NPTEL

NPTEL ONLINE CERTIFICATION COURSE

Discrete Mathematics
Graph Theory – 3 &
Generating Functions

NetworkX - Graph complement

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We are now going to learn how to create complement of a graph, so the first step always is to import NetworkX as nx, now I'm going to create a graph as in always I'm going to create let me say G, the graph, to be a random graph GNM, random graph on let me say 15 edges, 15 vertices and let say 10 edges, 15 nodes and 10 edges, right.

Now let me draw the graph nx.draw G, do you see that the graph is disconnected,
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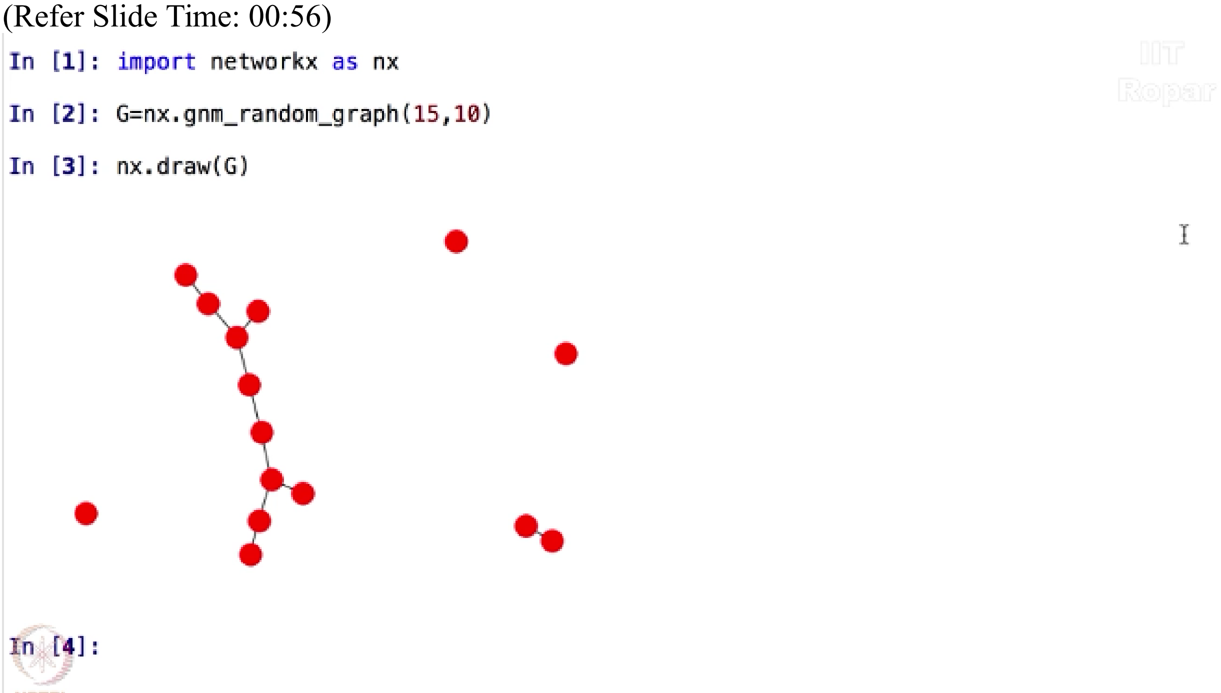

