NPTEL

NPTEL ONLINE CERTIFICATION COURSE

Discrete Mathematics
Graph Theory - 2

Eulerian and Hamiltonian - Are they related?

By
Prof. S.R.S Iyengar
Department of Computer Science
IIT Ropar

Now that we know what are Eulerian graphs and what are Hamiltonian,
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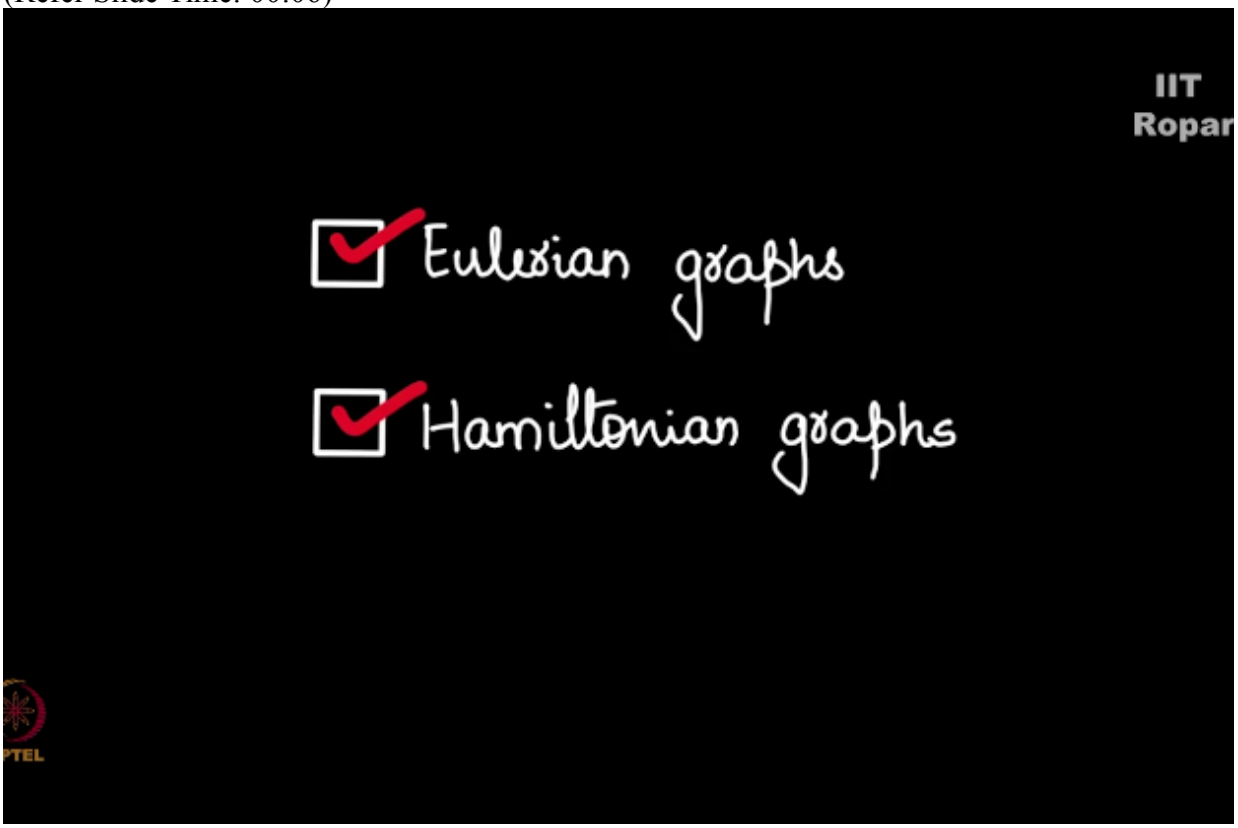

