NPTEL

NPTEL ONLINE CERTIFICATION COURSE

Discrete Mathematics
Graph Theory - 1

Spanning and induced subgraph

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The professor has already introduced what is a subgraph, let me just quickly revise it, consider this graph,
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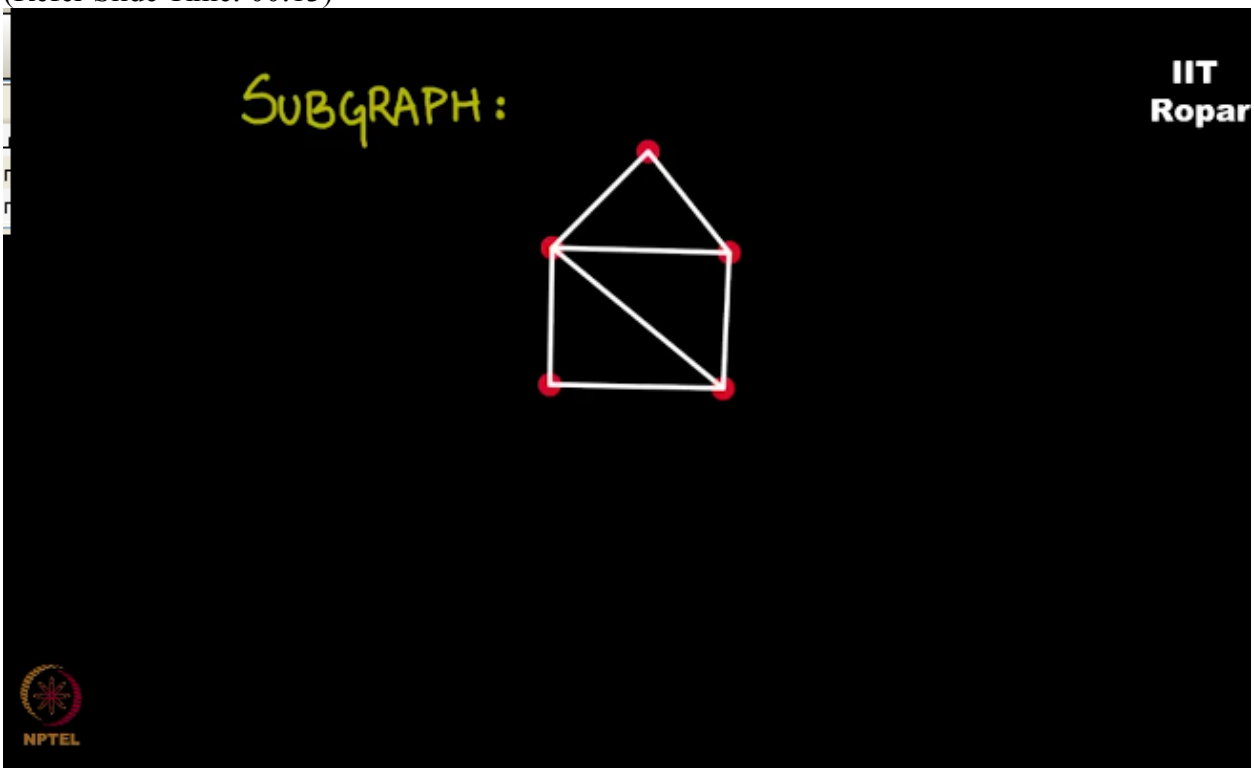

now this is a subgraph of this graph,
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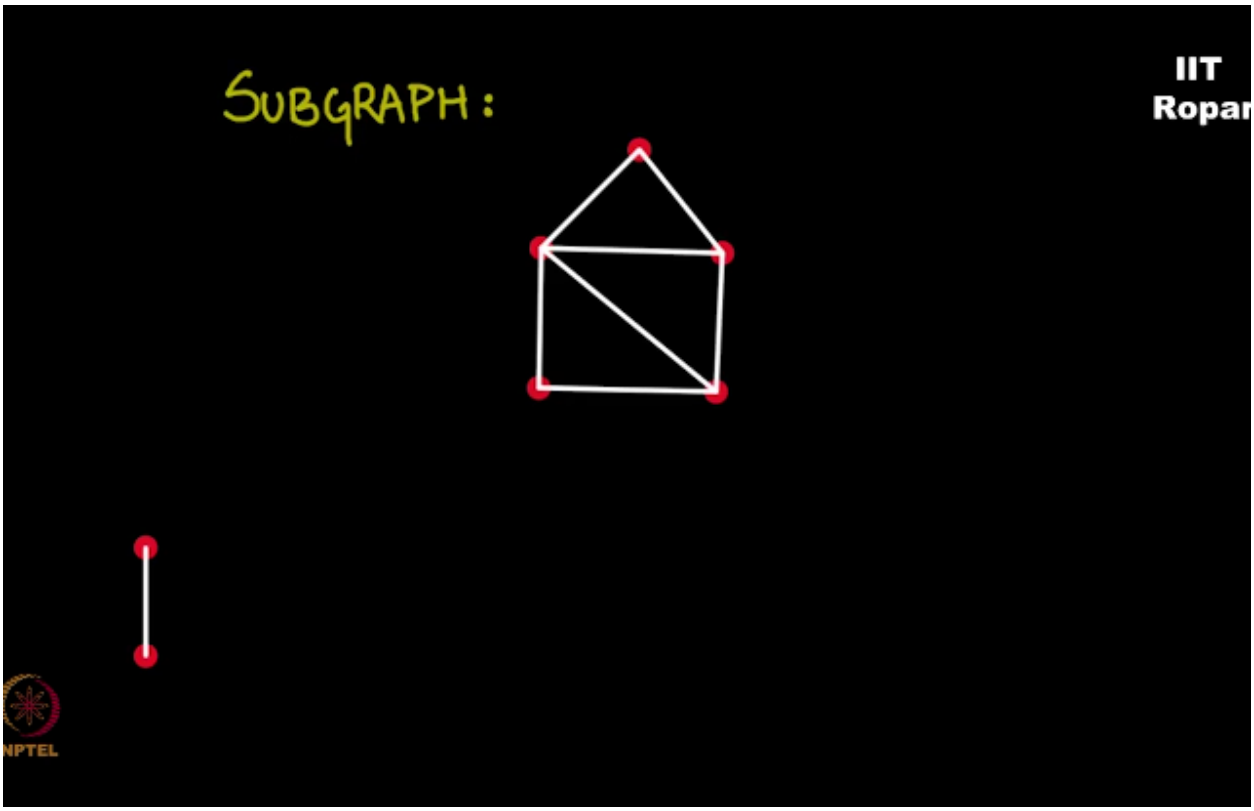