now let us check the complement of this graph, so GC let me name it as GC = nx.complement is the command of G, do you see the command here it is GC = nx.complement (G), the complement has got created, let us now draw GC, so nx.draw GC,
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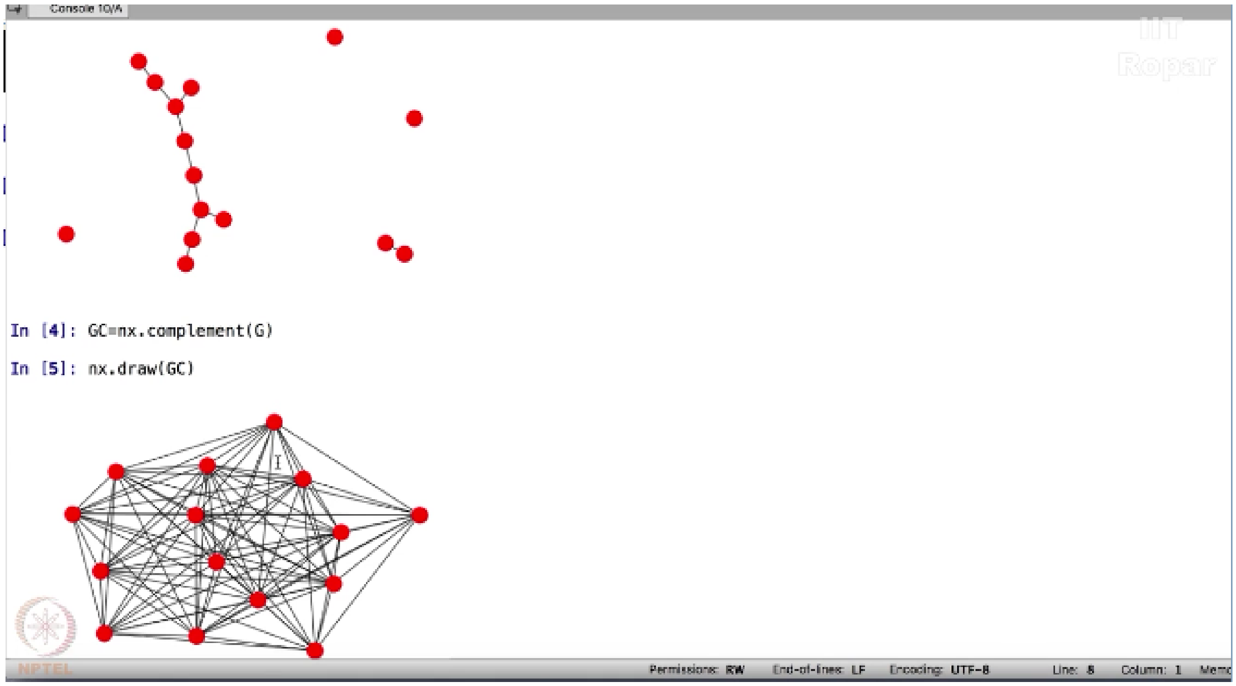

so do you see that this graph is connected, we had earlier drawn a graph G and now the complement of graph G which was disconnected is connected, we had seen this if you remember in the previous week that complement of a disconnected graph is always connected.

Now let us move ahead and draw another graph, let me say, okay, we can also verify one more thing here, let me say nx.is_connected (GC), right, see it says true so we have verified what we had seen in the video, now let me go ahead, and let me clear the screen, and now I'm going to create another graph, let say I'll create H as nx.complete_graph on 5 nodes, and I'm going to draw H,

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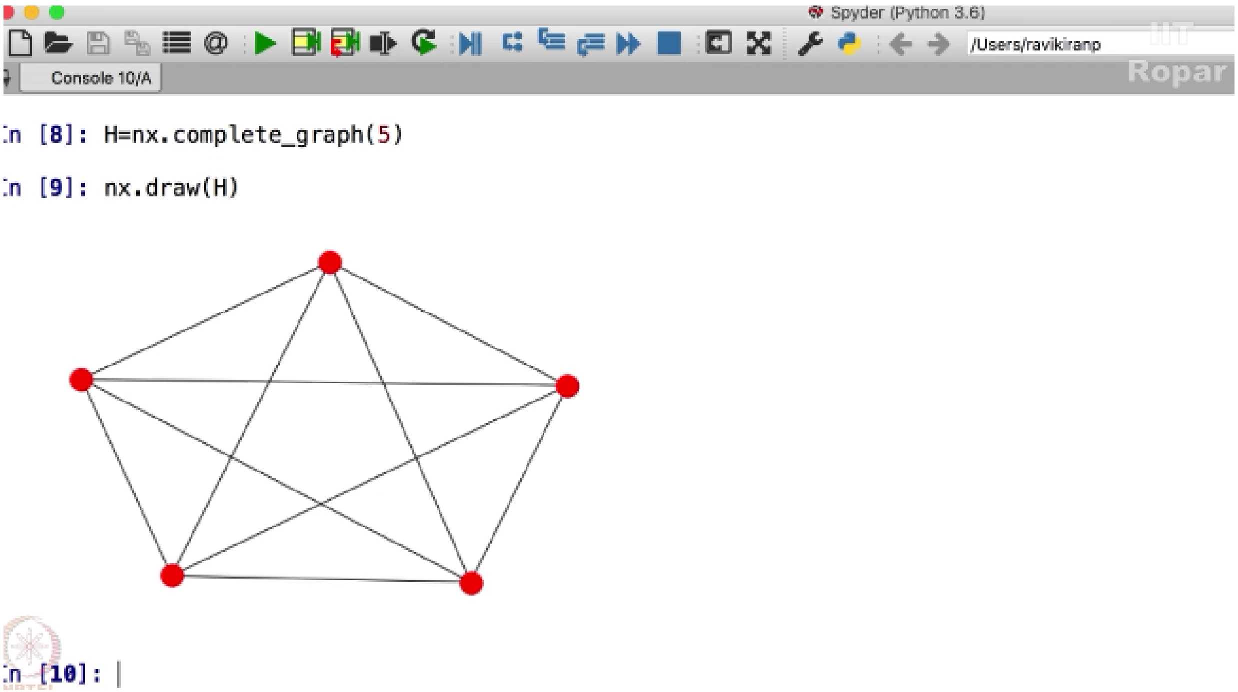