let me ask you this question, is every Eulerian graph Hamiltonian?
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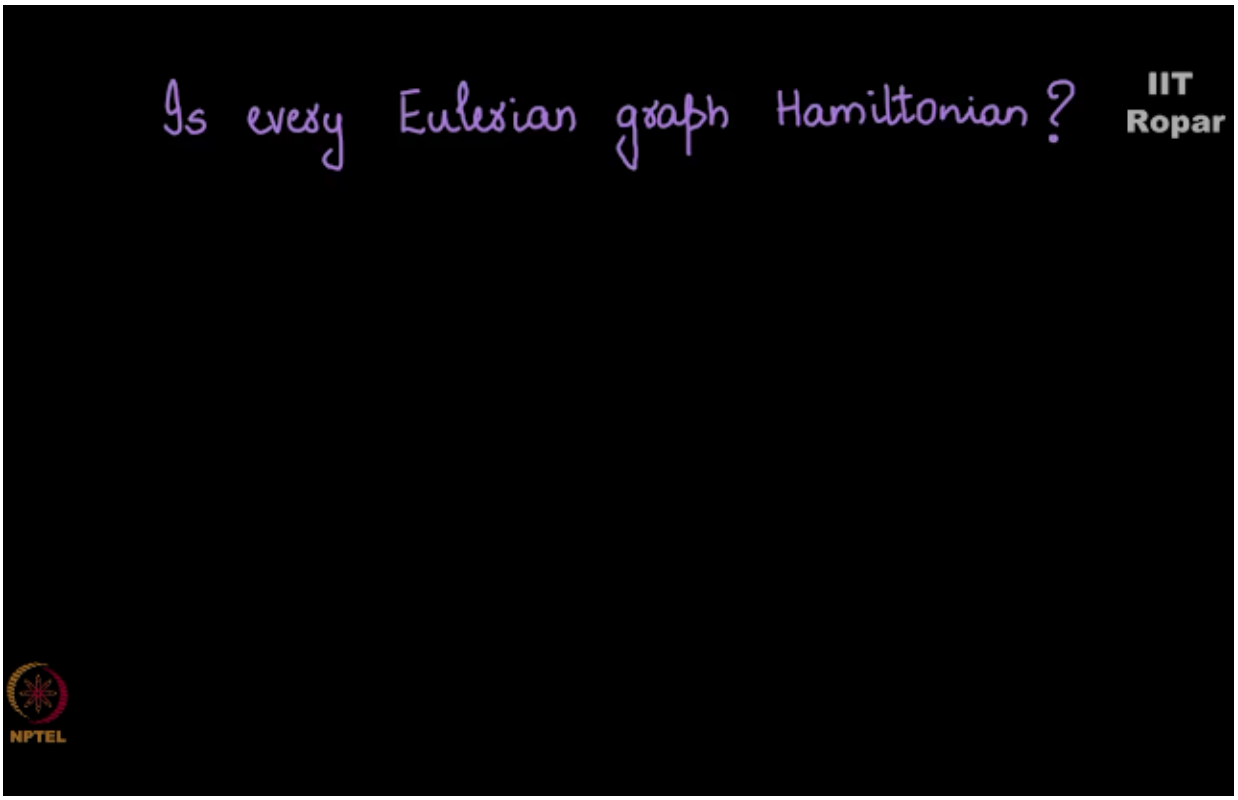

