NPTEL

NPTEL ONLINE CERTIFICATION COURSE

Discrete Mathematics
Graph Theory - 2

Adjacency matrix representation

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Let us now see how to represent this graph as a matrix
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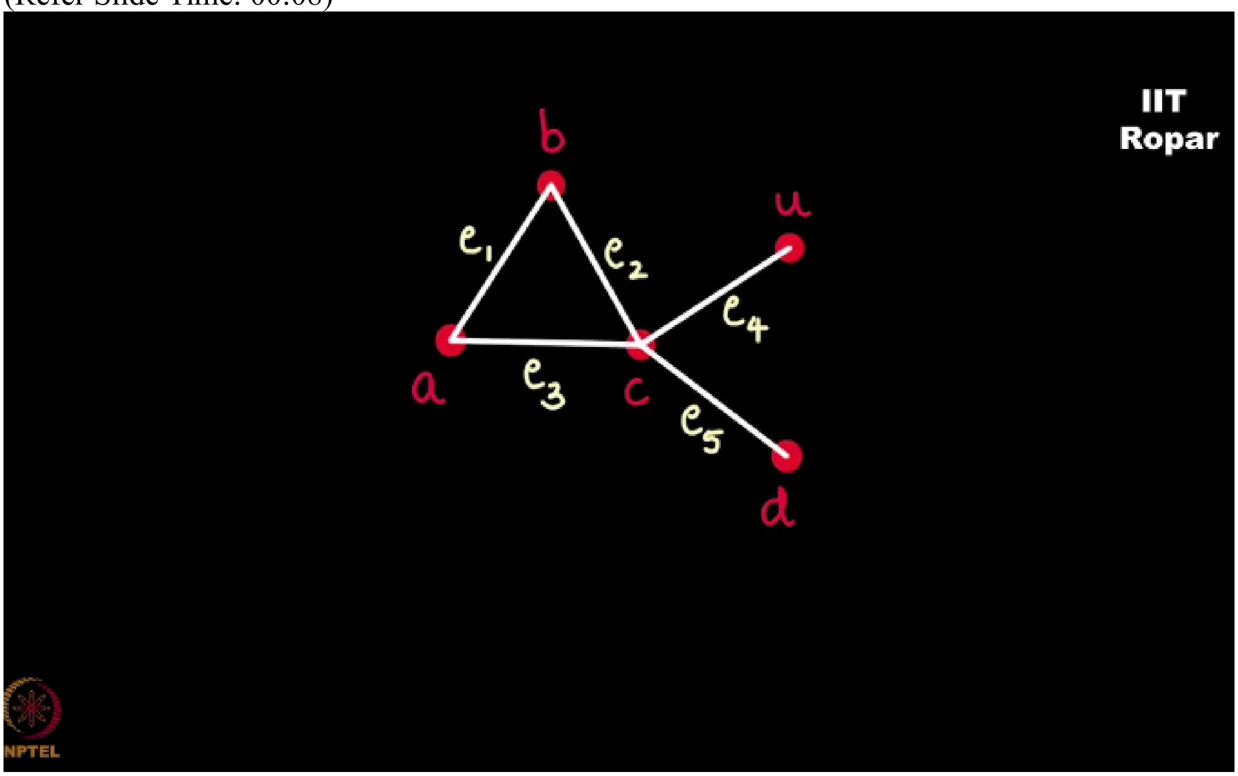