you see this is a complete graph on 5 vertices.

Now I'm going to create the complement of this graph as HC = nx.complement (H), and I'm going to draw it, let us visualize this graph HC,

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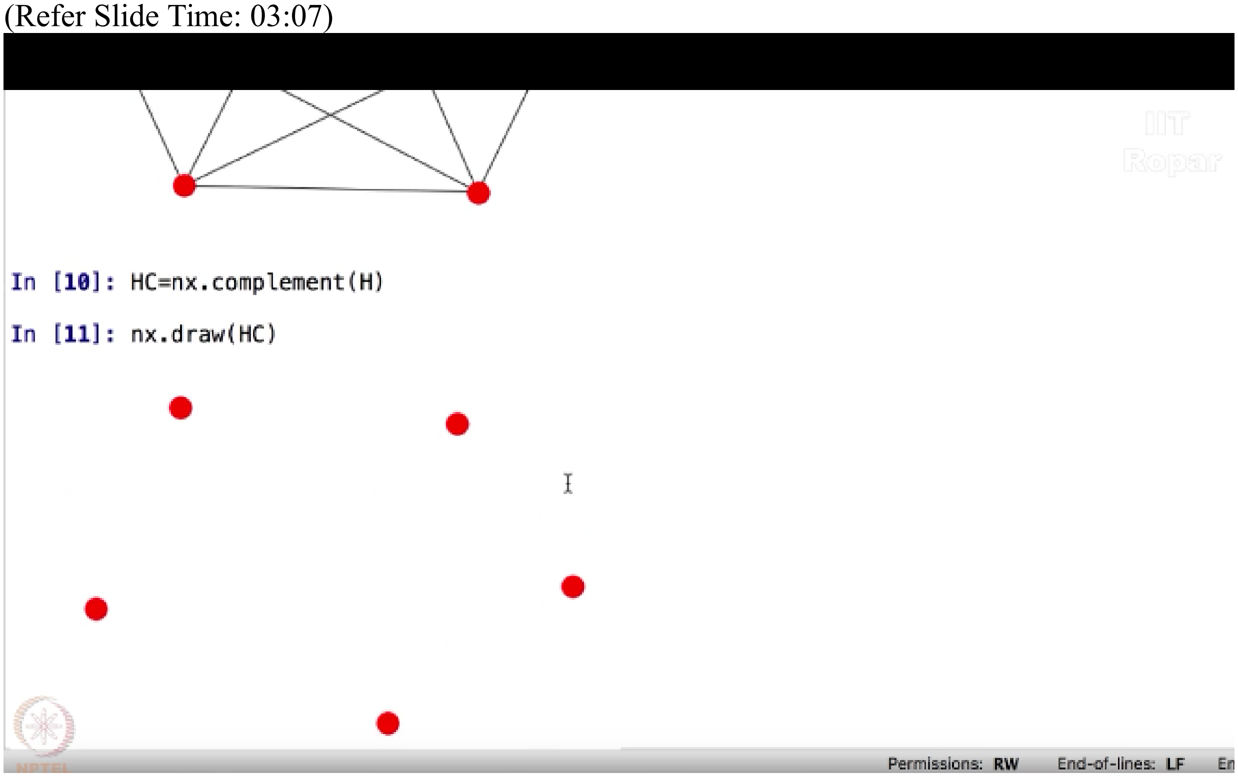

