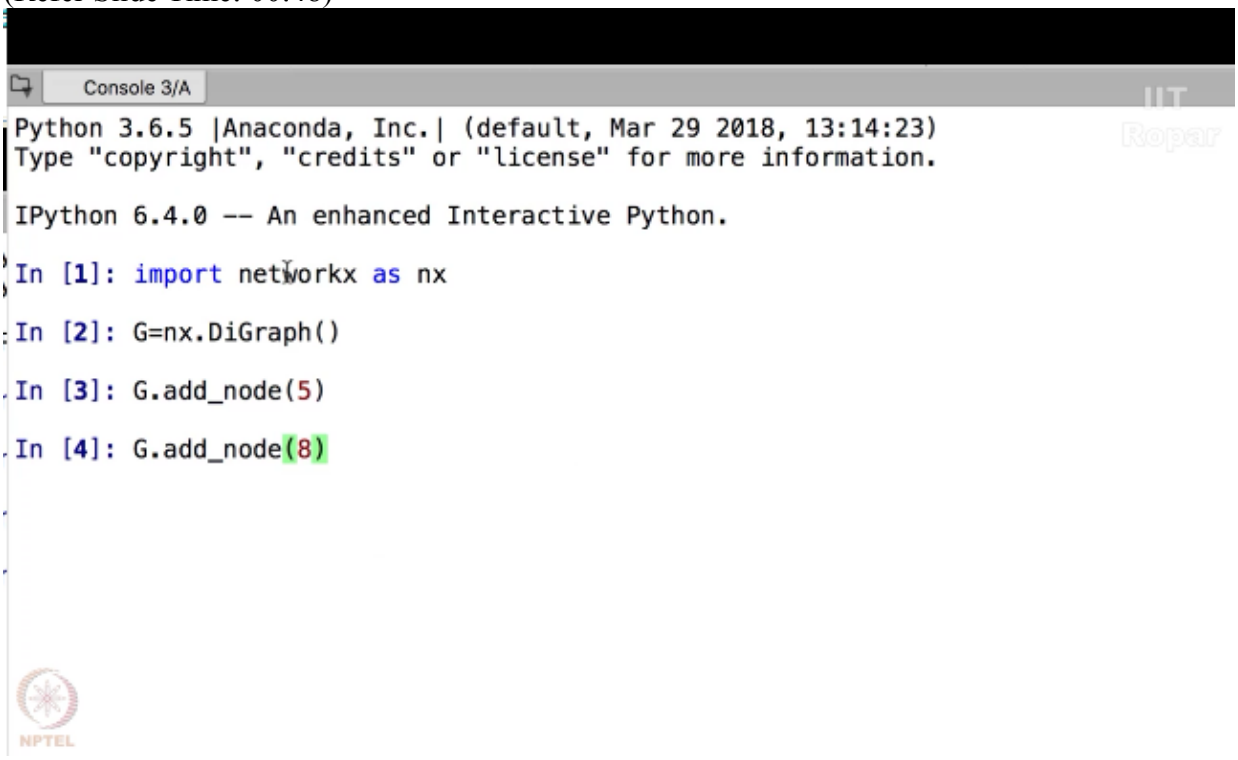

you need not always start from 1 to 10, okay.