if you are thinking how as a graph and a matrix related it is quite simple,
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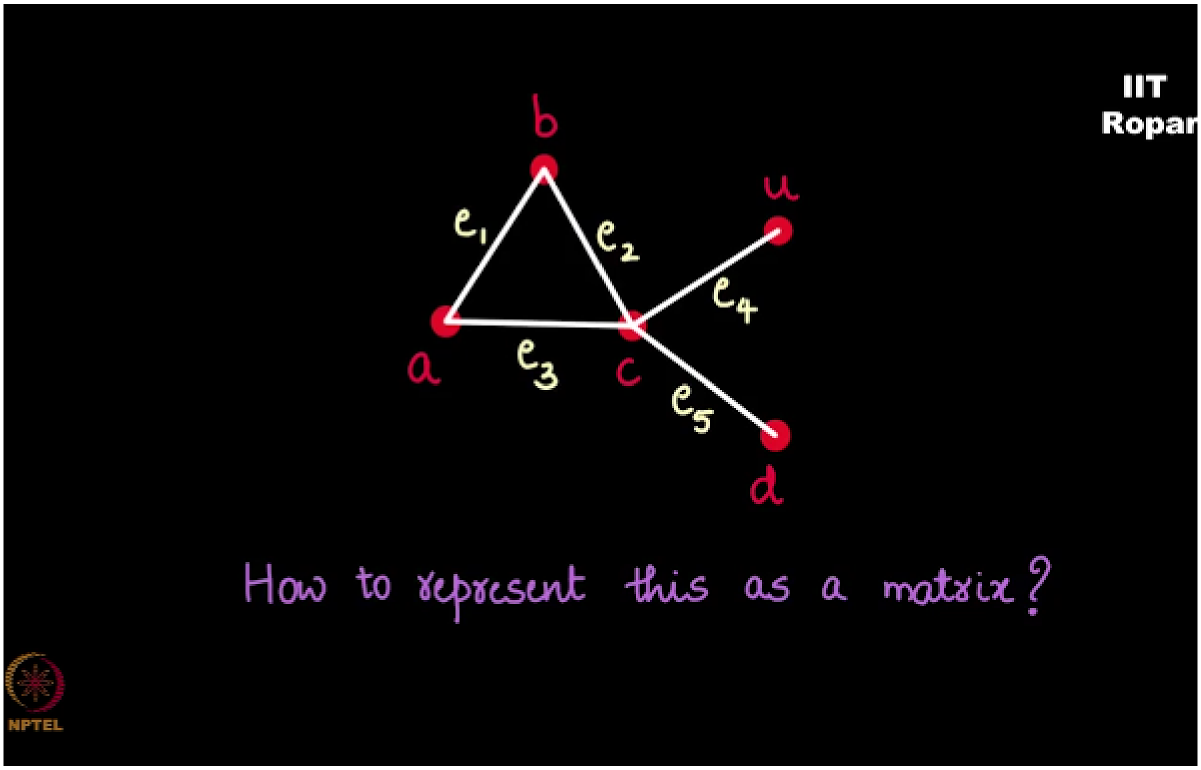

and I must tell you all that all of you know it, you just have to revisit your understanding, how? Let us see, consider this graph it's a C3,

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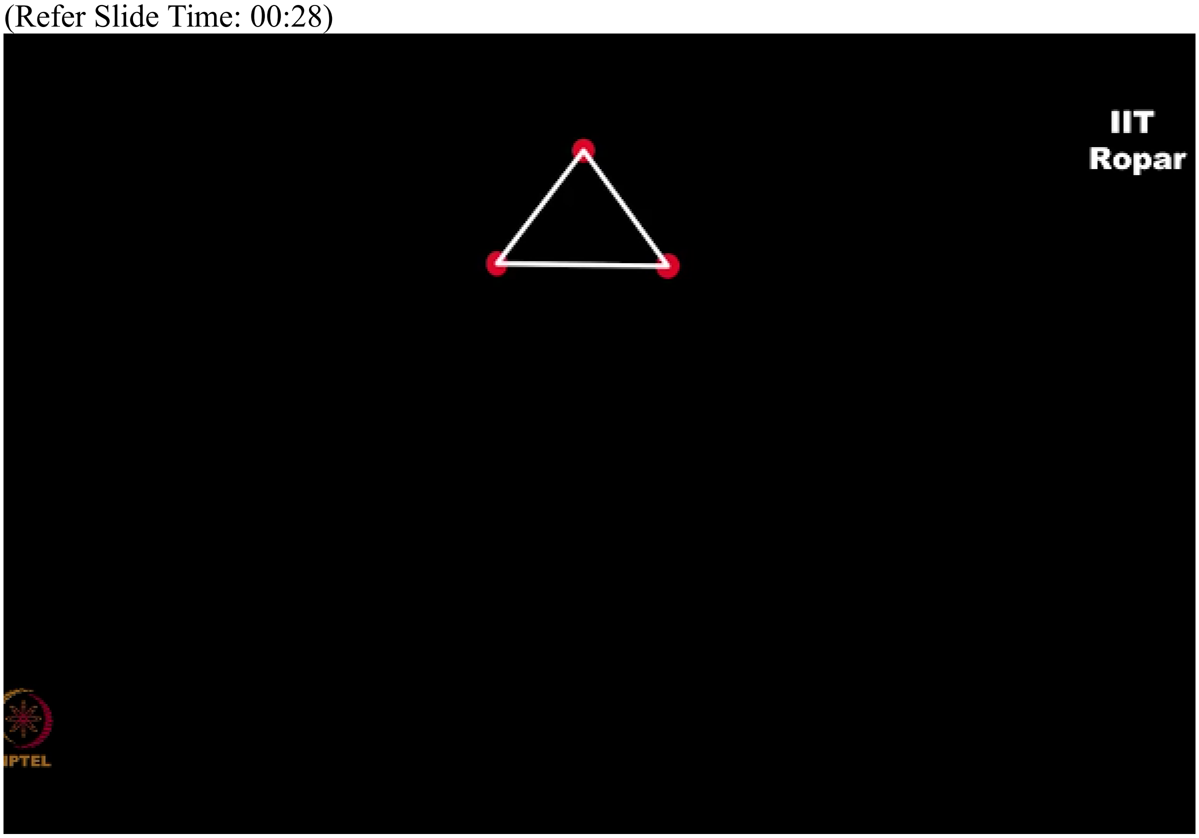