Consider this graph,
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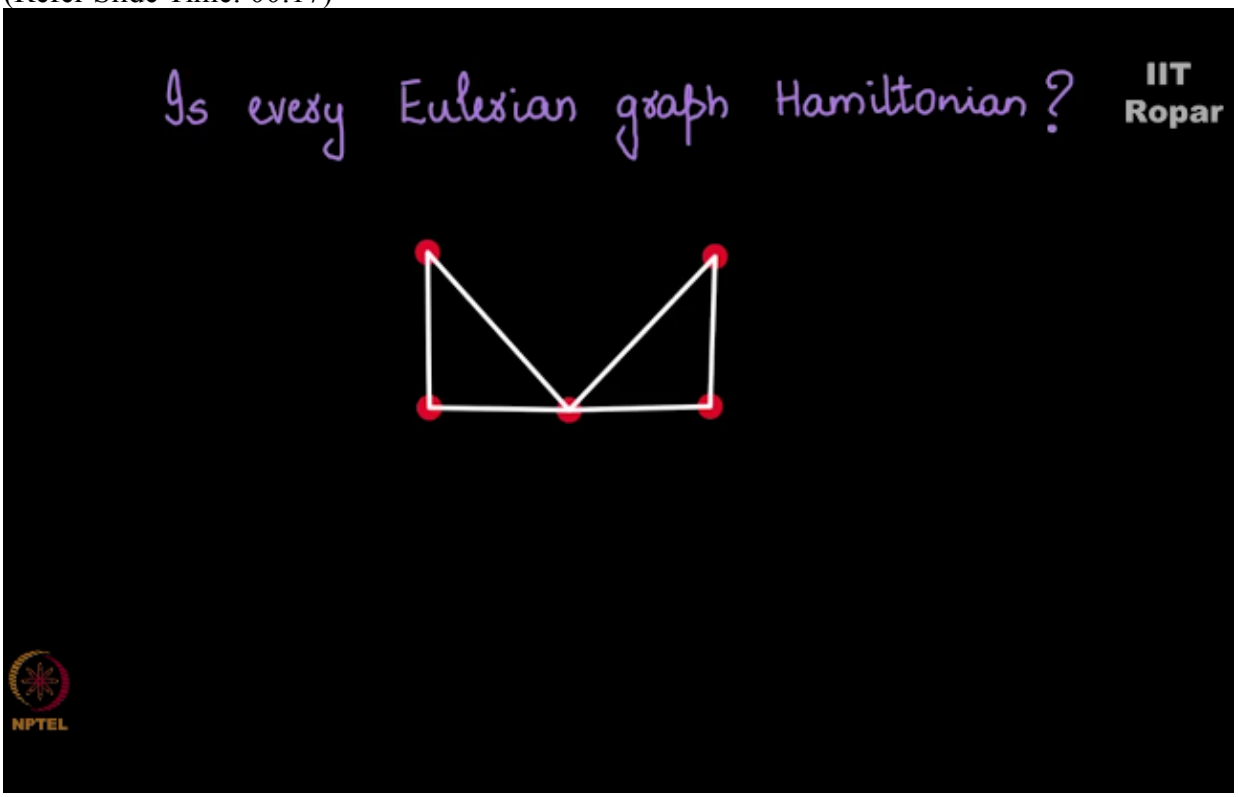