Now another one let me call it differently as IIT,
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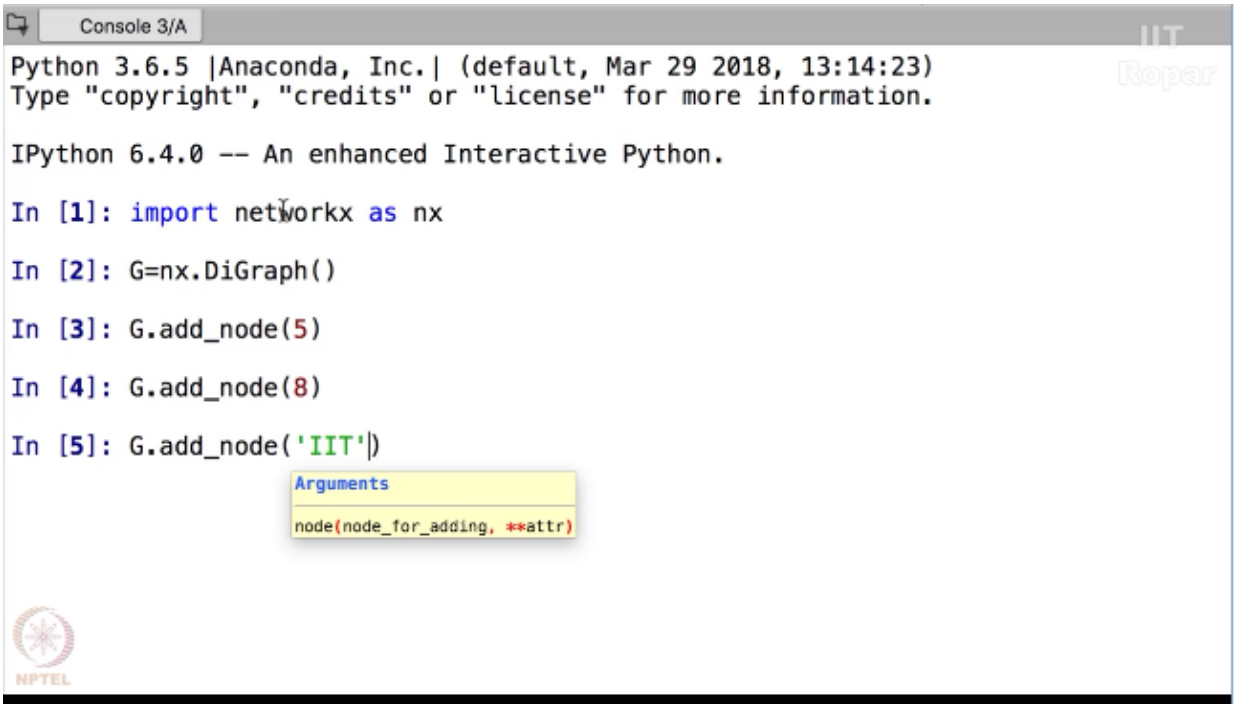

so this is my last node you see this quotes here because IIT is a string, now I am going to add some edges G.add_edges as 5, IIT, what did I do now?
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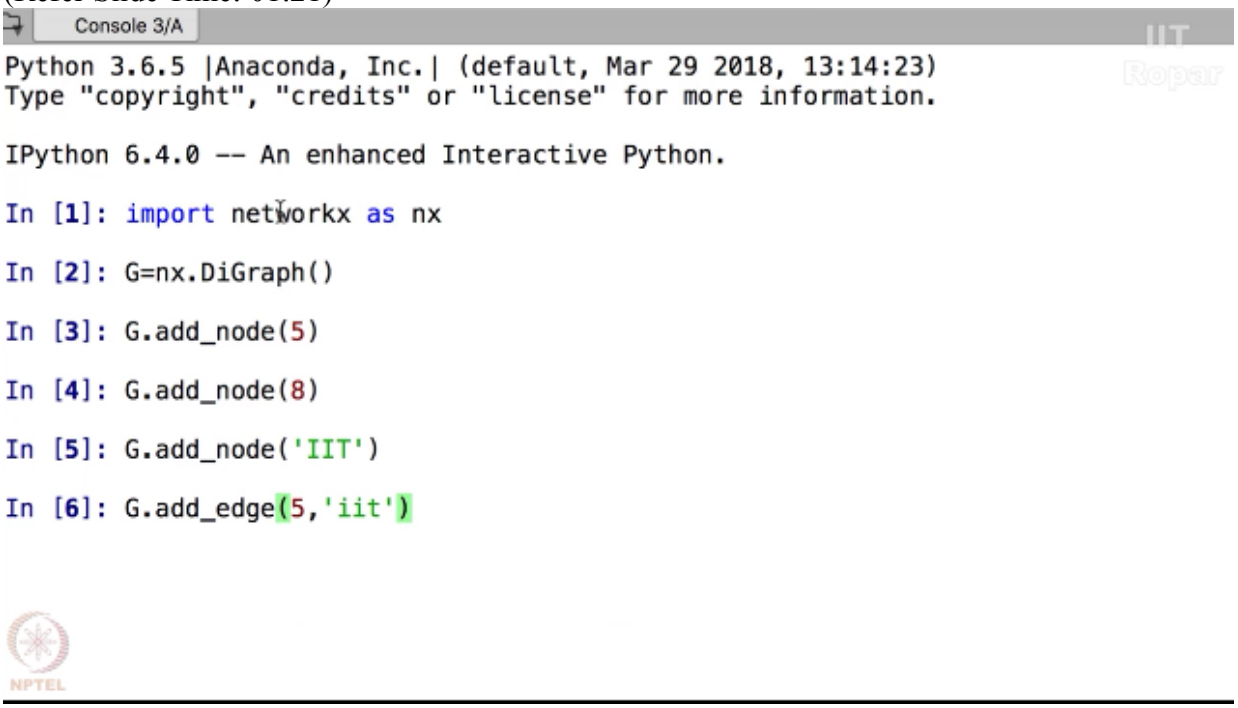