this is yet another subgraph,

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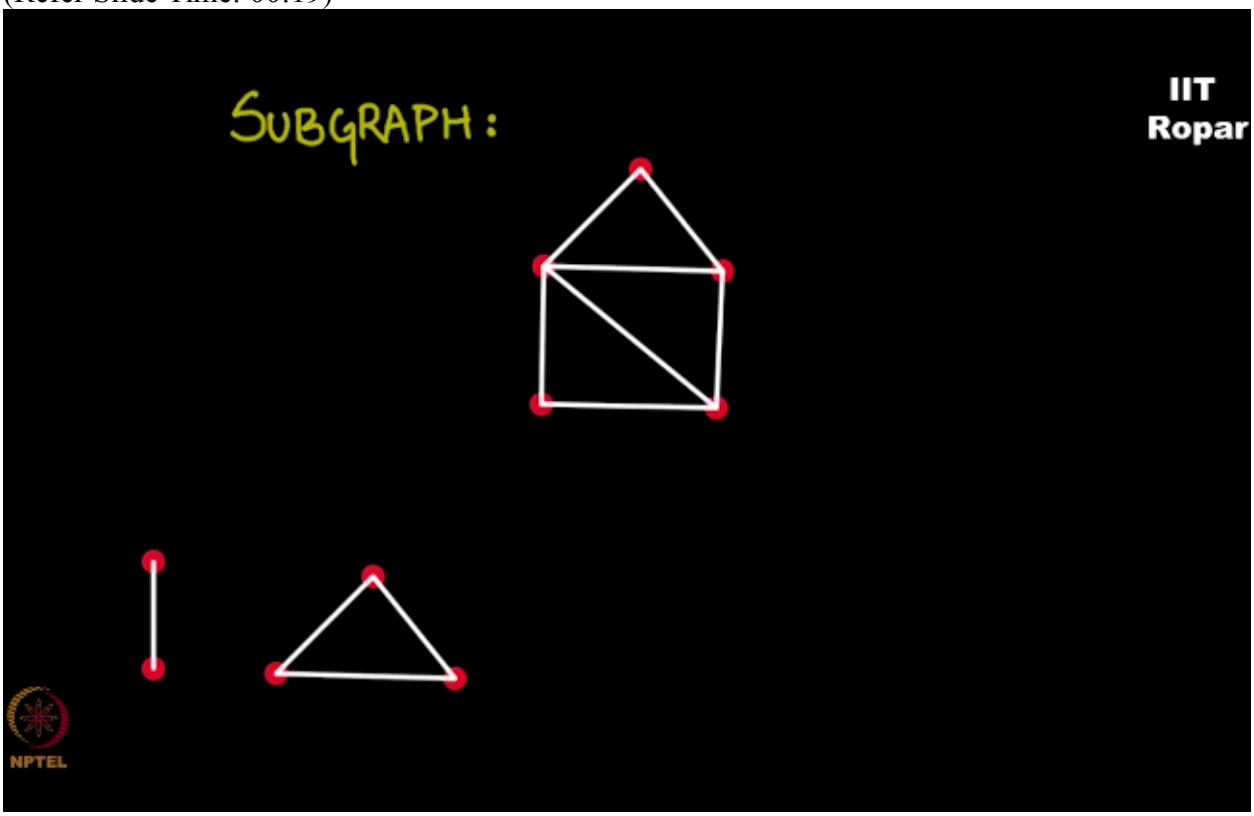

this is another subgraph,

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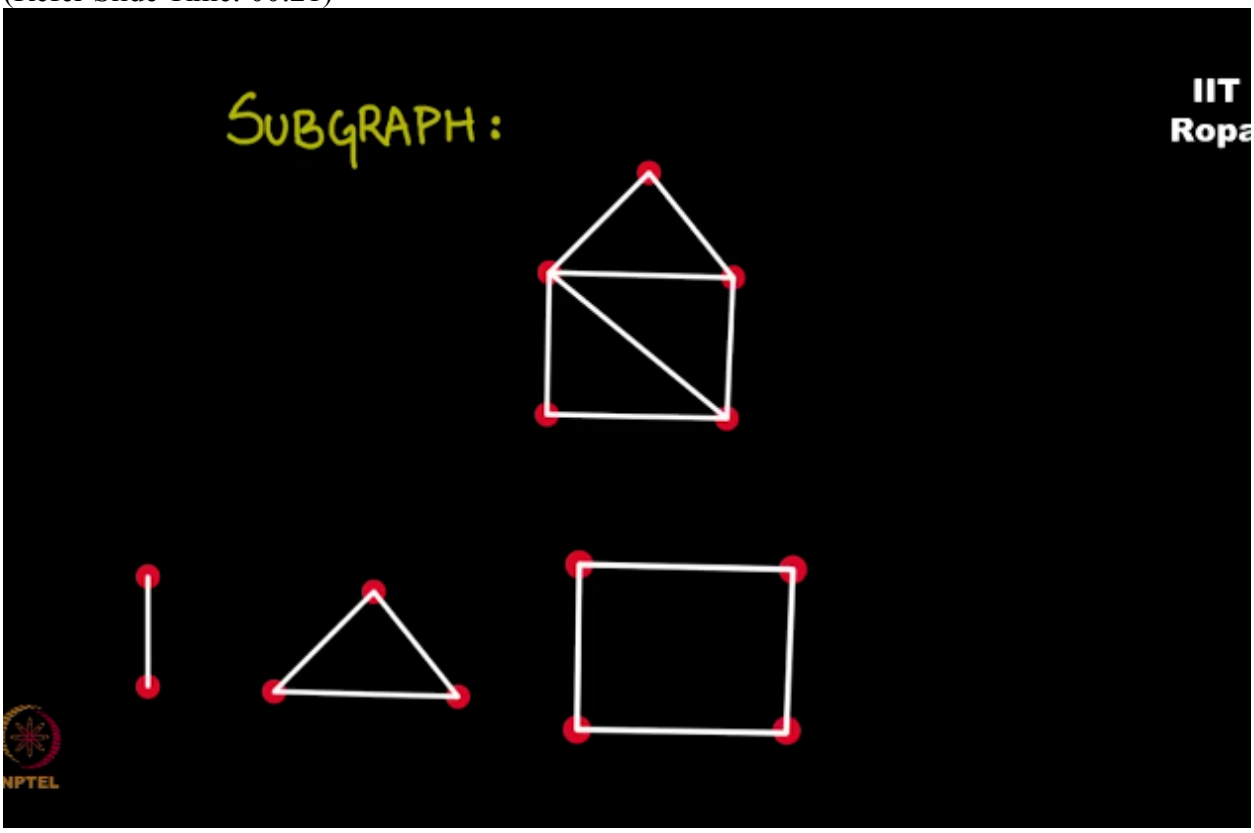

and this 1, 2,

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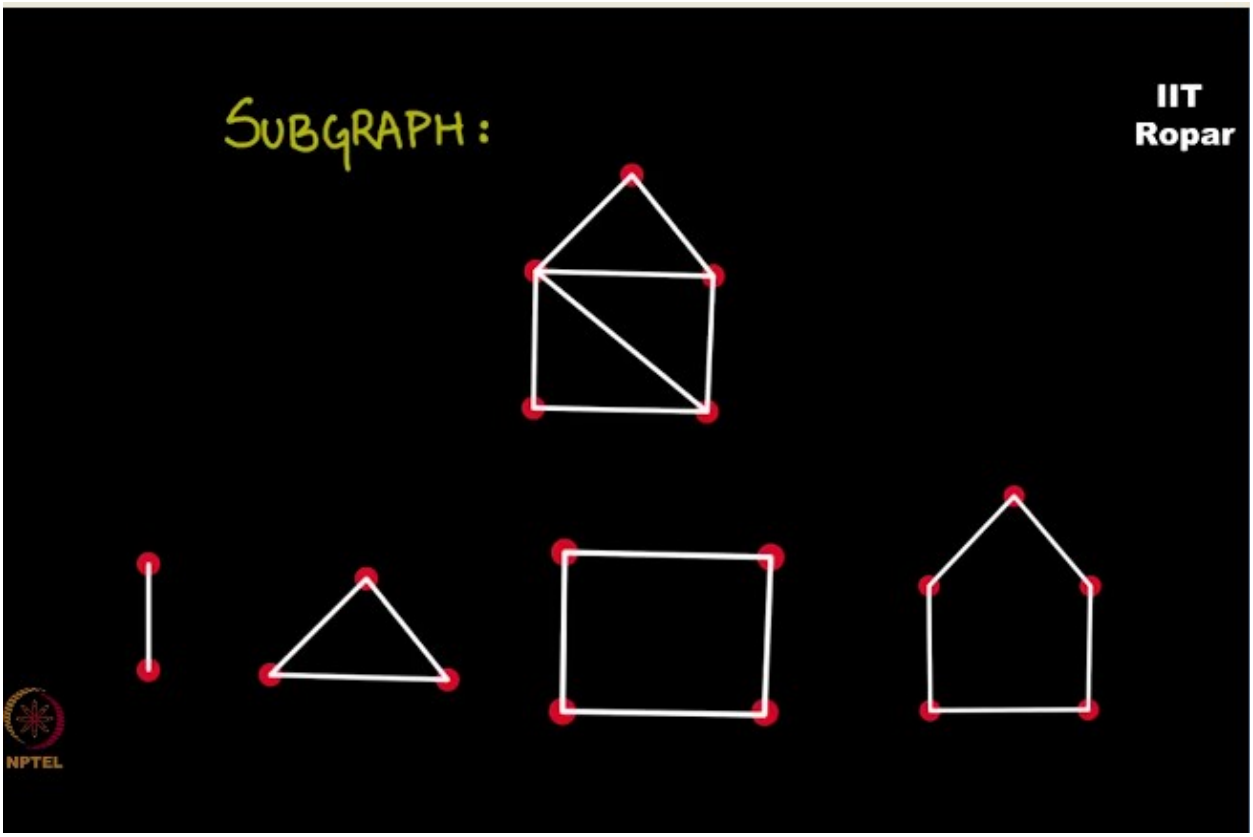