Do you see this vertex U here?
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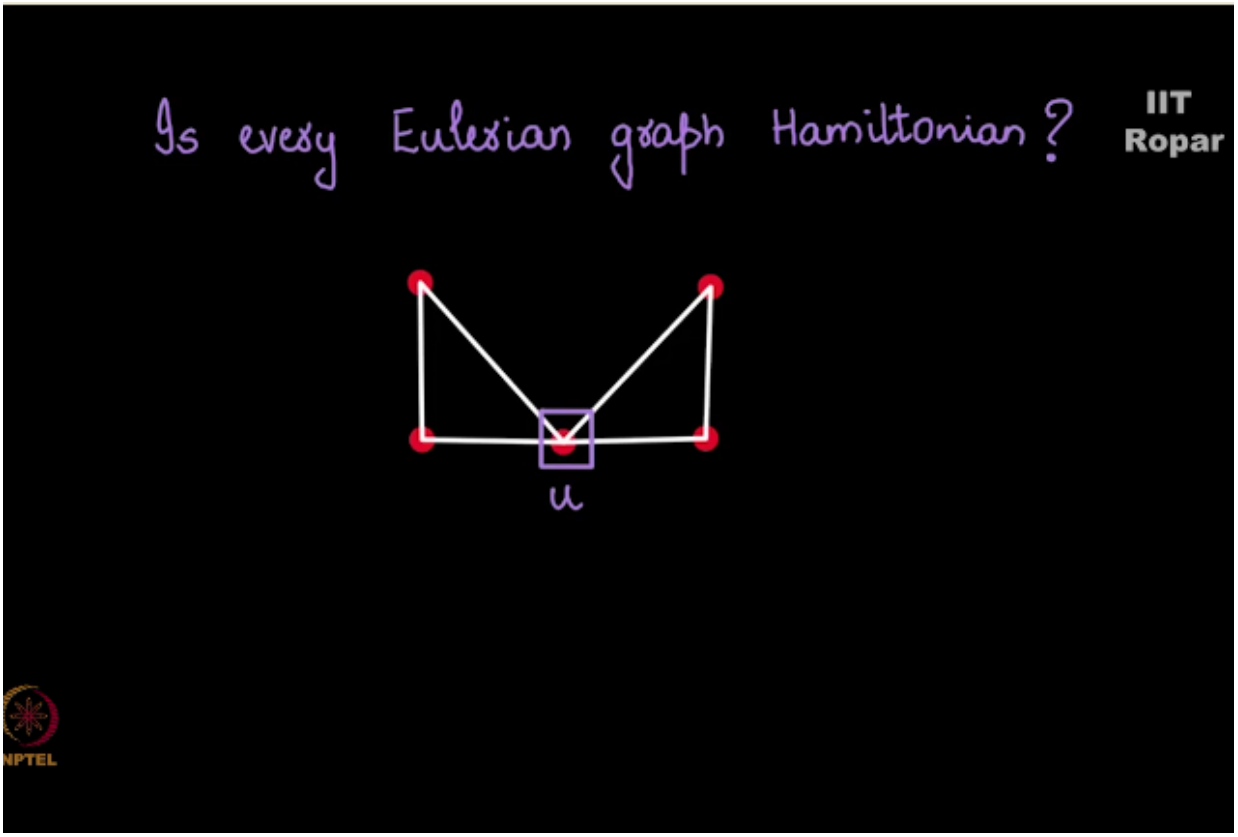

If I start from this vertex, let me say A, B, U, C, D, U, do you see that I've to pass through U twice,

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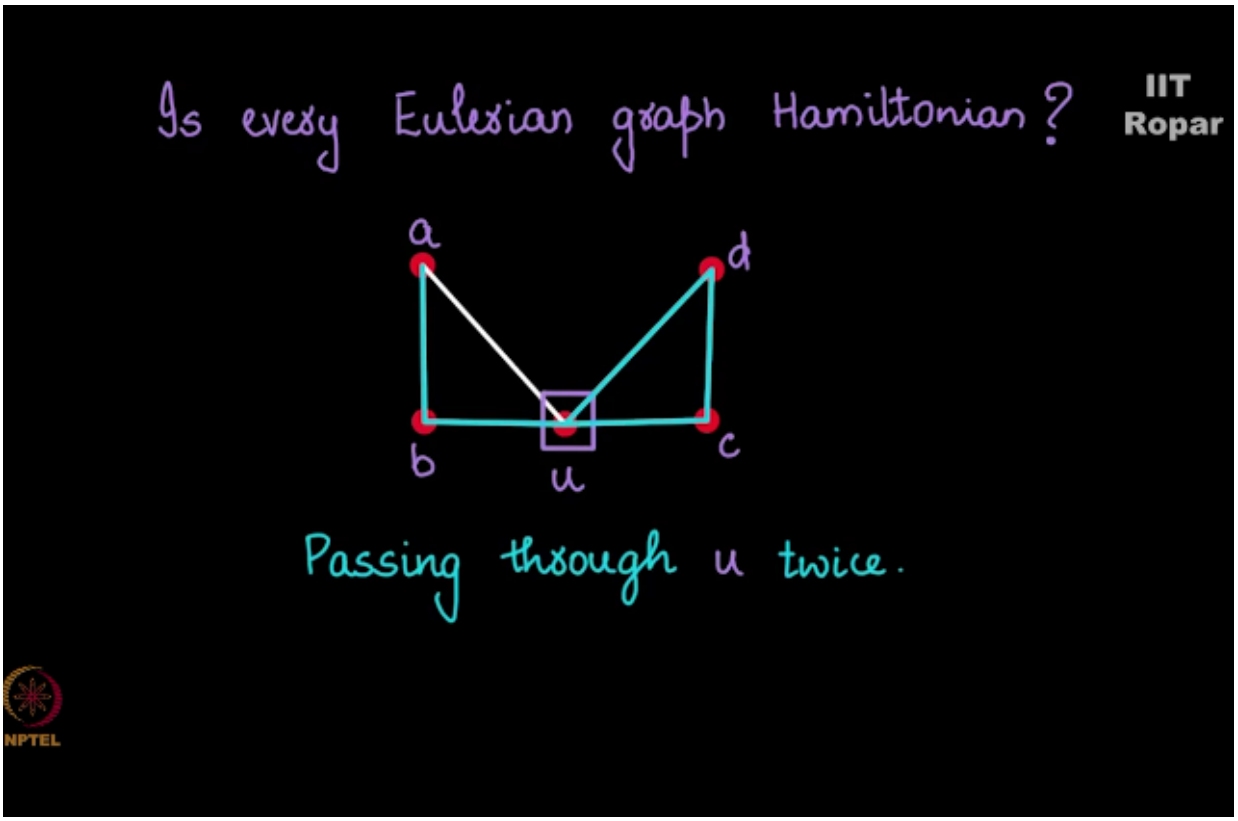