a cycle on 3 vertices, now what I'm going to do first is write a table like this, a column A, B, C and a row A, B, C,

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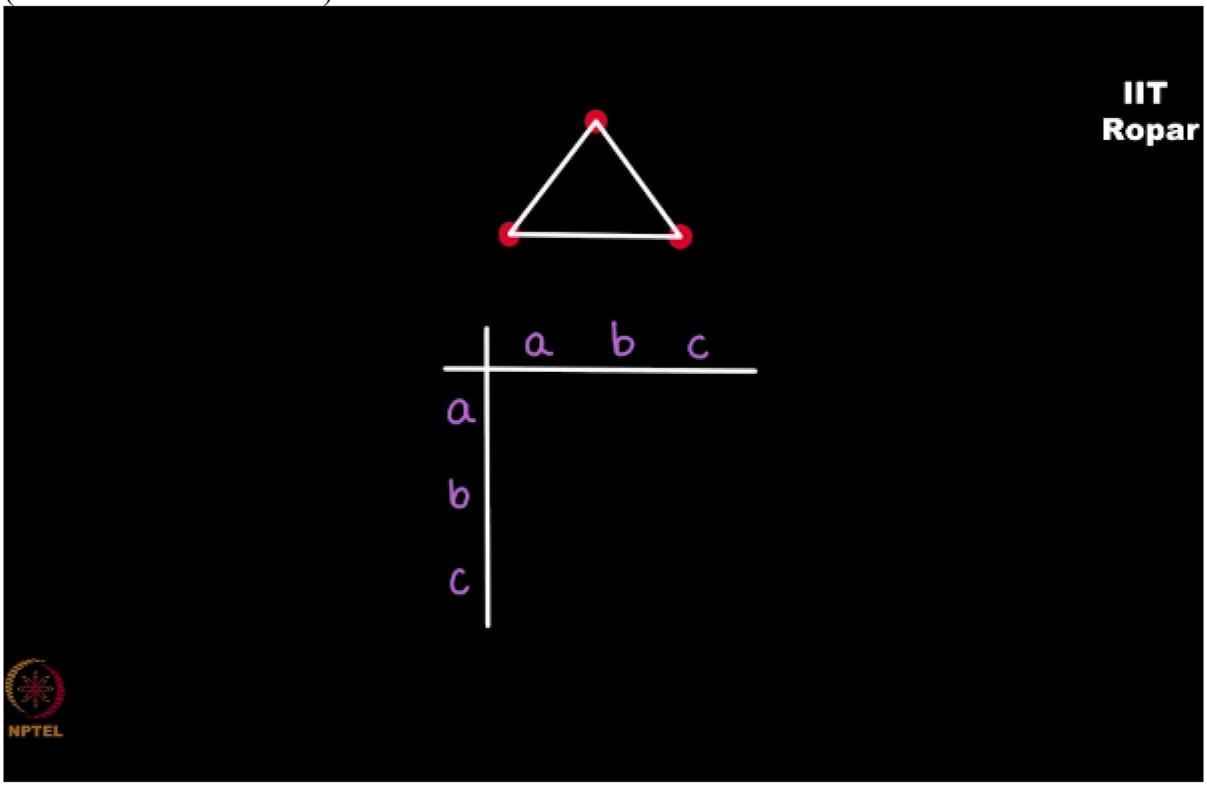