but what is so special about this subgraph,

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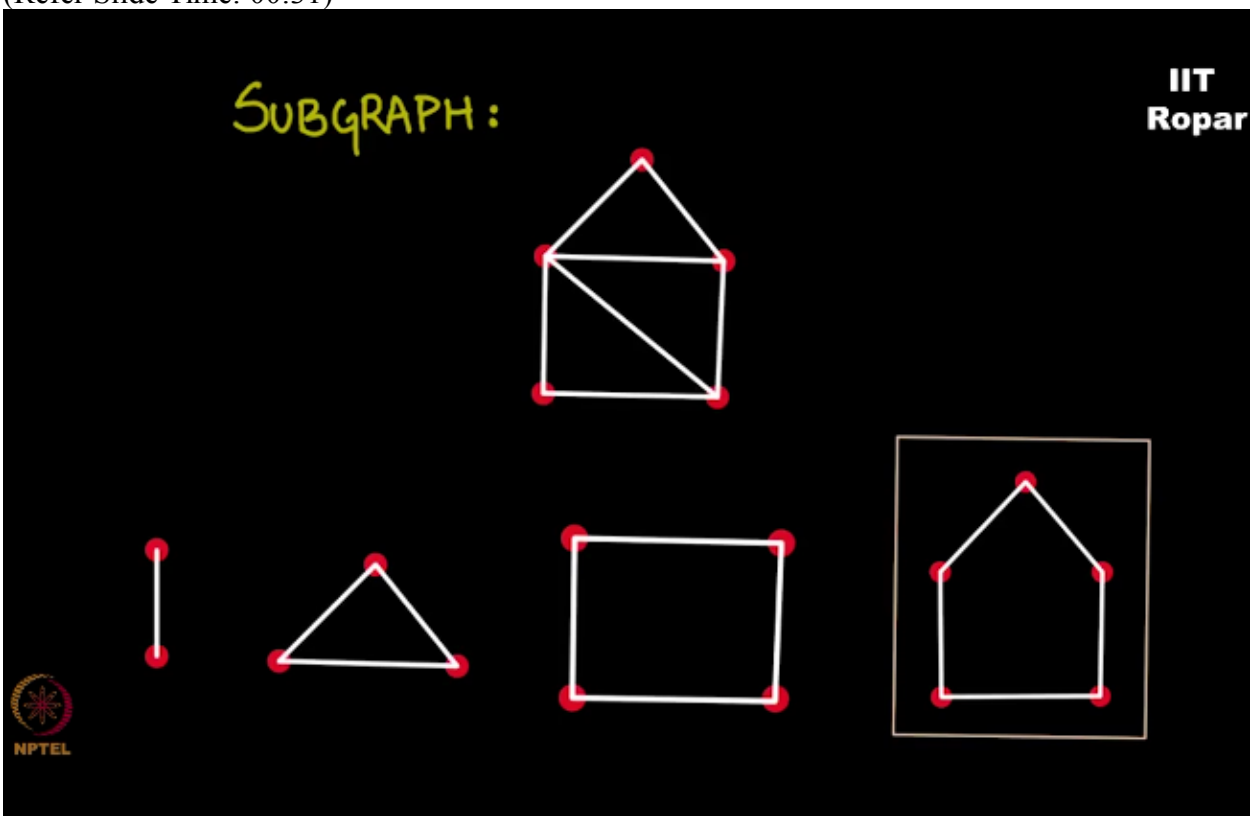

there is a special name for it, but why particularly this subgraph has special name? Let me tell you, this subgraph has

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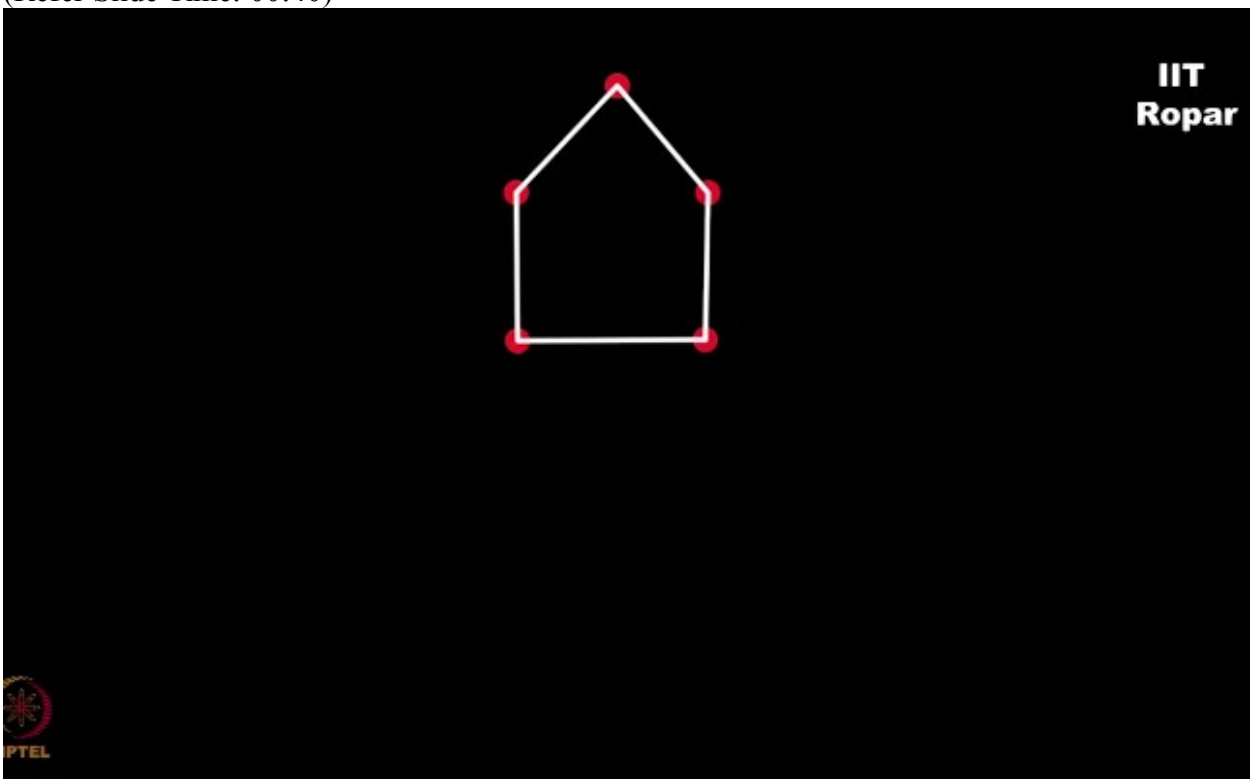

all the vertices which the graph has, the vertices which are in the original graph are also there in this subgraph,