though the graph is Eulerian, because the degree of every vertex is even, it is not Hamiltonian.
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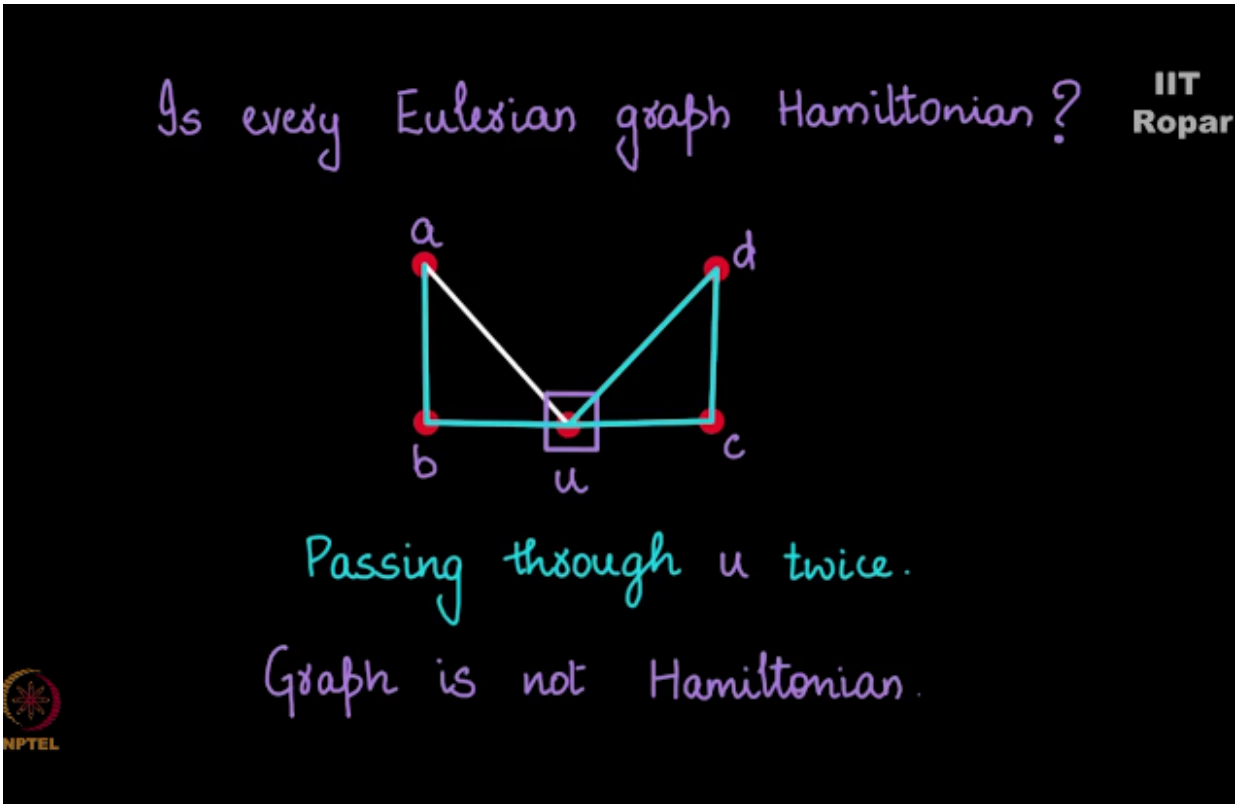