do you see that the complement of a complete graph is always disconnected, it is having 5 isolated vertices, because we had drawn a complete graph on 5 nodes, so the complement is, a disconnected graph with just 5 nodes, it is having 5 components, right, so we cannot generalize

that complement of a connected graph is always disconnected, it can be connected too, let us try that with some random graphs, now I'm going to draw a graph K as nx.gnm_random_graph on let say 10 nodes and 10 edges, now I'm going to draw it nx.draw(K)
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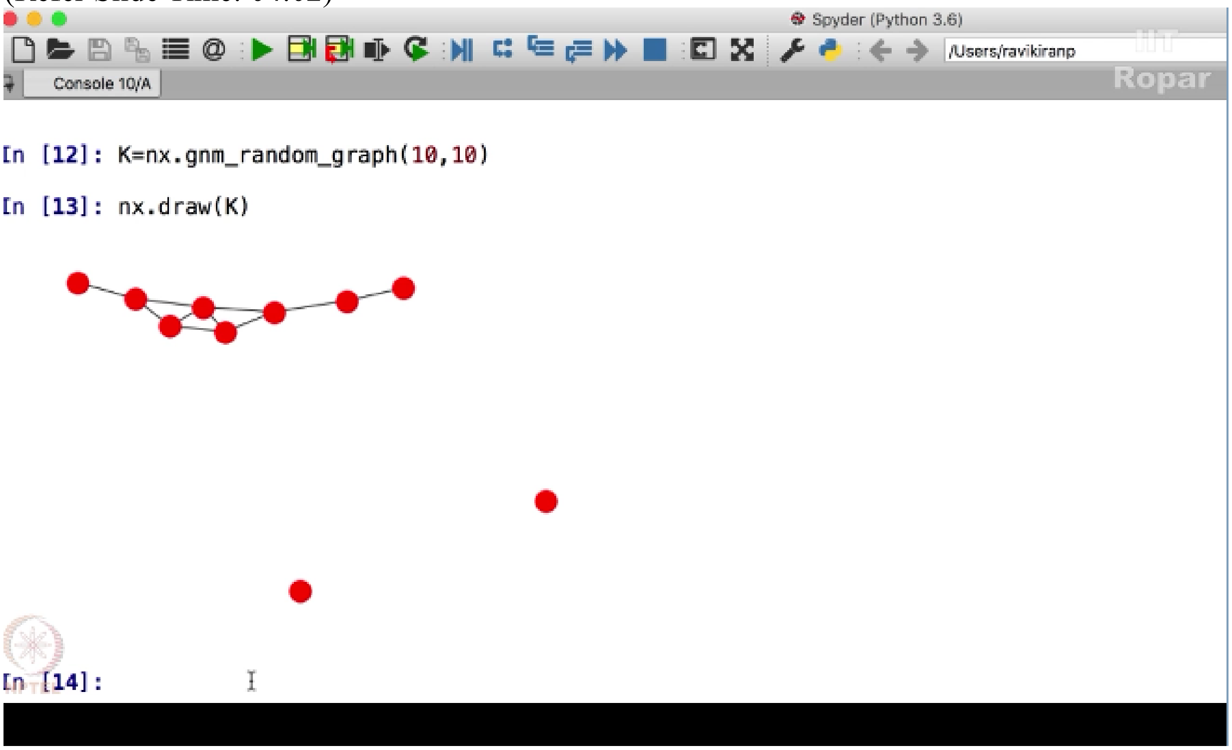