I have just, you see if I give like this it will not get added it you throw up an error, why? Because I have written IIT in small letters, and hence I have to write it like this,
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```
Console 3/A
Python 3.6.5 |Anaconda, Inc.| (default, Mar 29 2018, 13:14:23)
Type "copyright", "credits" or "license" for more information.

IPython 6.4.0 -- An enhanced Interactive Python.

In [1]: import networkx as nx

In [2]: G=nx.DiGraph()

In [3]: G.add_node(5)

In [4]: G.add_node(8)

In [5]: G.add_node('IIT')

In [6]: G.add_edge(5,'IIT')
```


now the next edge I'll add is 8, IIT this is the new edge which I am going to add.
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```
Console 3/A
Python 3.6.5 |Anaconda, Inc.| (default, Mar 29 2018, 13:14:23)
Type "copyright", "credits" or "license" for more information.

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In [7]: G.add_edge(8,'IIT')
```


Now nx.draw G,
(Refer Slide Time: 01:54)

```
Console 3/A
Python 3.6.5 |Anaconda, Inc.| (default, Mar 29 2018, 13:14:23)
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In [7]: G.add_edge(8,'IIT')

In [8]: nx.draw(G)
```

I draw G now, let me say I'll give labels with labels as true,
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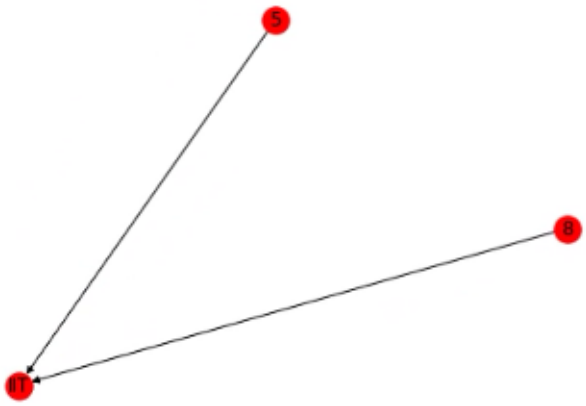
```
In [7]: G.add_edge(8,'IIT')

In [8]: nx.draw(G,with_labels=1)
```




```
In [9]:
```

do you see the graph here? Do you see this node here, it has IIT written on it, this is 5, and this is 8,
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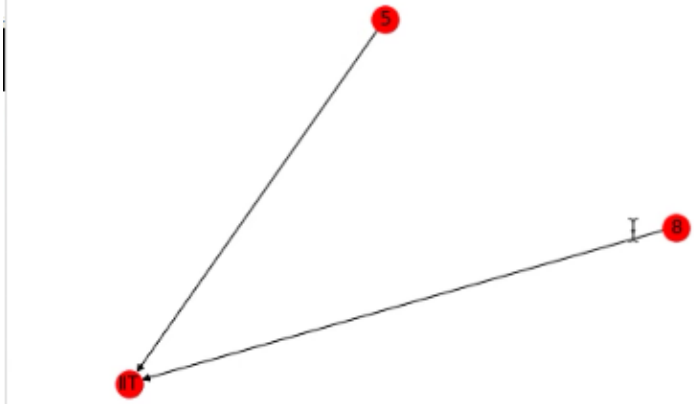
```
In [7]: G.add_edge(8,'IIT')

In [8]: nx.draw(G,with_labels=1)
```




```
In [9]:
```

so we have created the graph, now it's always not necessary to just like that add edges and add nodes and create the graph, you can also add certain vertices or nodes from a list which you will mention prior, so if I give a list like this as 11, 111, and let me say 1111,