now once I represent the vertices here like this

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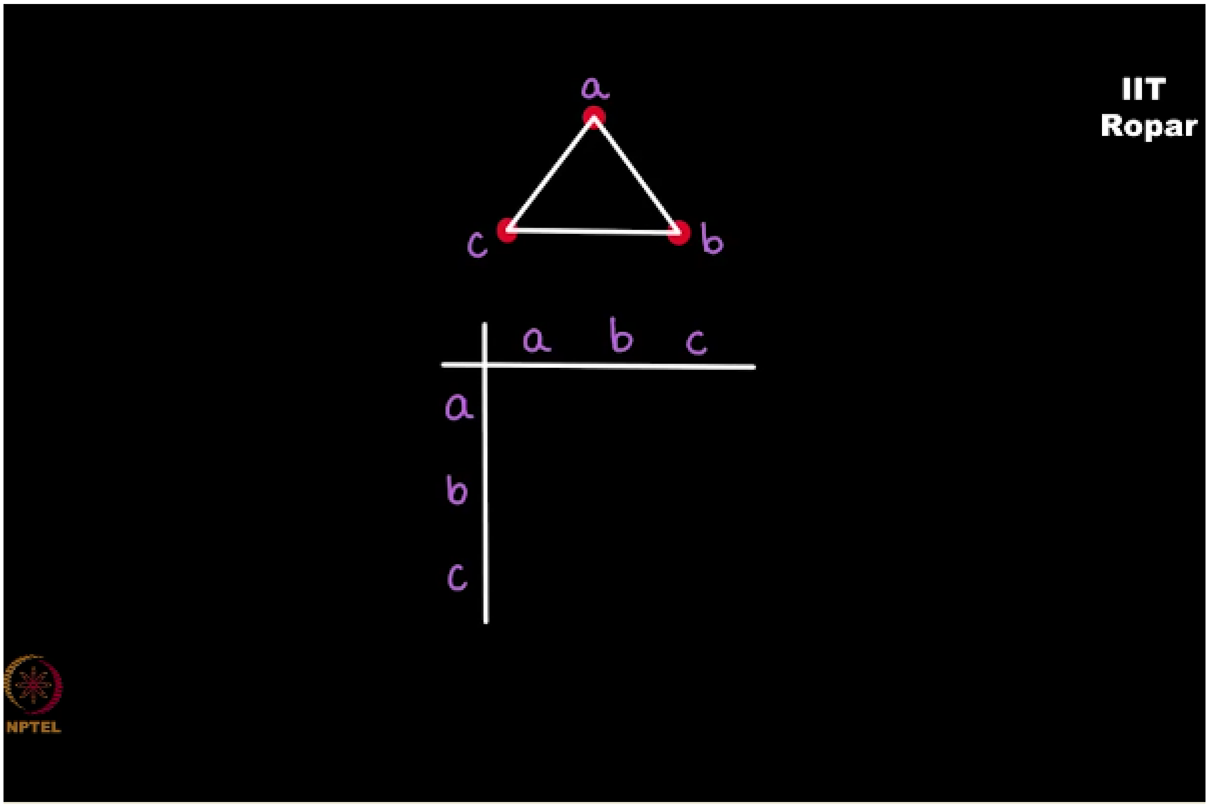

I write the vertices as the first thing, now I'll start filling this table with 0s and 1s, how will I do that? I'll explain, but before that a table if I remove this A, B, C and this A, B, C, you see it will become a matrix, but now for the first example I'll keep it as a table itself, for the second example I'll be showing you the matrix or rather after writing the table we can write it as the matrix.