right, it is disconnected, let us try it again, let me say K1 here, let us draw K1, nx.draw(K1)
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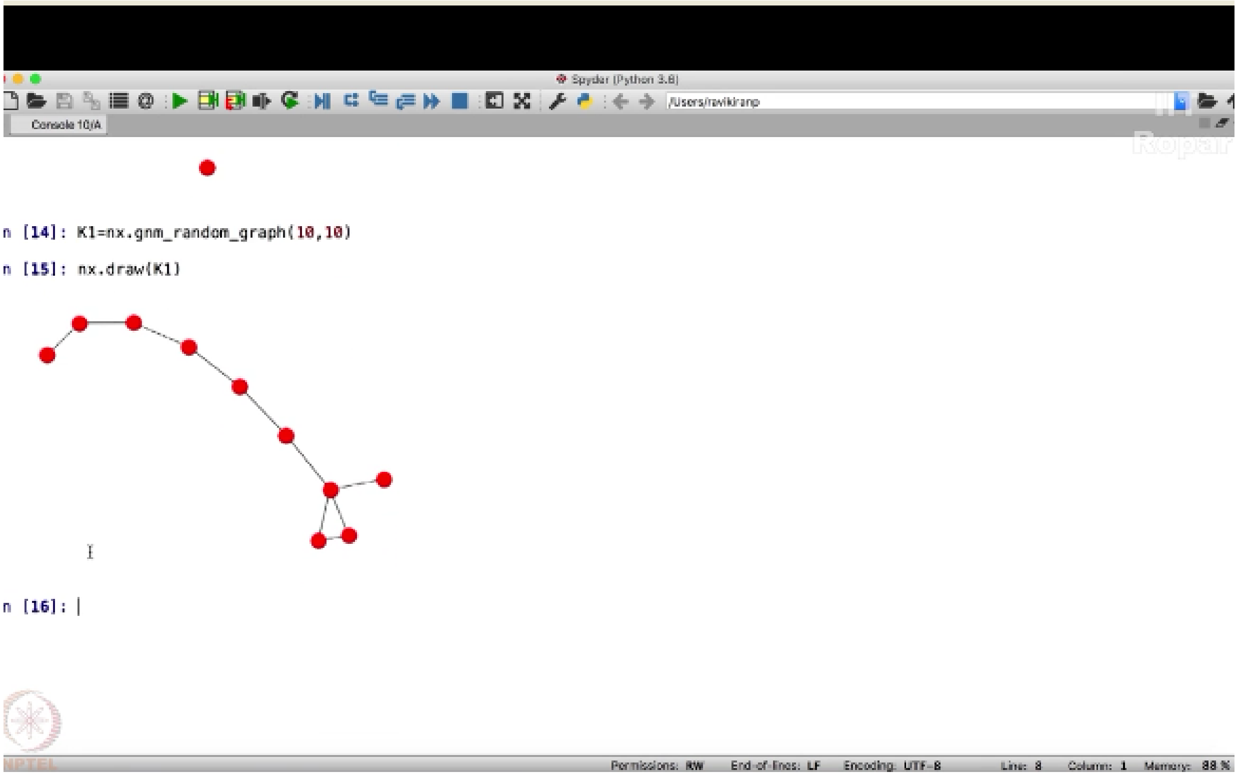

you see K1 happens to be a connected graph, now let us check the complement of K1, let me name that as KC = nx.complement (K1) right, and let us draw it nx.draw(KC)