So here is a graph which is Eulerian, but it is not Hamiltonian.

The obvious next question would be is every Hamiltonian graph Eulerian? Let me take this graph, it is a C5 with an edge in between,
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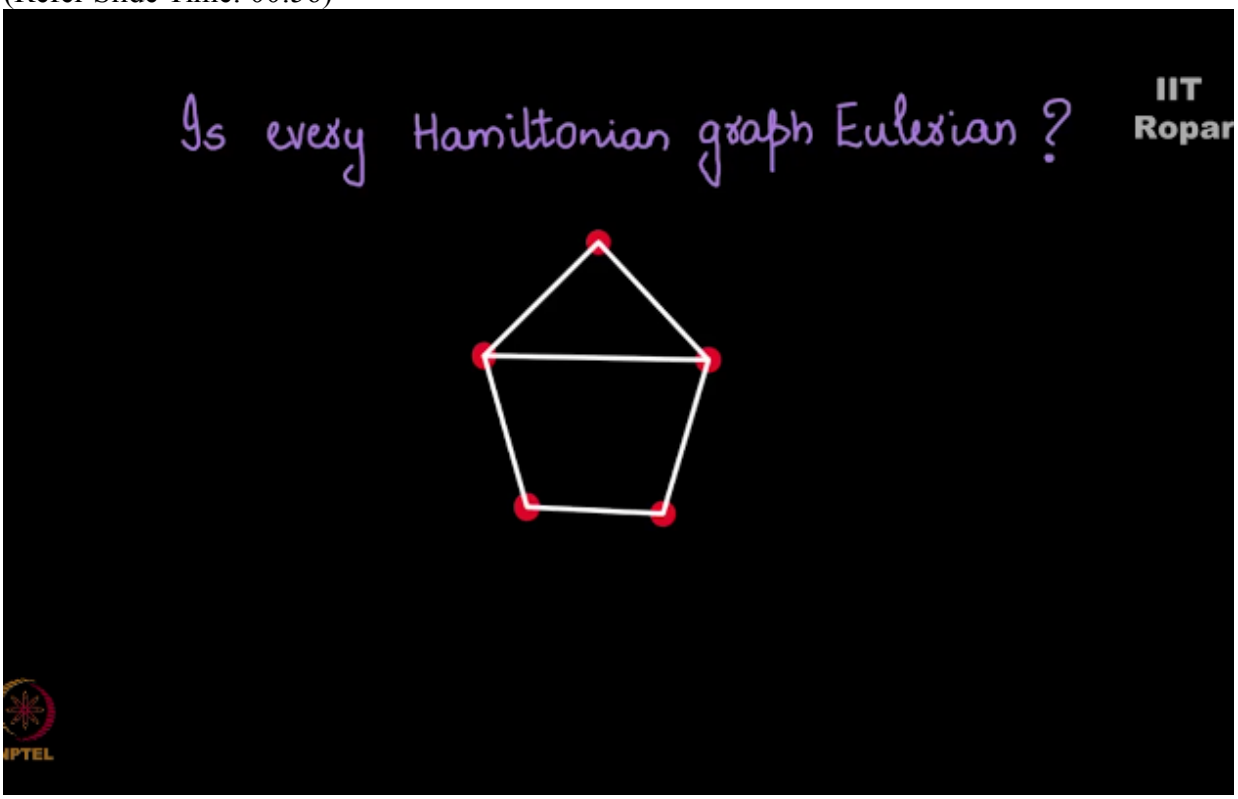