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```
In [9]: l=[11,111,1111]
```

and now I'll add these as my nodes, so what am I going to do G.add_nodes_from this list L, so did you see what just, what I did? I have created a list here and these are going to be my nodes in G now, I am going to add them, so G.add_nodes from this list,

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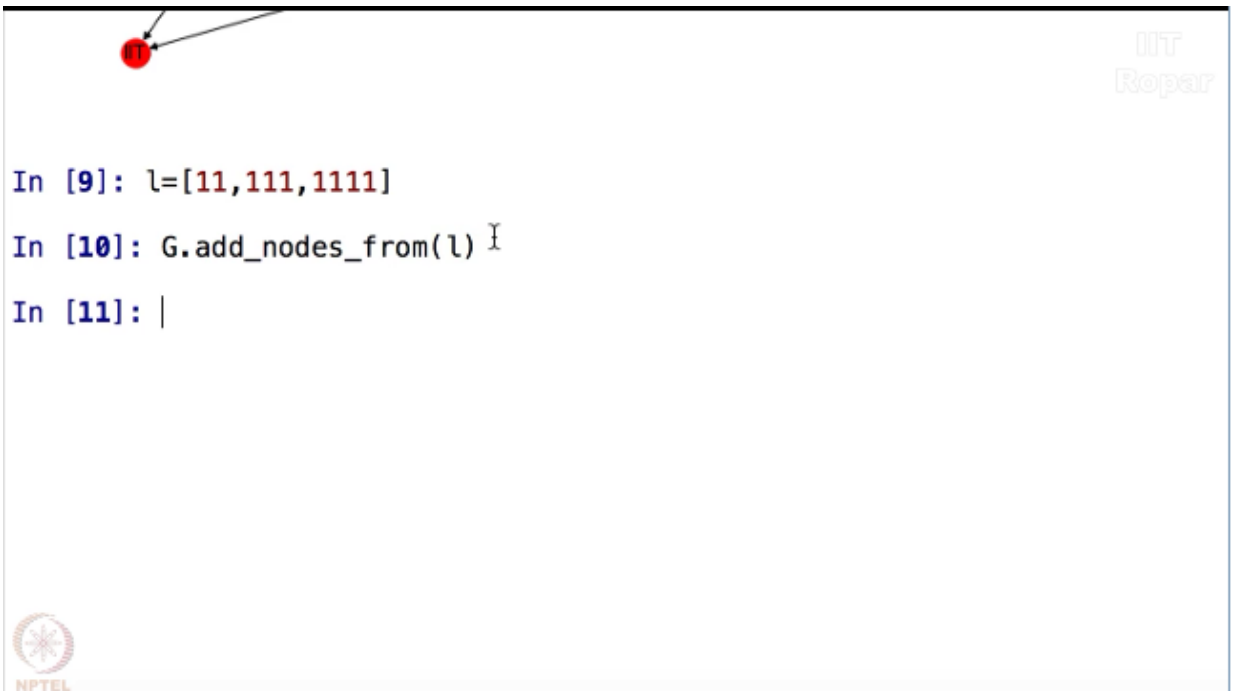

let us see all the nodes in G, so G.nodes do you see 5, 8, IIT were earlier there,
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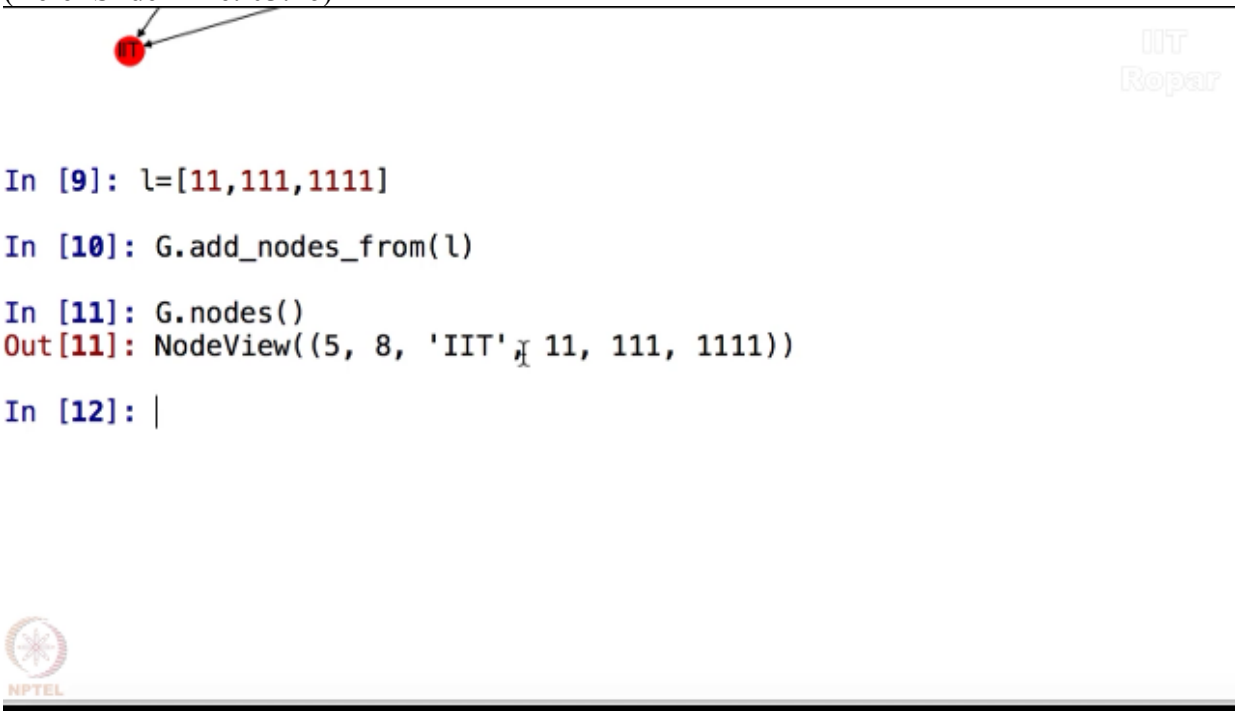

and now these have got added from the list.

Now what I'm going to do is I am going to create another new graph H = nx.bull_graph,
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```
In [9]: l=[11,111,1111]

In [10]: G.add_nodes_from(l)

In [11]: G.nodes()
Out[11]: NodeView((5, 8, 'IIT', 11, 111, 1111))

In [12]: H=nx.bull_graph()
```