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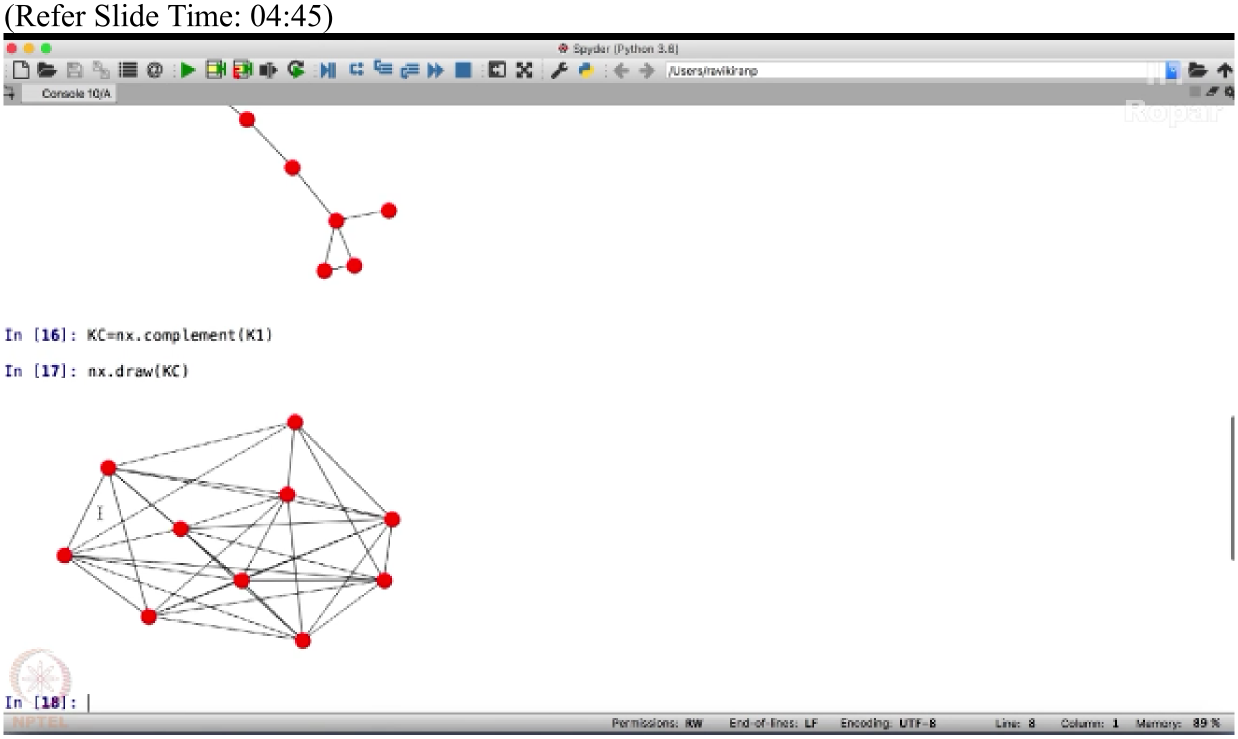

do you observe this? Complement of a connected graph can be connected too, so this was the graph K1 and this is the complement of K1, KC, so we have seen that complement of a disconnected graph is always connected and complement of a connected graph can either be connected or disconnected.

Now let us move ahead, I'm going to clear the screen again, so we are now going to see something called the self-complement graphs, if you remember we had seen that whose complement is itself is called a self-complement graphs.

So now I'm going to draw G = nx.cycle_graph, you must be knowing what is a cycle graph? It's nothing but CN, so I'm going to draw this graph on 5 vertices, nx.draw(G)
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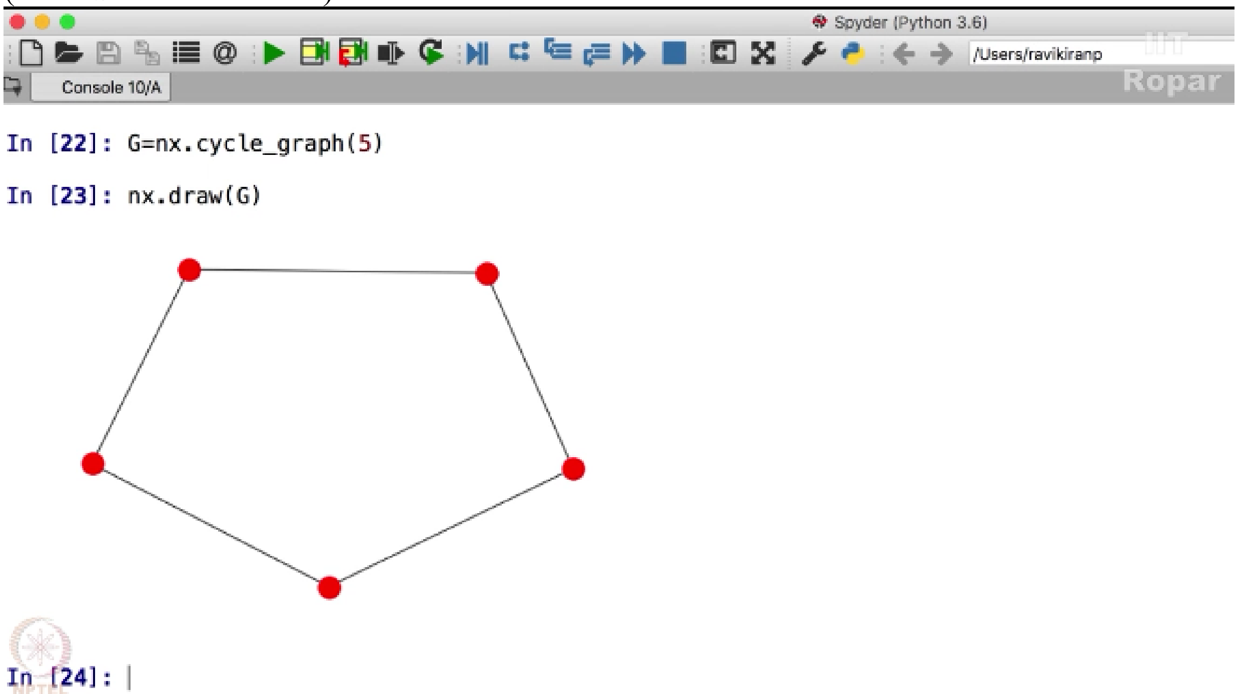

