

NPTEL

NPTEL ONLINE CERTIFICATION COURSE

Discrete Mathematics
Graph Theory - 1

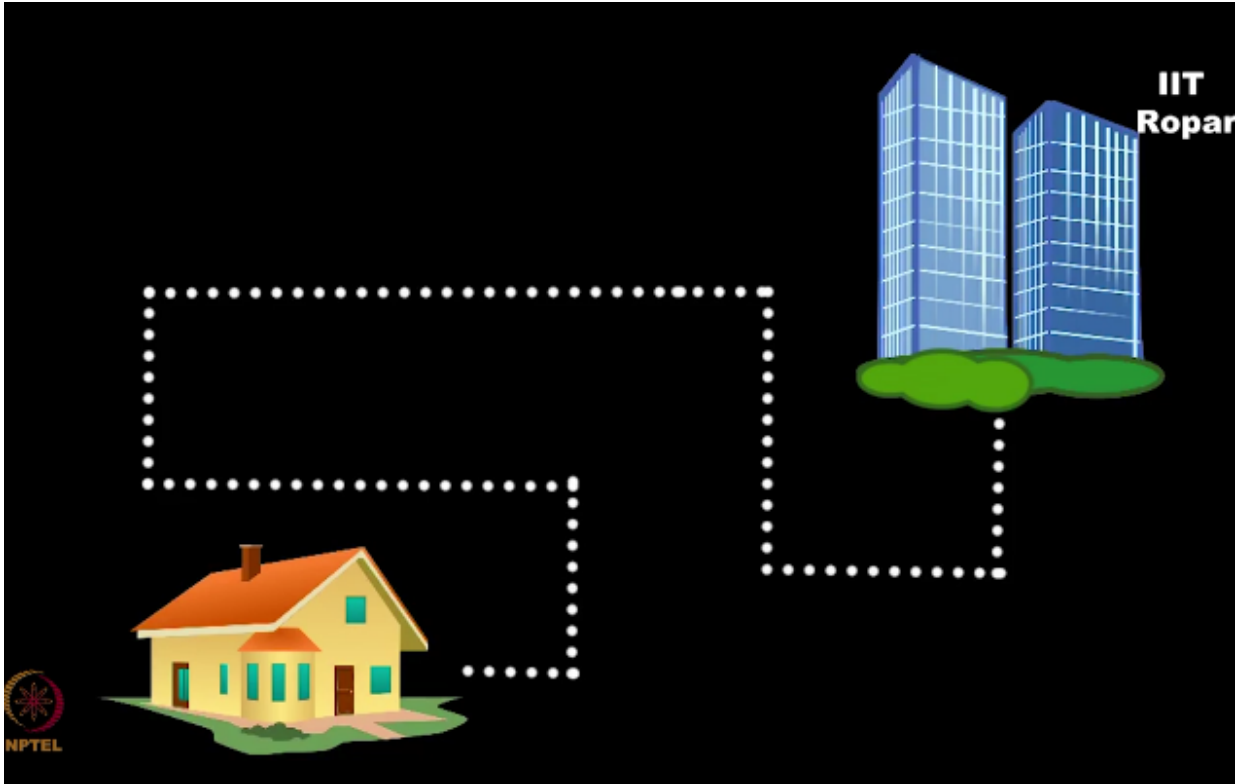
Relation between walk and path

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Look at this statement, if there is a walk from U to V , there is a path from U to V ,
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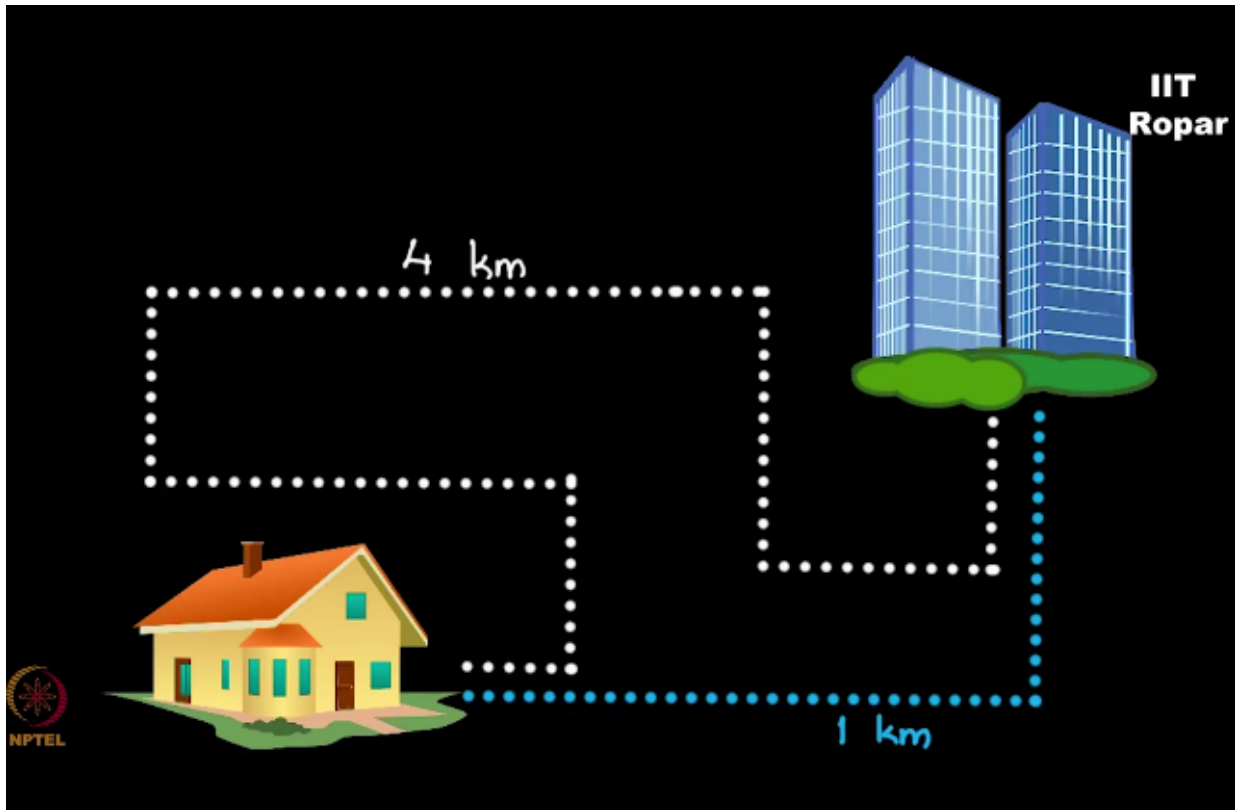
The slide features a black background with handwritten text in orange and green. The text reads: "If there is walk from u to v , there is a path from u to v ." The variables u and v are written in green. In the top right corner, the text "IIT Ropar" is displayed in white. In the bottom left corner, there is a circular logo with a star-like pattern and the text "NPTEL" below it.

think about this question, you know what is a walk, a walk is simply I walk on the road from a point to another point, right, so let's say I start from my home, I reach my office by taking a long, long walk,
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basically the idea is to take the walk not necessarily to go reach the office at the earliest, it's a early morning walk for me, that's how I reach my office.

Now when I take such a walk my office is actually just one kilometer away from my house, but I take 4 kilometers,
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why? Not because I'm foolish, it's because I want a long walk early in the morning, on a good and nice, good and nice winter morning I need a very long walk, so when I take this walk, if I ask you this question based on this walk can you tell me what is the shortest path to my office, you will realize that they had possibly easier way in which you can reach your office quickly as well, but I choose not to reach quickly.

Similarly in a graph when you take a walk from let's say a starting node U to let say ending node V, if you take a walk, walk please note can repeat nodes and edges, correct,
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can repeat nodes & edges
When you take a walk from u to v ,

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when you are doing this what I will do is I'll observe, as I'm going from U to let say another vertex X_1 to some vertex X_2 to some vertex X_3 and so on as you know I can repeat vertices in my walk,