Now so A, B, C here, A, B, C here, now when do I write a 0, I write a 0 if 2 vertices are not connected, and I write the 1 if 2 vertices are connected, if they have an edge in between I write 1,

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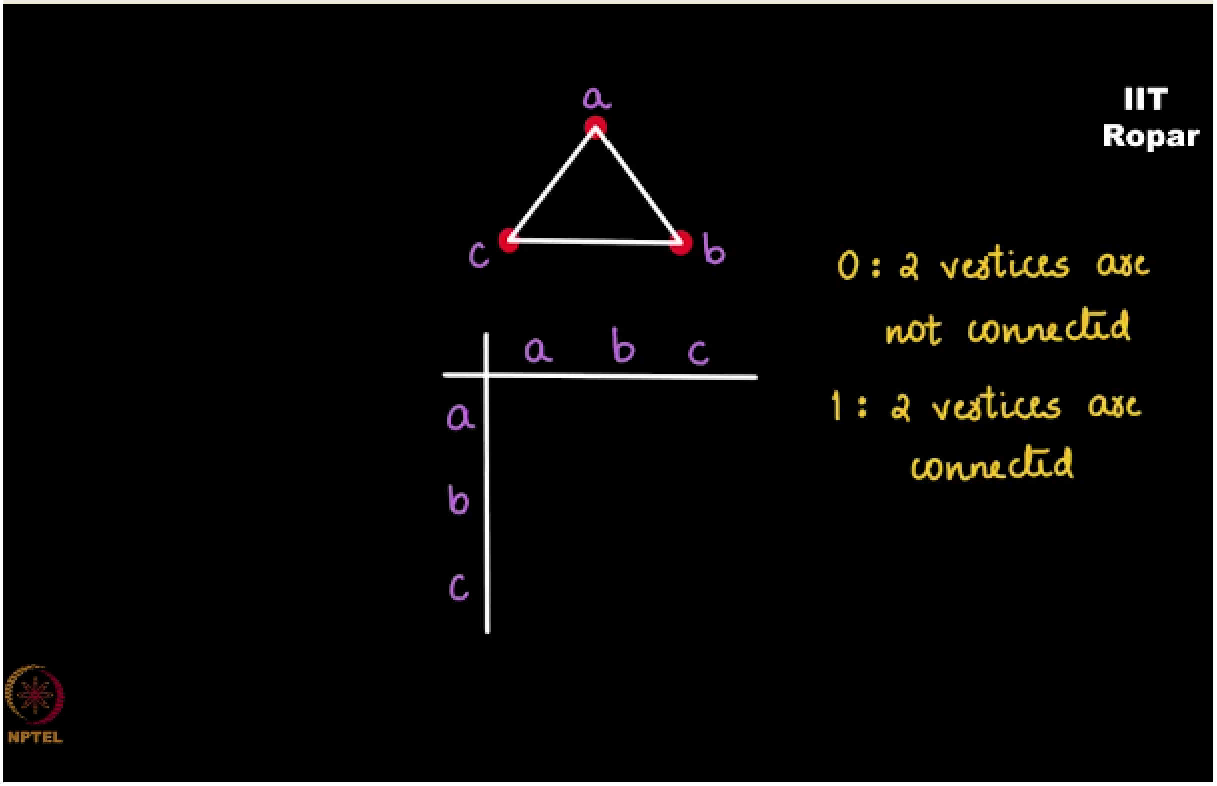

so these are the two points you have to keep in mind, and you see if there is a simple graph and a vertex is not connected to itself, because it is a simple graph and a vertex being connected to itself will be a multi-graph, right.

Now you see here A and A there is no edge and hence it's a 0, A and B there is an edge and it's a 1, A C is connected hence it's a 1, A and B are connected which means B and A are also connected and hence it's a 1, B and B there is no edge between B and B and hence it's a 0, B C is connected hence it's 1, A is connected to C as we saw here, and hence C is also connected to A this is a 1, C is connected to B this is a 1, C is not connected to C there is no loop here like this and hence this is a 0.