you see I have obtained a cycle on 5 vertices, now I'm going to take GC as nx.complement(G), now I'm going to draw GC,
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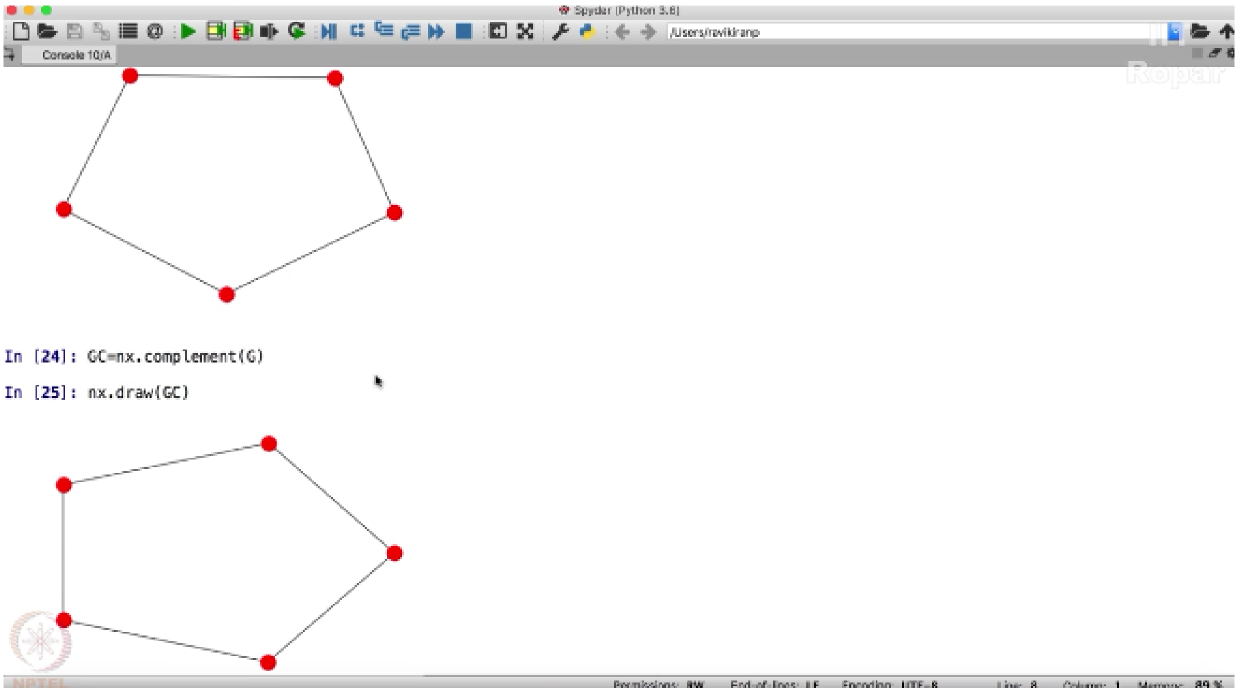

do you see I have obtained the complement of G which was a cycle as again a cycle, right, now here is a nice command what we can use at this time, it is nx.is_isomorphic and in bracket you can give G and GC, right, true, do you see that the complement of C5, C5 itself, and it says that it is isomorphic.

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