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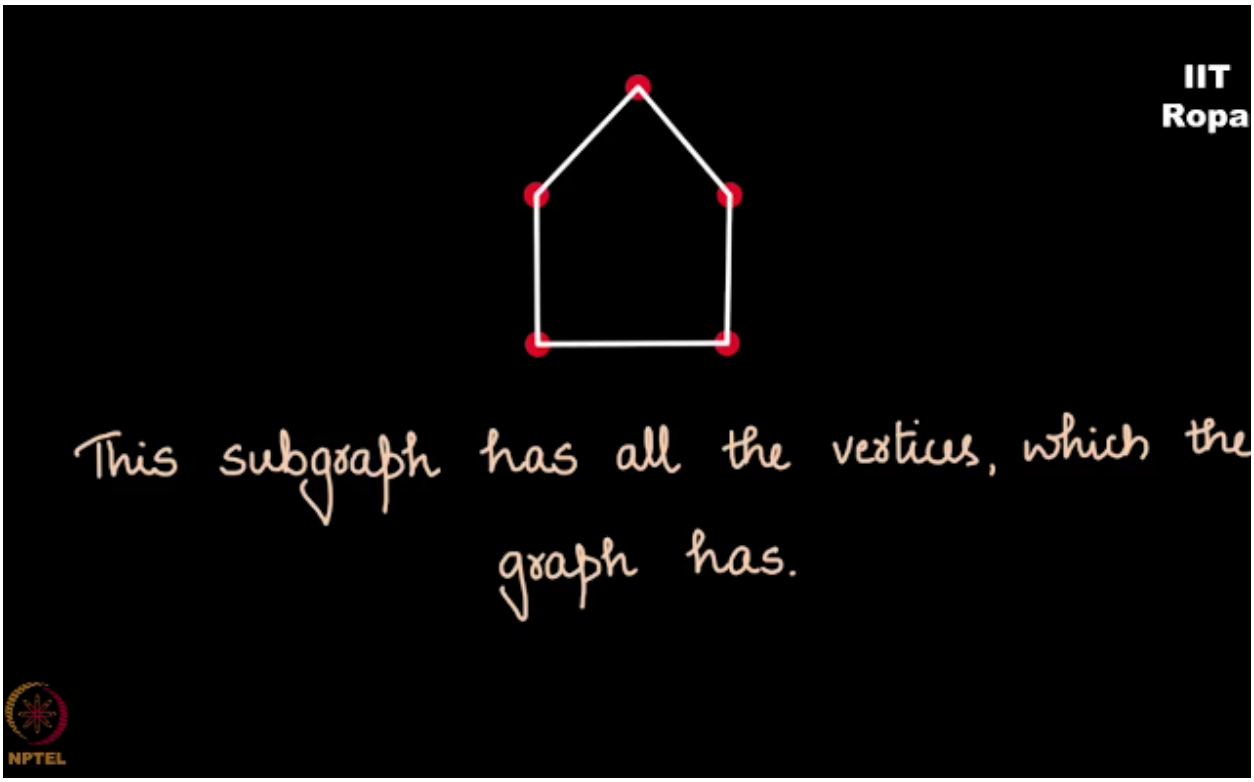

all the vertices you see, the vertex set has 5 elements in the graph, and so as this subgraph.

Now the subgraph which has the same vertex set as the original graph is called as a spanning subgraph, so this is a spanning subgraph of this graph.

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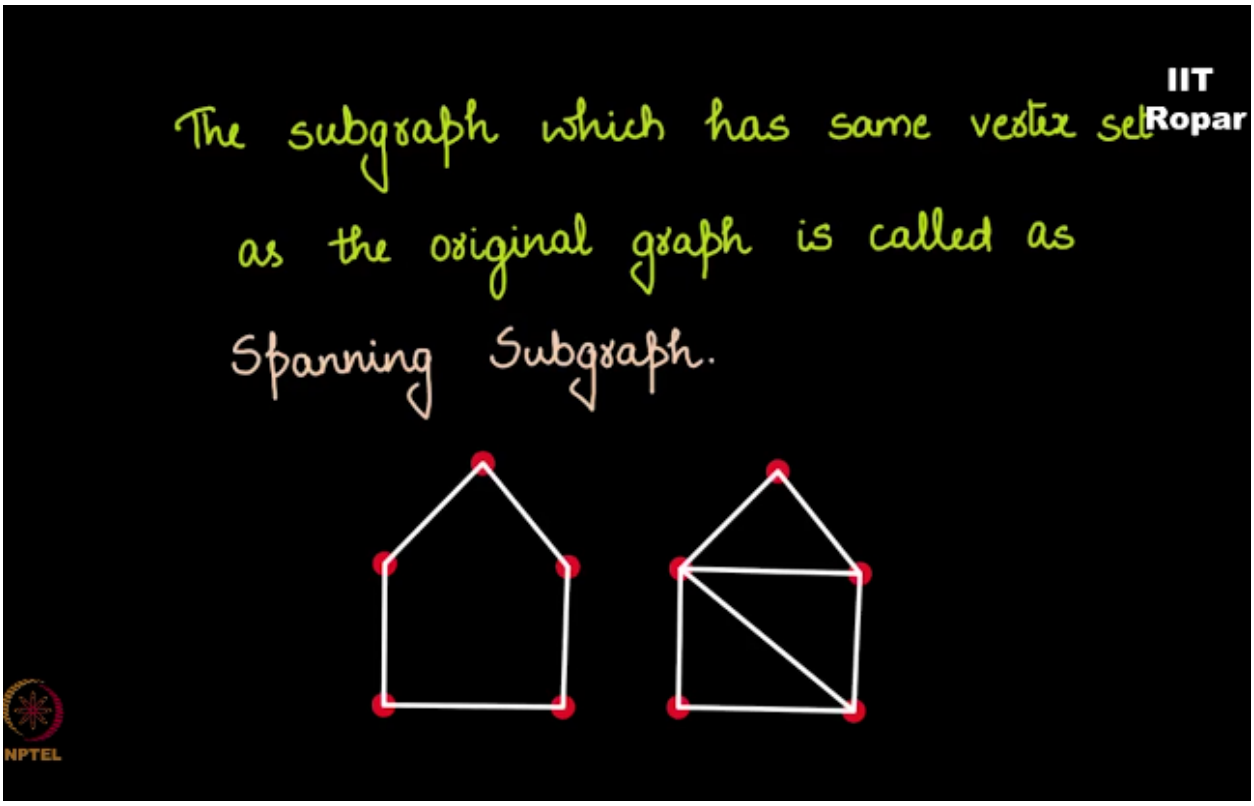

Now let me consider this subgraph, is this is spanning subgraph?
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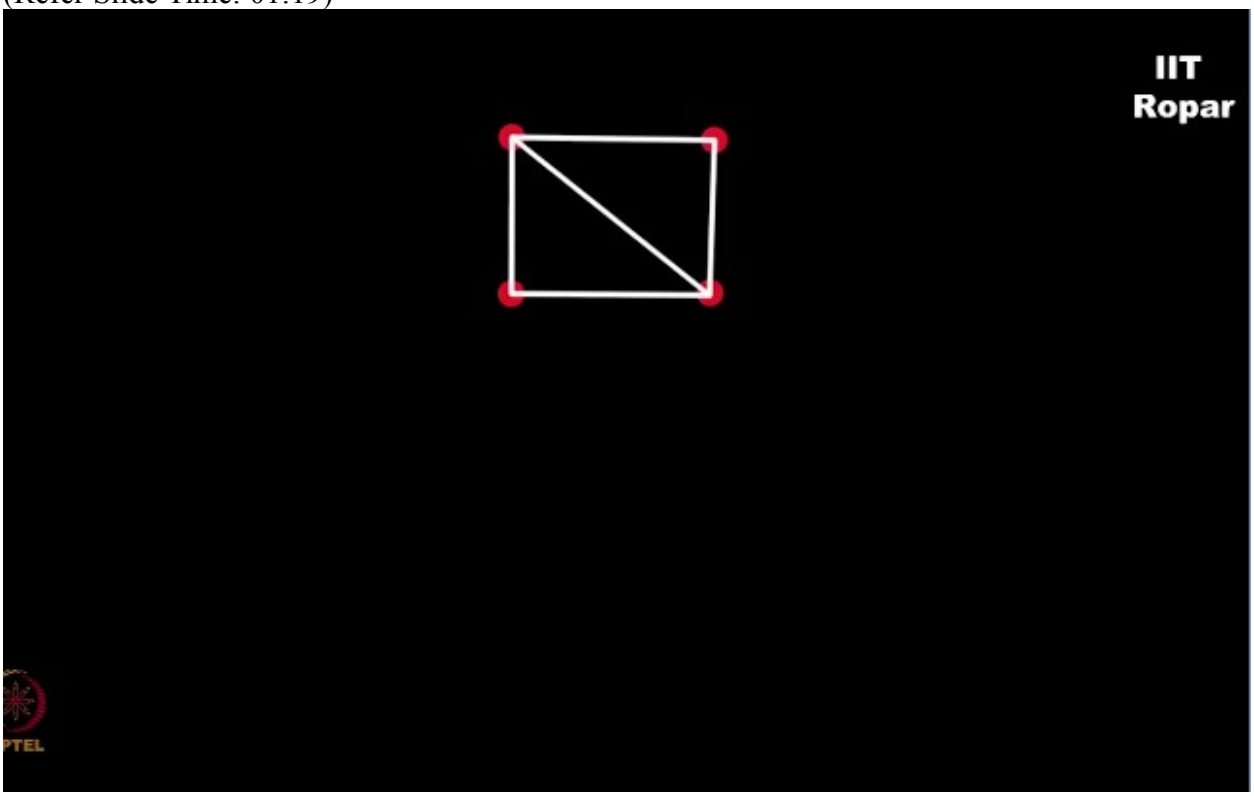