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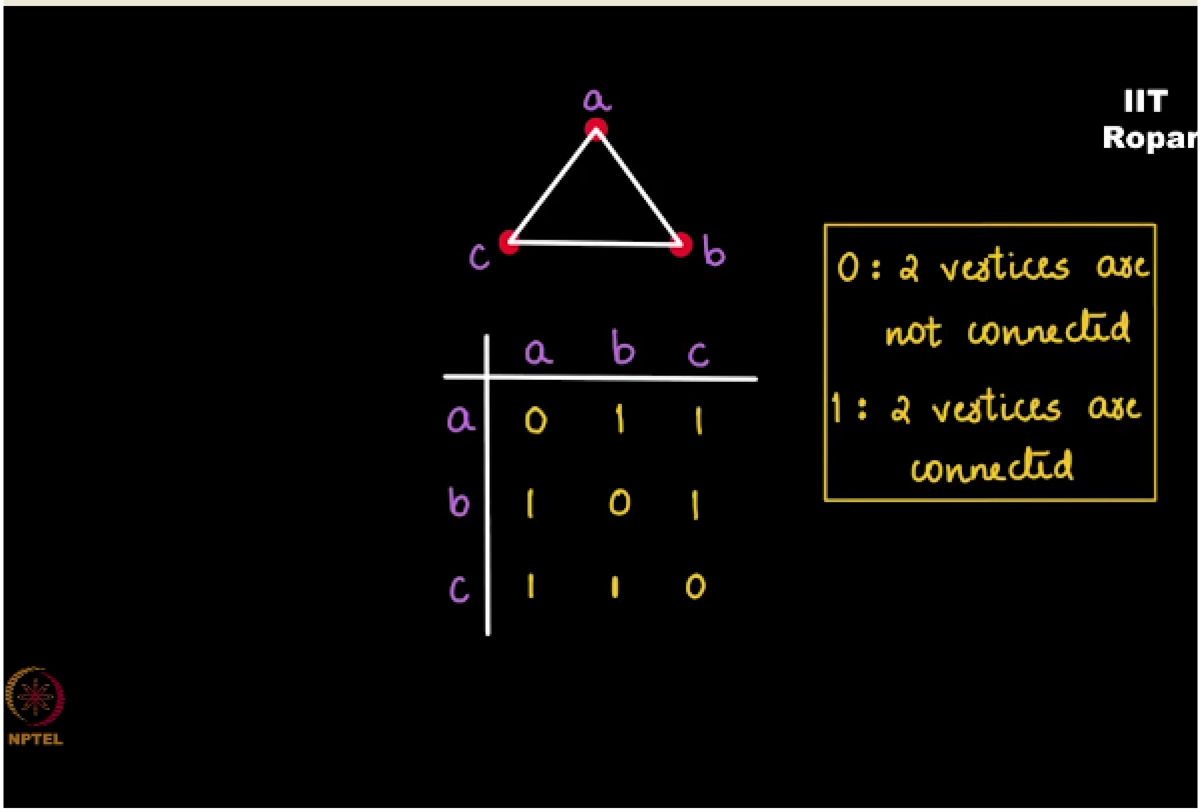

Now there are 2 observations here, one is if you keenly observe why did I tell that you all know it and you must just revisit your understanding, yes, few weeks back we had studied the relations and representing relation in terms of a matrix, well, this is just the same thing we are doing, we are representing here if two vertices are connected there we just took two elements from a set and if they were related we put a 1, right that was a set theoretic approach and this is a graph theoretic approach, but the concept remains the same.