do you see that the degree of these two vertices is odd, definitely the graph is not Eulerian, but it is Hamiltonian very obvious, there is a cycle here, so this is an example of a graph which is Hamiltonian, but not Eulerian.
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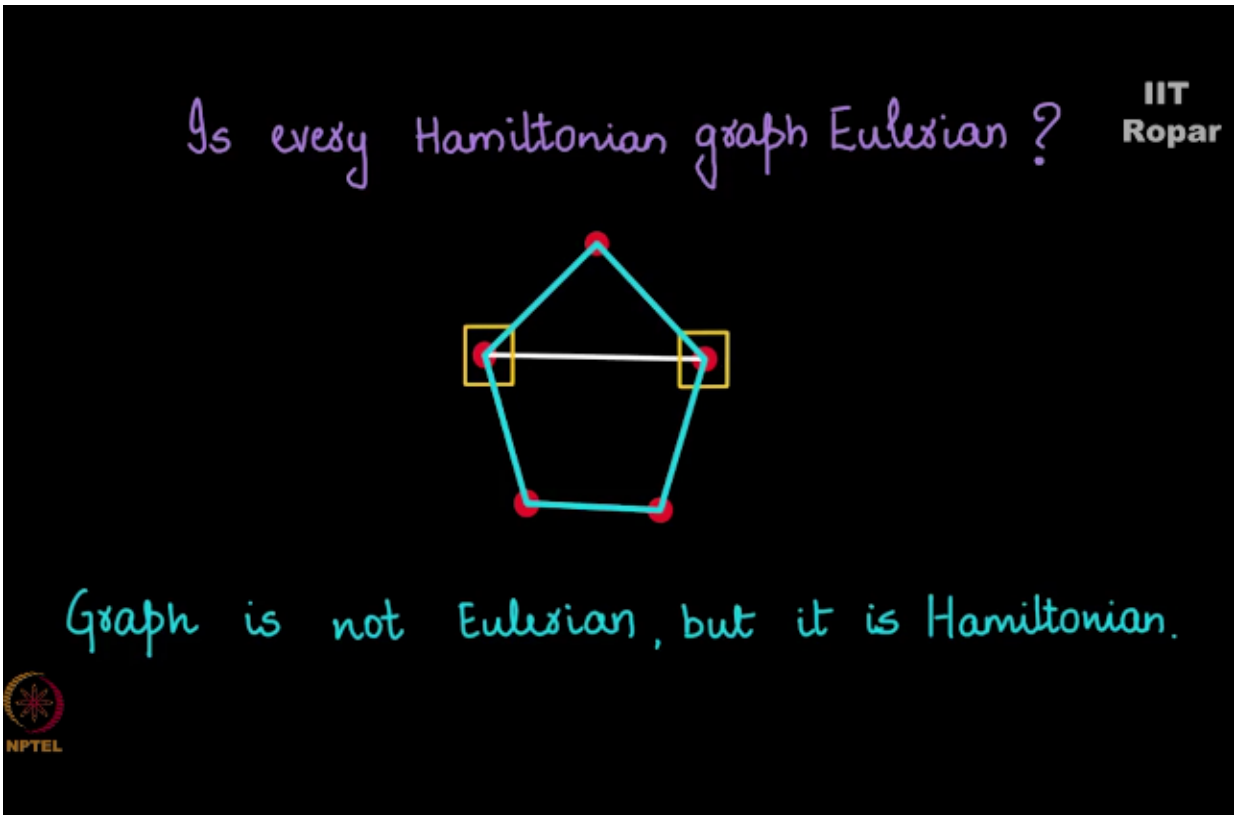