No, this is not, we haven't covered all the vertices here.
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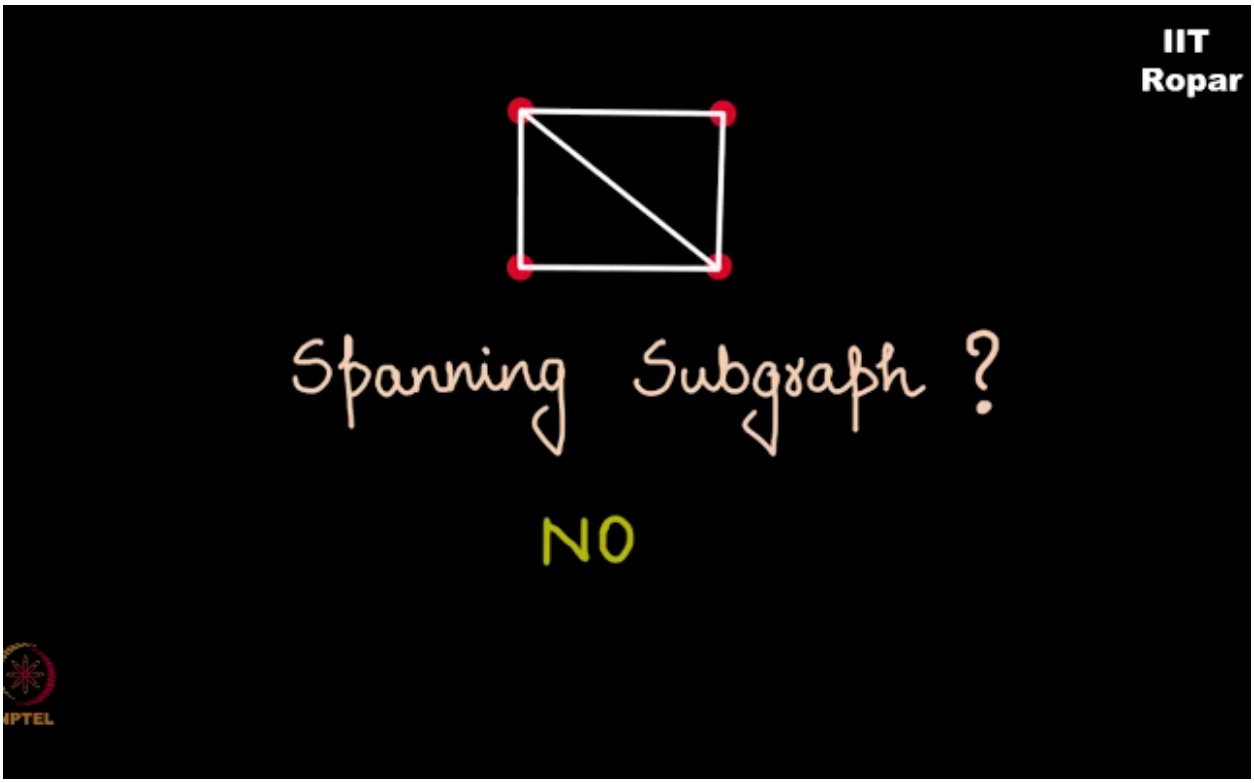

Now let me take another example, if I consider these 3 vertices of the same graph,
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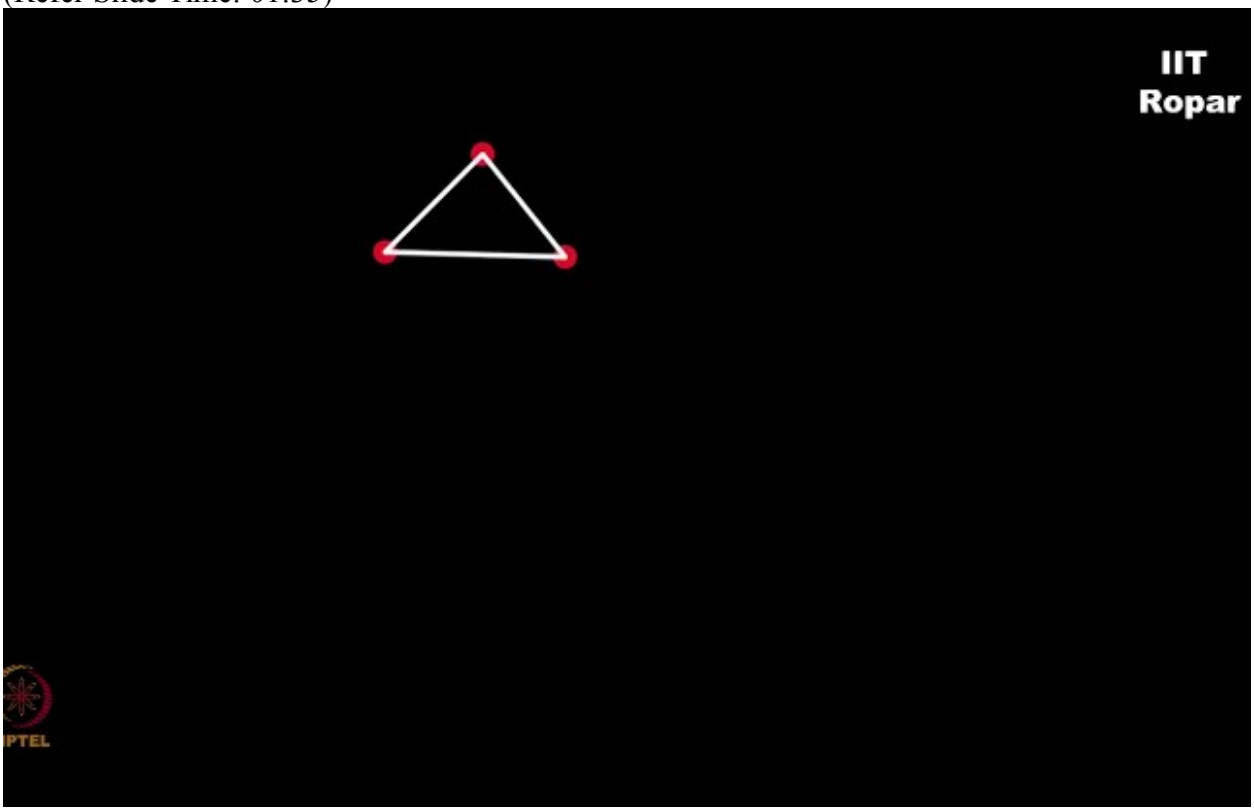