Now observation 2 what is it? Observe the matrix carefully, don't you see that it is a symmetric matrix,
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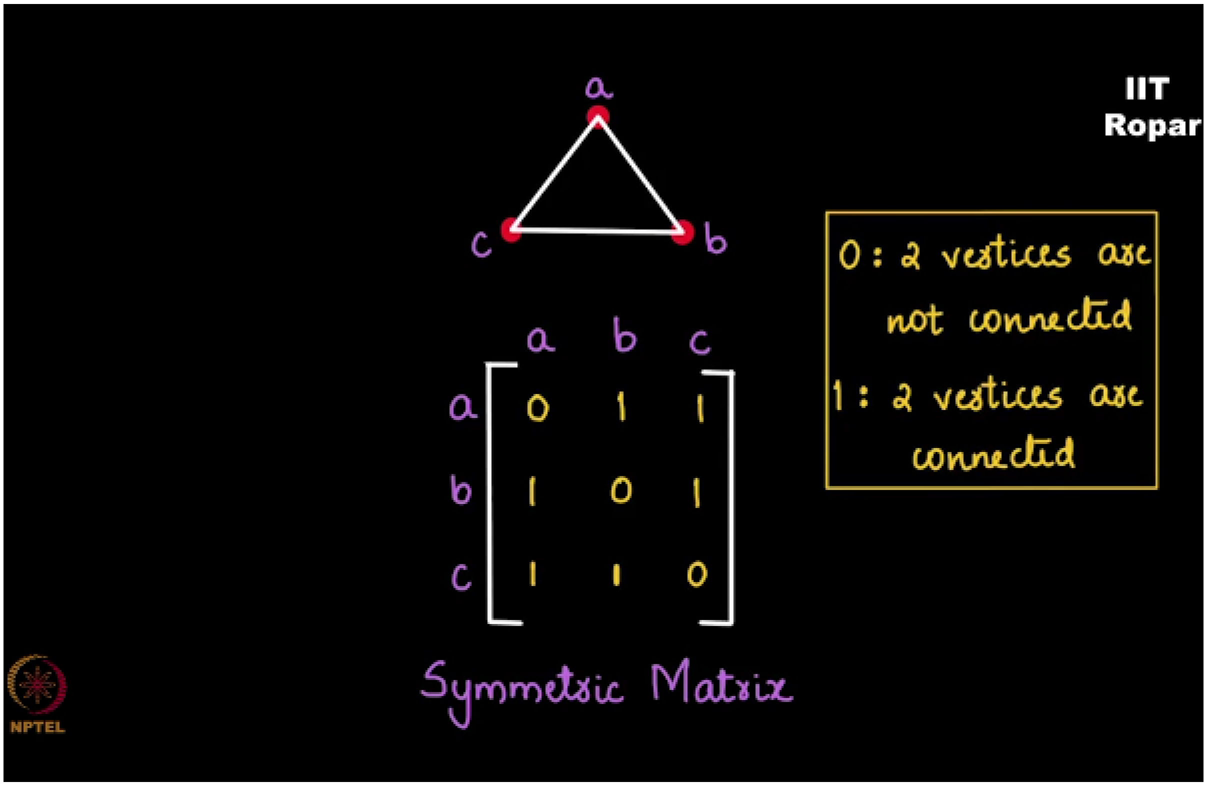

yes, a matrix representation like this is always symmetric, now the matrix of this graph is represented like this, from now on we'll not be writing the table version, whatever we'll do is just in terms of a matrix like this,

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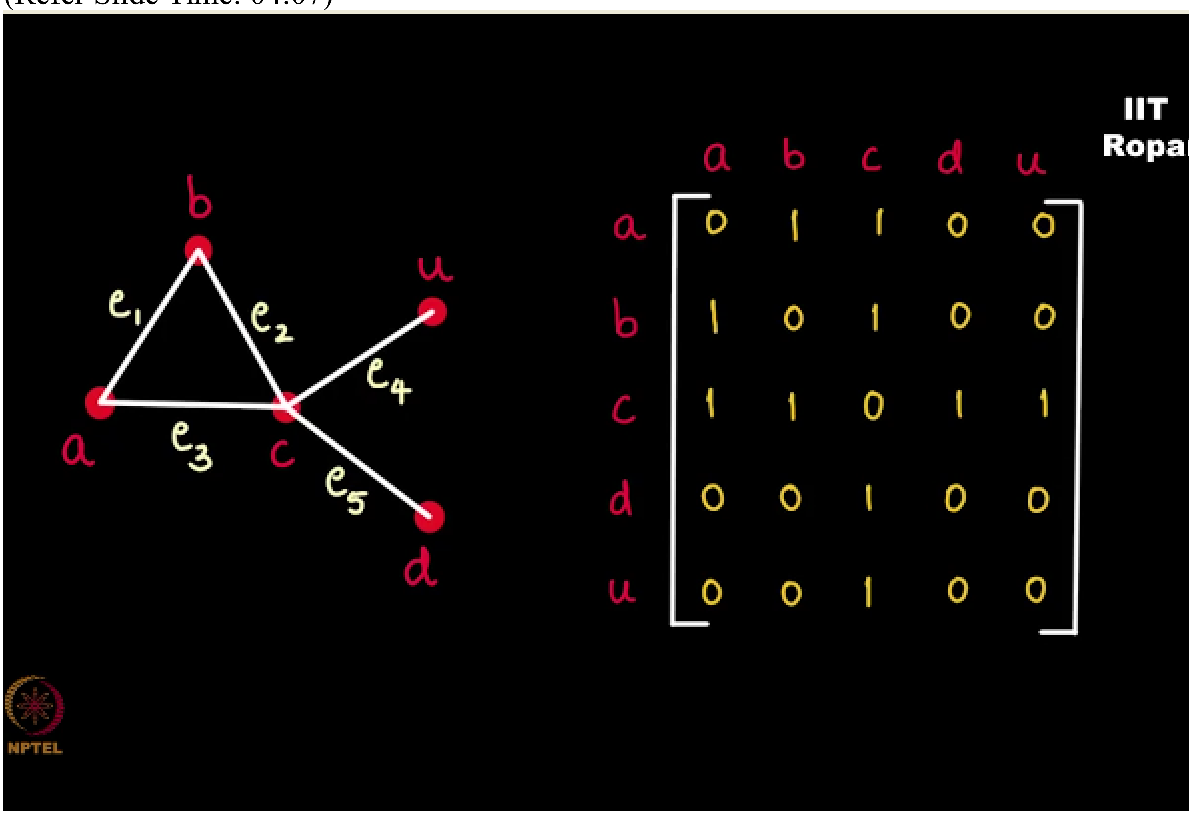