Now are there graphs which are both Eulerian as well as Hamiltonian? Yes, definitely CN,

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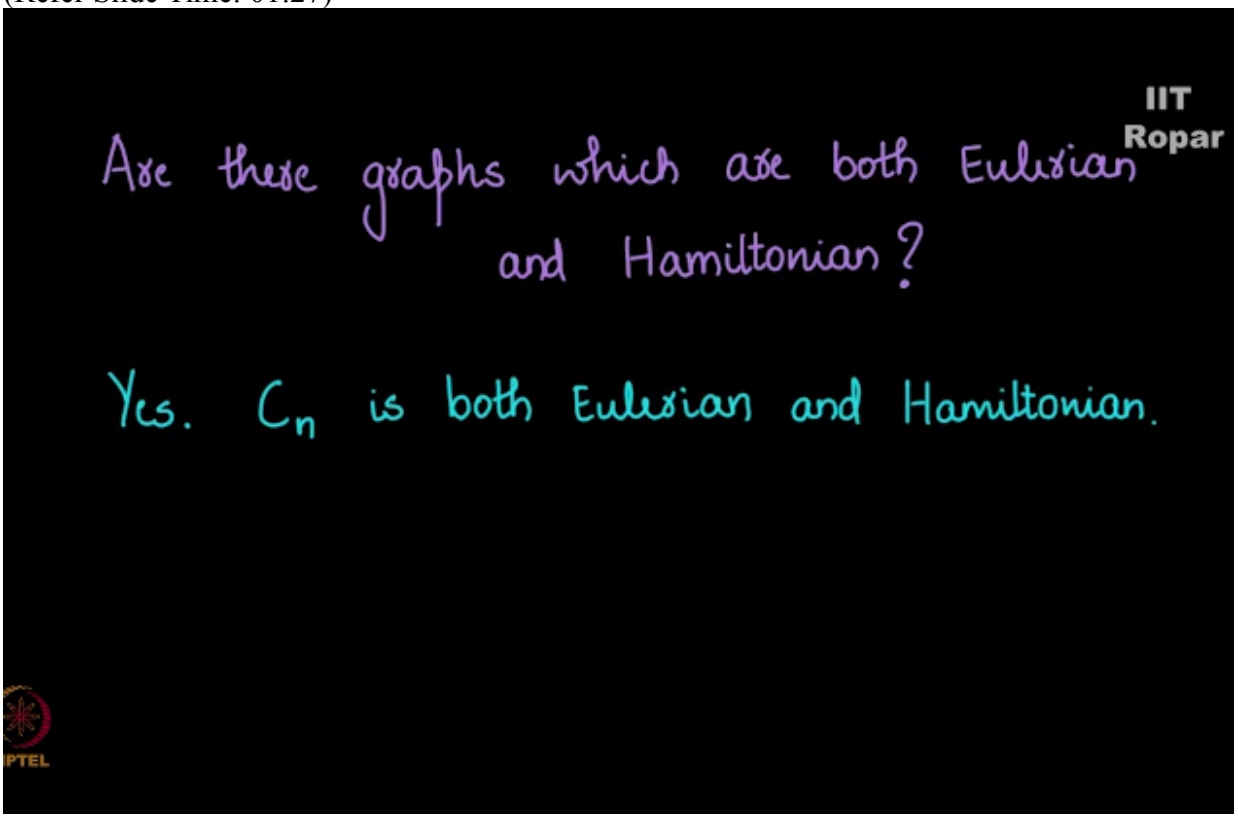

all CN are Hamiltonian as well as Eulerian, we cannot state in general that graphs which are Hamiltonian or Eulerian or vice-versa, it always depends on the graph.

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