this is the subgraph of this graph itself, now do you see
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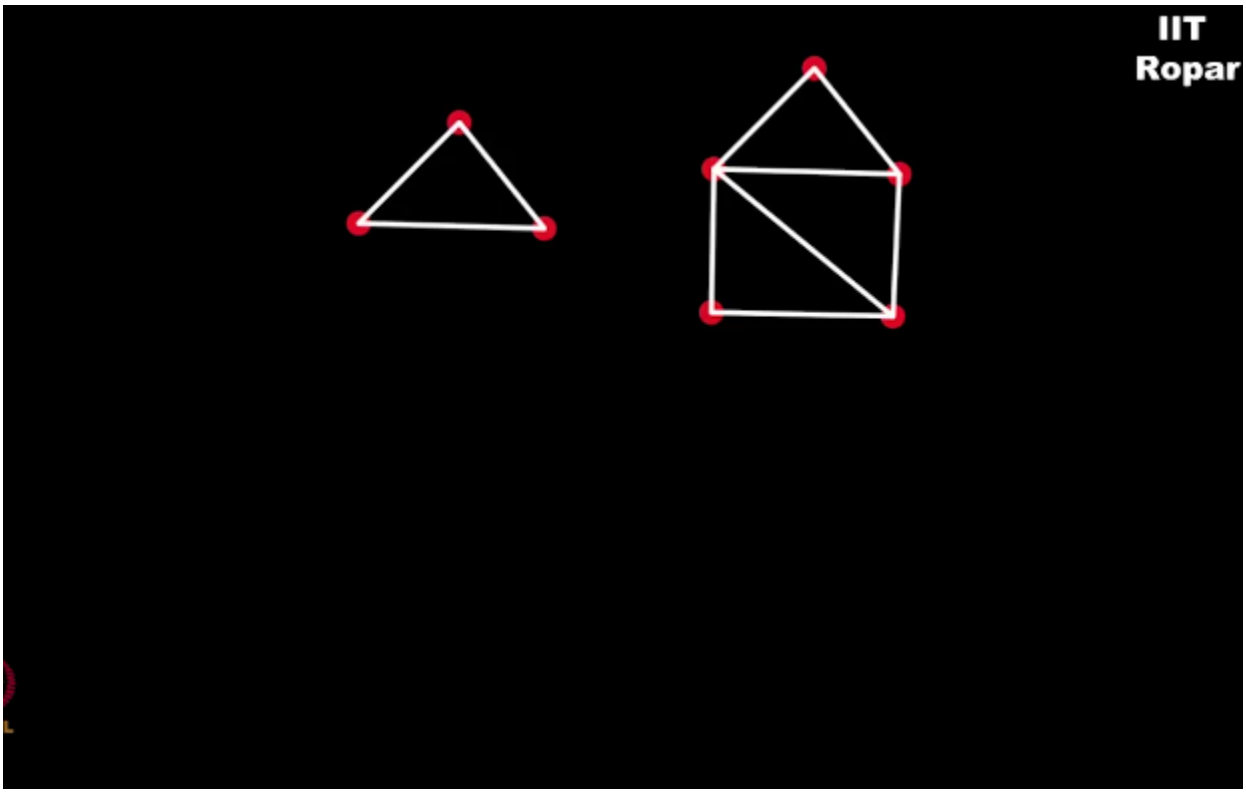

that I have covered or I have written all the edges corresponding to these 3 vertices, haven't I? You take this 3 vertices, this edge is there, this edge is there and this edge is also there,

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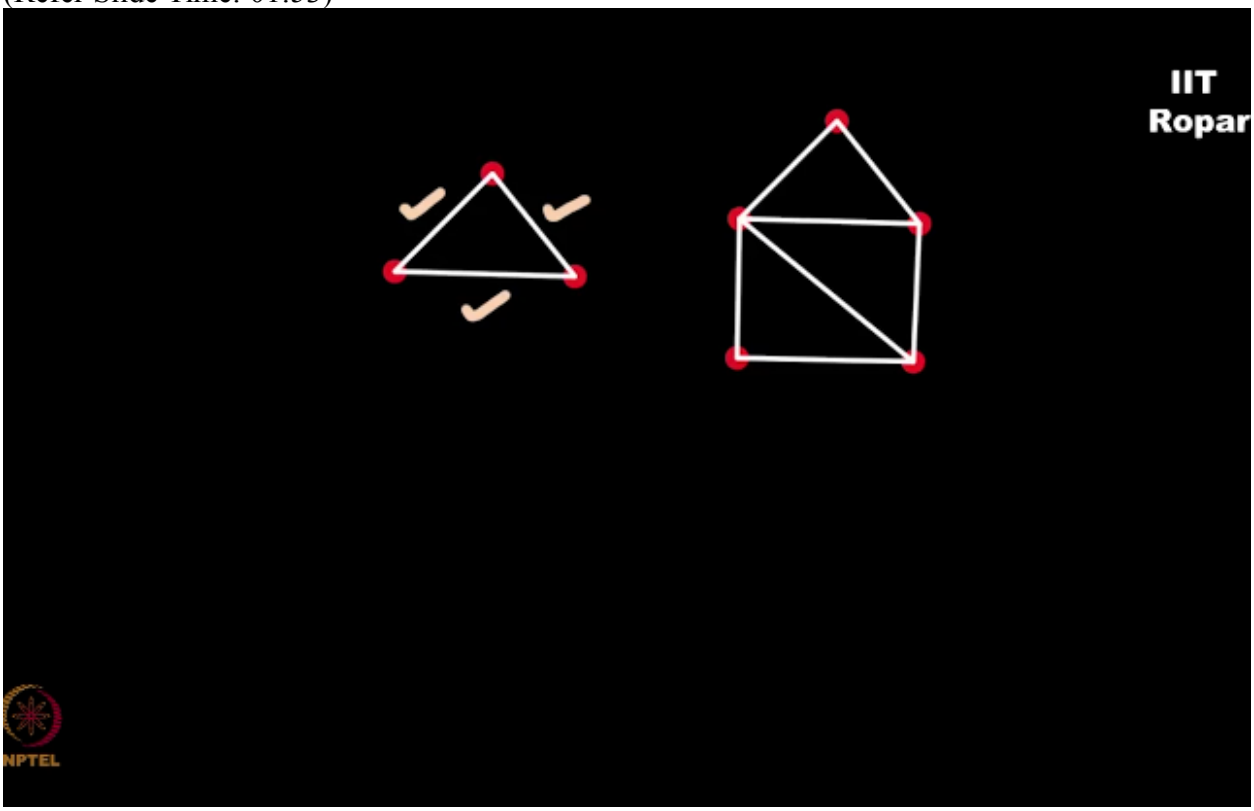