yeah, it sounds a little funny and weird, but this is the name of the graph you can probably draw, now let me draw it, nx.draw with labels H, with labels equals true, now let us see how the graph looks like,
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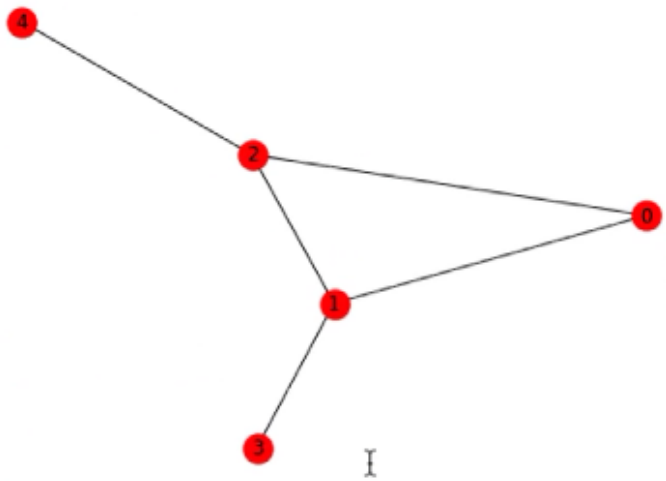


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In [14]:
```

well, this is the bull graph,
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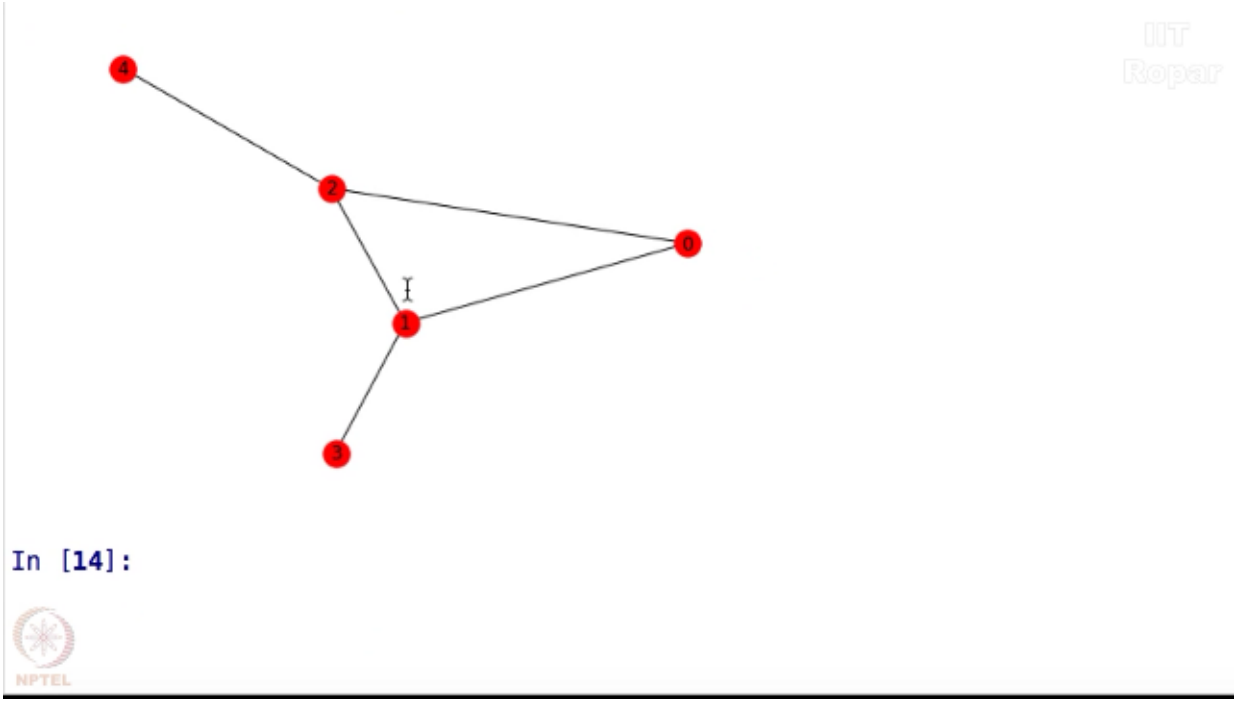

so did you see the bull graph this is called as a bull graph, it has 5 vertices, it shows 4 here but observe the 0 here, we start from 0 and end at 4, and this is called as a bull graph.