writing the vertices was just for an explanation and for convenience from now on we'll omit that, this matrix where we represent which vertex is adjacent to which vertex in terms of 0s and 1s is called an adjacency matrix,

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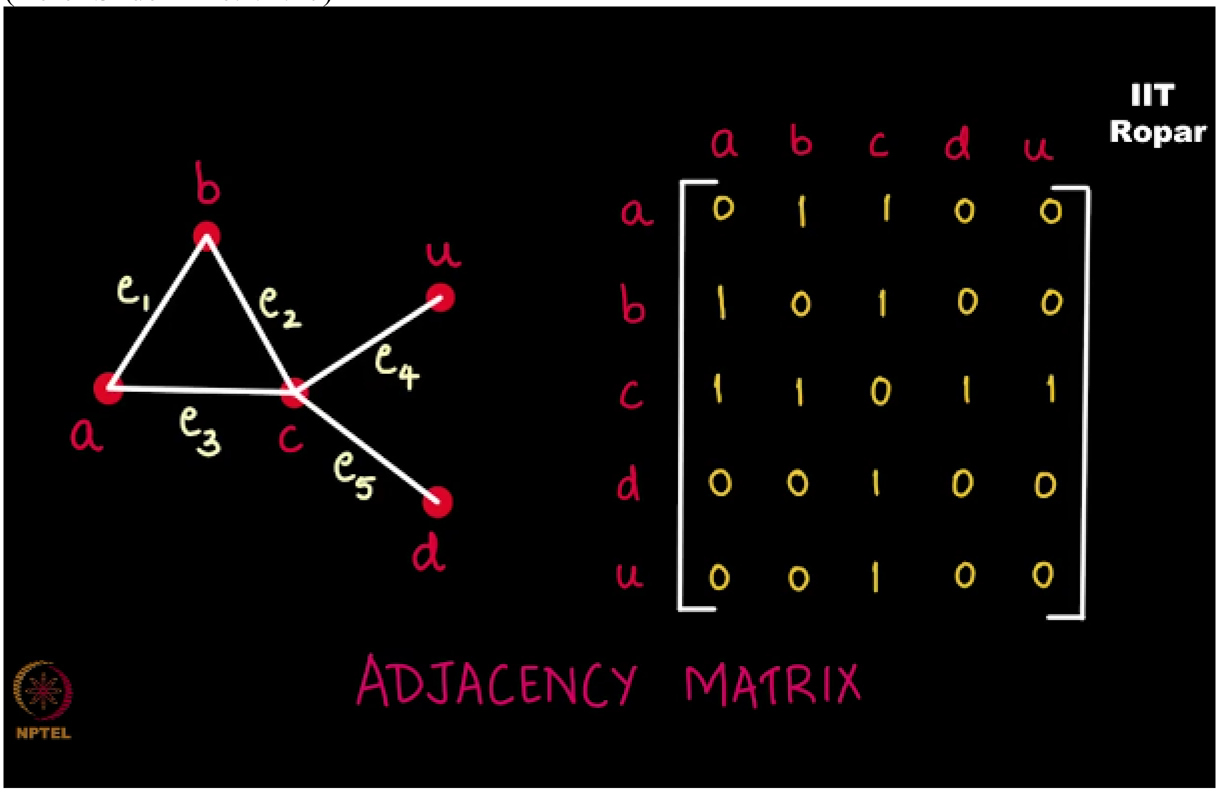

we'll be using this term frequently so please keep a note of it.

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