now such a subgraph where it has all the edges corresponding to those set of vertices is called an induced subgraph.
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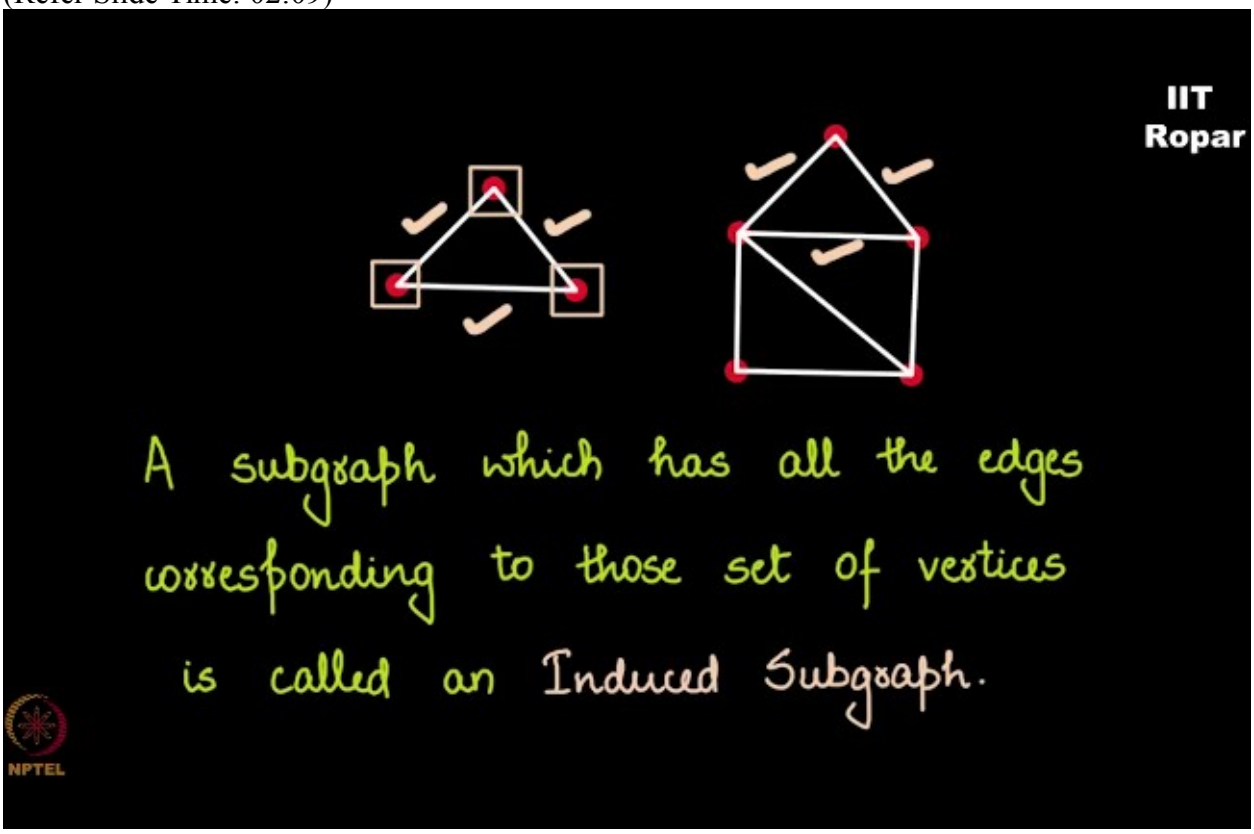

Now if I consider this subgraph, it was definitely a subgraph of the original graph, but is it a induced subgraph, no, why?
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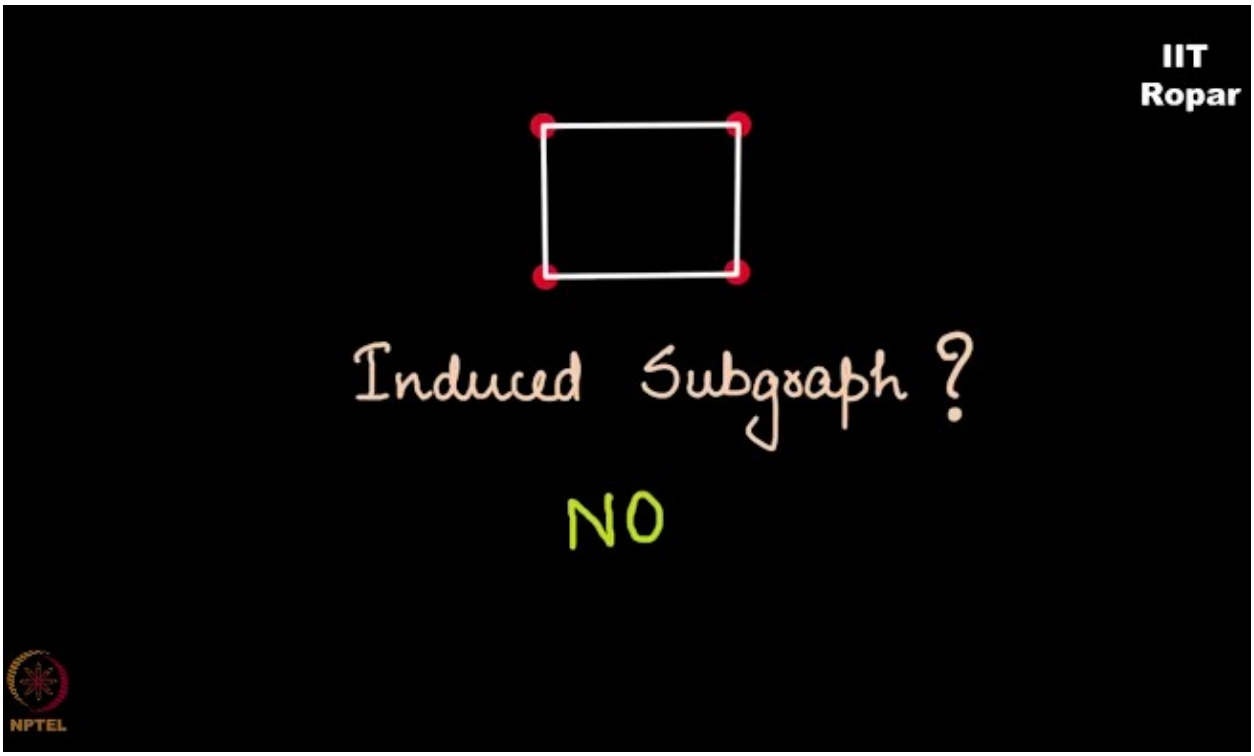

This edge is missing, so if I include this edge

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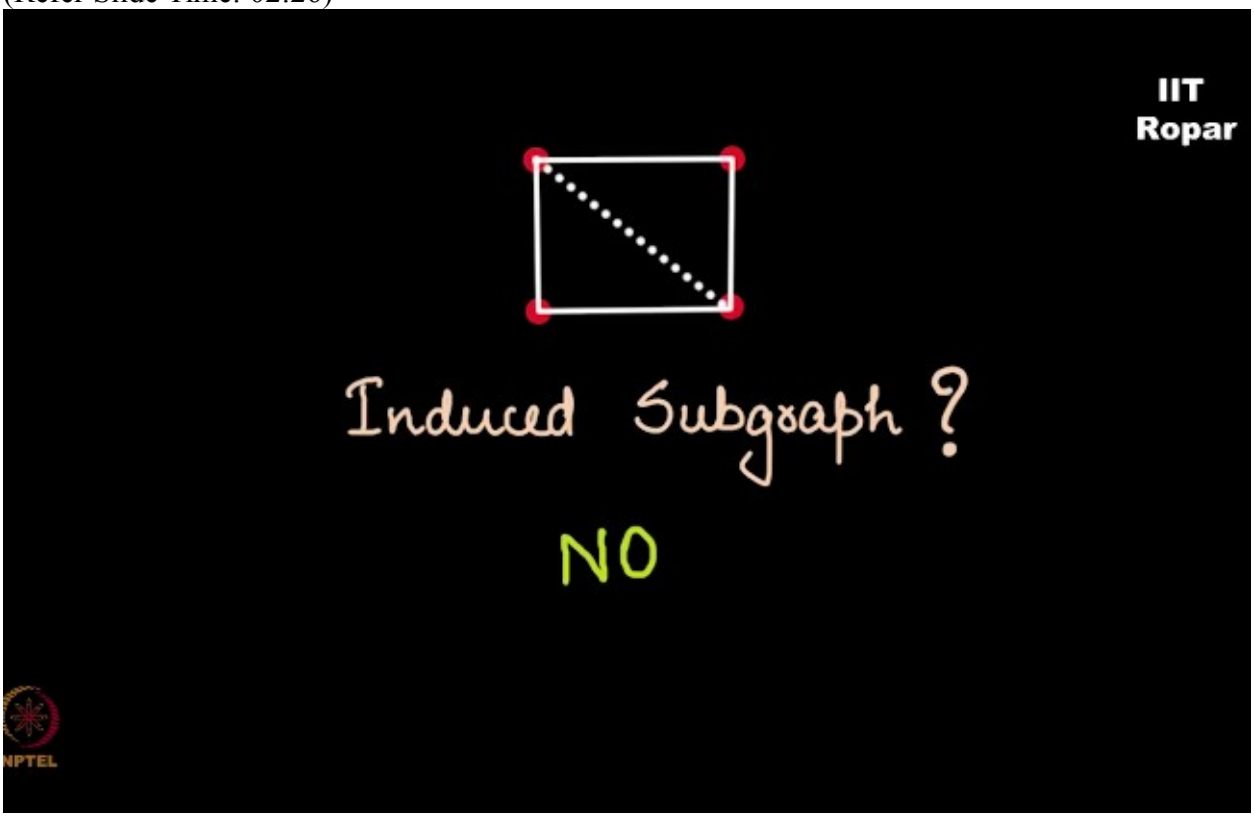

definitely it is an induced subgraph.