Now what I'm going to do next is G.add_notes from H.nodes,
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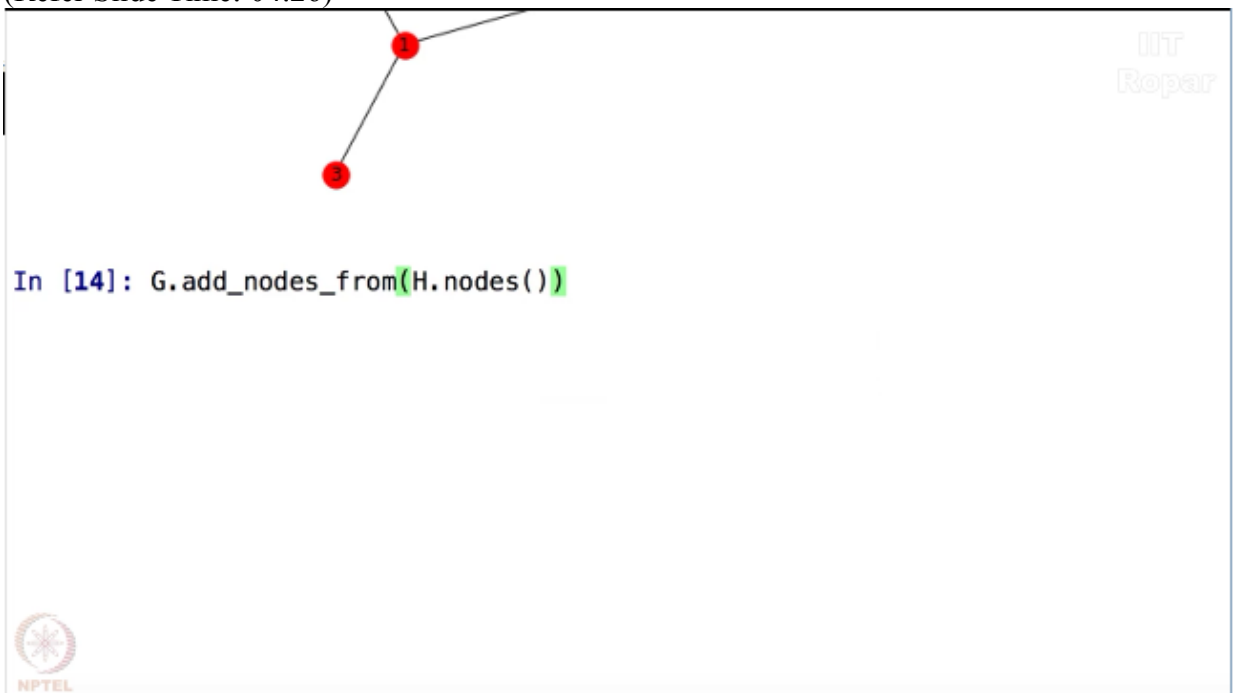

so do you see this, I am going to add the nodes from H to G, so all my nodes from H whichever are there in H get added to G now, after adding the nodes from H to G I am going to add edges like this, well you must know it will be the similar process G.add_edges_from, yeah you must be guessing it right H.edges like this,
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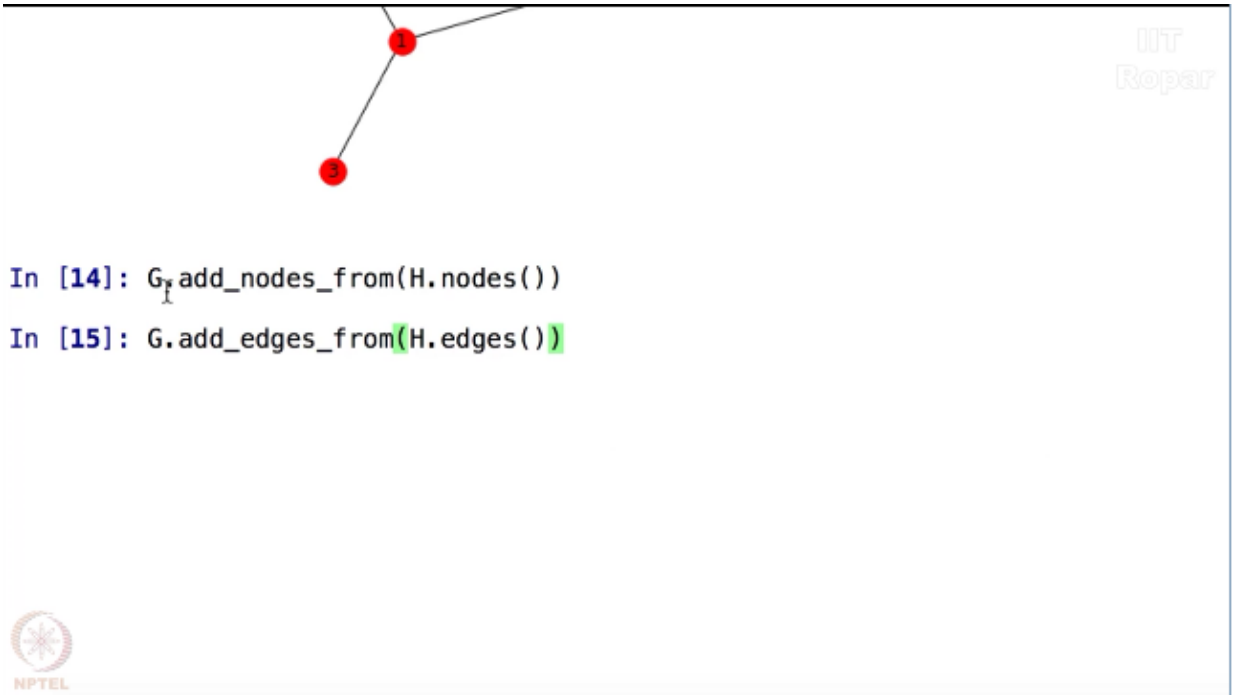