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can repeat nodes & edges
When you take a walk from u to v ,

$$u - x_1 - x_2 - x_3 \dots\dots\dots$$



whenever I repeat a vertex in my walk it means I have seen a circuit, right, I start from x_3 , I go take a circuit as route, a detour, and I might end up in x_3 ,
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can repeat nodes & edges
When you take a walk from u to v ,

$$u - x_1 - x_2 - x_3 \dots\dots\dots x_3$$



I remove such circuits, whenever I spot a circuit I remove it which means U, X1, X2, X3 and then if you see a circuit remove that circuit don't use that circuit, simply go to X4,
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can repeat nodes & edges

When you take a walk from u to v,

$$u - x_1 - x_2 - x_3 - x_4$$

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okay, if X4 was X2 then it means you have a circuit on X2, right, then don't go to X3, X4, and then back to X2, you go from X2 directly to X5,
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can repeat nodes & edges
When you take a walk from u to v ,

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$$u - x_1 - x_2 - x_5$$



you see the point, what I am saying is extremely commonsensical you just have to see the point, that's it, so x_5 and so on and finally you get v ,
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can repeat nodes & edges
When you take a walk from u to v ,

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$$u - x_1 - x_2 - x_5 \dots \dots \dots - v$$



a walk from U to V might have circuits when you remove these circuits you will get a path from U to V, so what did we just now prove,
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can repeat nodes & edges

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When you take a walk from u to v,

$$u - x_1 - x_2 - x_3 \dots - v$$

A walk from u to v might have circuits.
If you remove the circuits, you will get a
path from u.



we proved that whenever there is a walk from U to V there is also a path from U to V always.

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