Now for another quick example, if I consider see this was originally, this was the original graph, now this was a spanning subgraph if you remember, right, this is spanning subgraph, but is it a induced subgraph?
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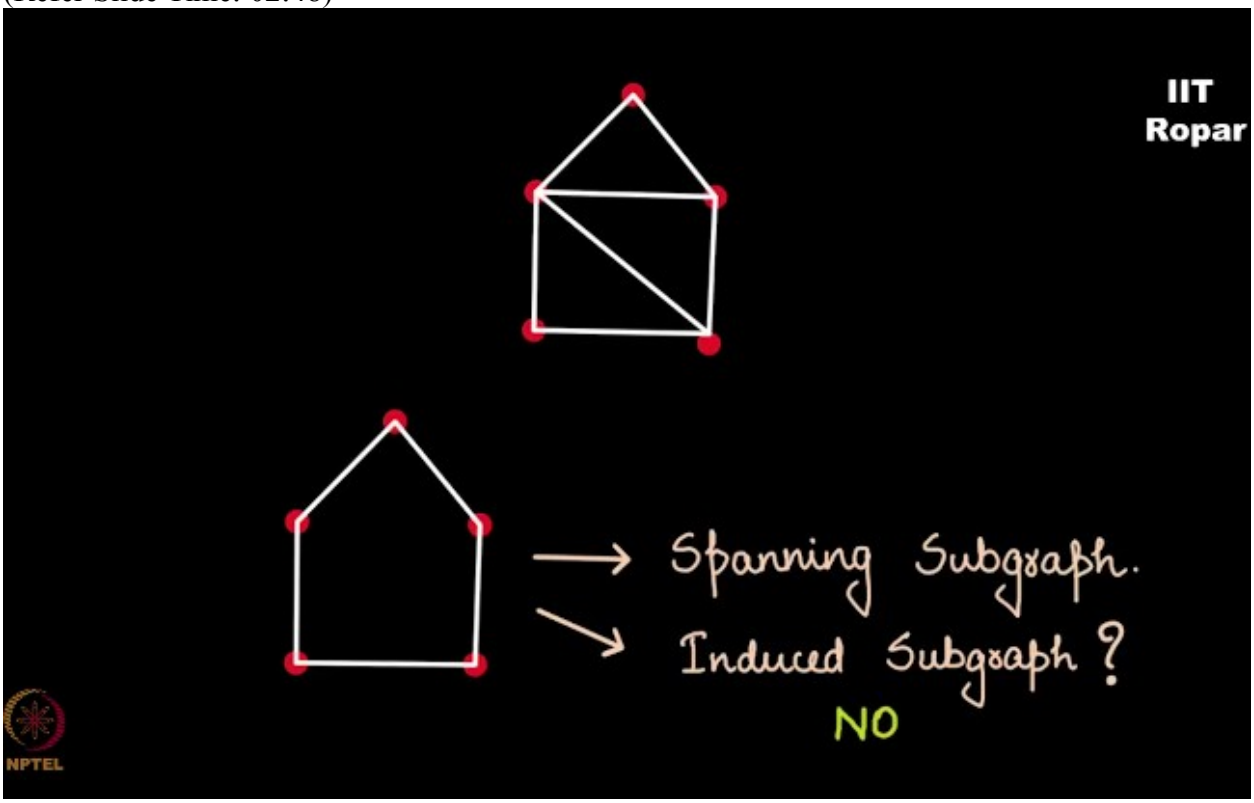

No, we haven't written this edge and this edge, so it is not an induced subgraph, but it is just a spanning subgraph.

So let me summarize it quickly, a spanning subgraph is a graph which has the same vertex set as the original graph, but an induced subgraph is a subgraph which has all the edges corresponding to your vertex set in the subgraph,
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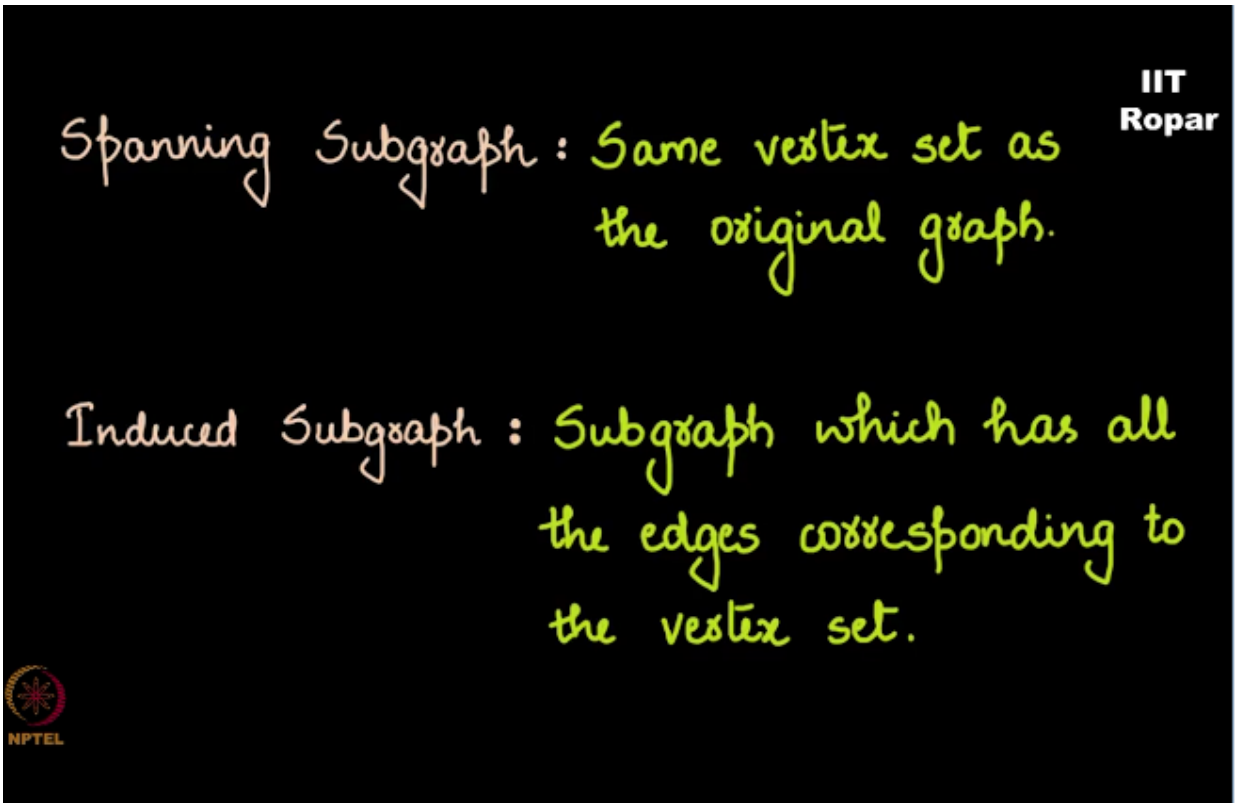

with more examples it will be clear.

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