H.edges, now what are the nodes and edges in G? It will have all those nodes and edges which were earlier there, and which I have added from H now, so some extra nodes and edges would have got added to G, let us check G.nodes if I view it do you see these nodes from the bull graph have got added to G,

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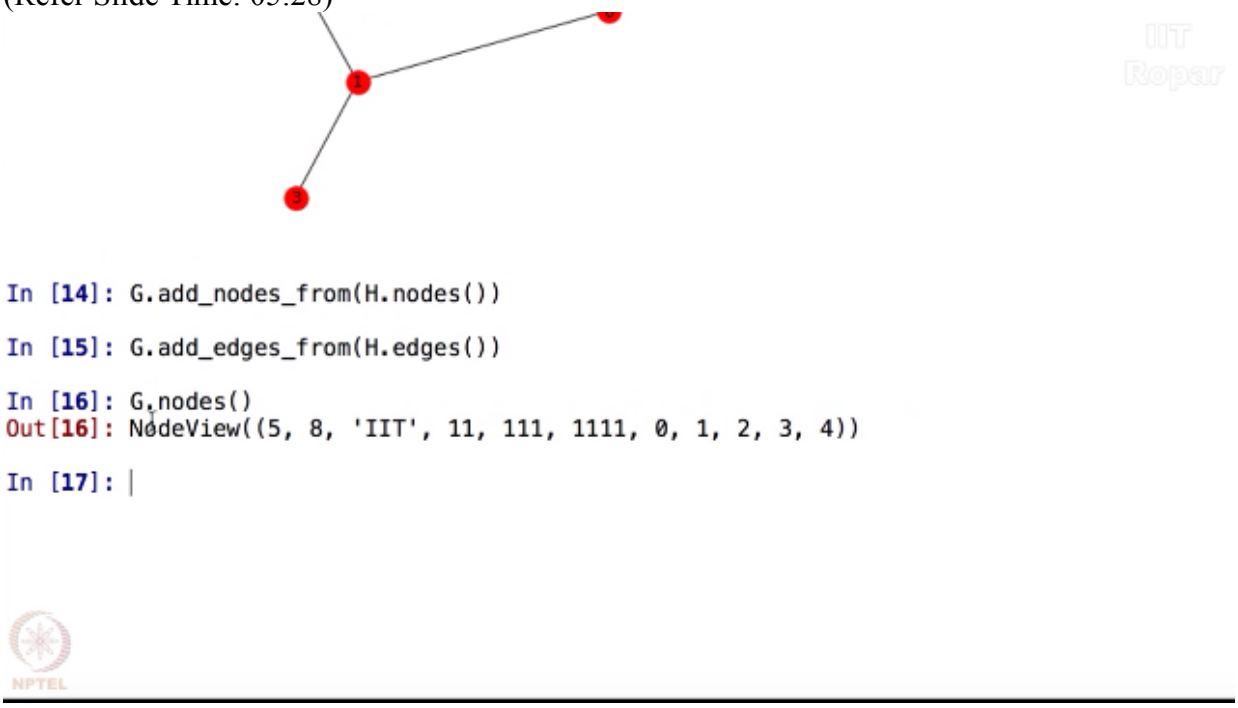

let me do it for edges G.edges, do you see these edges 5, IIT, 8, IIT these were earlier there, and now these have got added, do you observe it?

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```
Out[17]: OutEdgeView([(5, 'IIT'), (8, 'IIT'), (0, 1), (0, 2), (1, 2), (1, 3), (2, 4)])

In [18]:
```

Now let us draw G and check, nx.draw G, it's always good to see it with labels, so with labels as true, let us see how the graph looks like, so do you see the graph here? You see some isolated vertices these were already there in G here, you see these were the nodes which were earlier present I had added them from the list, and now these were earlier present in the graph

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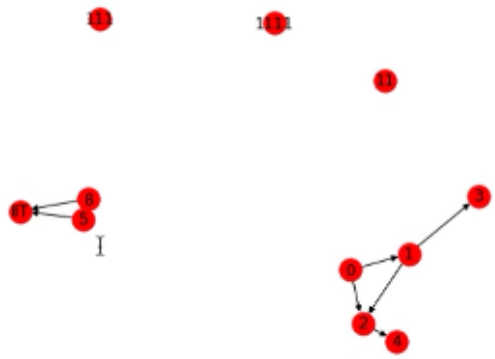
```
Out[16]: NodeView((5, 8, 'IIT', 11, 111, 1111, 0, 1, 2, 3, 4))

In [17]: G.edges()
Out[17]: OutEdgeView([(5, 'IIT'), (8, 'IIT'), (0, 1), (0, 2), (1, 2), (1, 3), (2, 4)])

In [18]: nx.draw(G,with_labels=1)
```




```
In [19]:
```

and this is the extra nodes and edges from H, but please note this entire graph is our graph G, it's a disconnected graph with how many components? 1, 2, 3, 4, 5, it has 5 components but this entire thing is the directed graph G.

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