



Graph Theory

Lesson Plan: Class 08 / DM / 02



Overall goal of the lesson	Understand graphs in terms of vertices and the edges. Understand how the edges connecting the vertices can be used to analyze the possibility of solving a problem with start and an end situation and a path to be taken.
Prior knowledge required	Concept of Vertices and Edges

MODULE 1: **Module time:** 35 minutes

Goal:	Solve problems using graph theory.
Description:	Solve the 5 room problem and argue why the problem is not solvable by using graph theory. This is a problem of starting from one point and going to another based on certain constraints. Solve the puzzle of farmer goat wolf and carrot using graph theory. This involves making the vertices which are possible states or feasible solutions and connect the vertices with an edge if it can be a possible next step. Make a path from the start to end so that each step is a logical next step.
Material required:	Physical: A worksheet is available with the 5 room problem and the puzzle. Electronic: Power point
Procedure Details:	<ol style="list-style-type: none">1. Start with the concept learnt last class about graphs being made from the states of the country. Each state is a vertex and the relation neighbor is an edge. Describe that graphs are finally made by vertices and edges connecting them.2. Say that this exercise we will go from one vertex to another. This is like going say from Kashmir to Kanyakumari passing through at least 10 states. Vertex 1 is Kashmir and Vertex last is Kanyakumari. Other 10 states are 10 vertices. We need to go through all these vertices.3. Vertices are connected by edges and we need to go along the edges to reach the goal. The relation here is that we can go from one state to another in the sequence and therefore there is an edge or connection.4. Say that this concept will be clearer when we play the game of 5 rooms.5. Describe the five rooms that are shown on the PPT and the worksheet. Every room is connected to the other room by a door. All rooms open to the garden which can be considered as a very big common room.6. The story goes like this – Nikhil the boy who stays in the house has to lock all doors and start at one place and end in another place. He should go through every door only once. He plays the game by locking the door once he crossed through it.7. The students have to play this game on the worksheet. One example is shown. It does not pass through one door.8. Ask the students to play this one or two times. The worksheet has many templates of the 5 room problem.9. They will find this difficult. Now take them back to the PPT and say that we will look at this as a graph theory problem. Every room has a vertex. Say that there is only one vertex for the garden. All door leading to the garden get connected to this vertex.10. Ask the students to connect the vertices.11. Now indicate that there are some vertices which has even number of connections or edges and some have odd number of connections.

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| | <ol style="list-style-type: none">12. Analyze this situation with the students. Say that what happens if the room has only one door. This is a situation where the vertex has only one edge. Explain that this is a situation where Nikhil can either enter the room or start from this room.13. Explain a situation where there are three doors. That is the vertex has 3 edges which are odd connection. In this situation Nikhil can start from the room, go out, come in and go out. Or he can come in, go out and come in again.14. So rooms with odd number of edges are good start or end points15. Explain the situation where the room has two doors. This is vertices with even number of edges. You can enter the room and exist. You cannot stay in the room. This is the same situation with 4 doors.16. Ask the students what do they infer from this? If in a graph you should start and end at a vertex, that vertex should have odd number of edges. Or in other words there can only be two vertices with odd numbers.17. In the 5 room problem. There are more number of vertices with odd number of edges and only two even number of edges.18. Therefore none of us can solve the 5 room problem.19. Conclude by saying that graph theory can be used to solve path problems where one has to go from one place to another, or from one situation to another and follow certain paths. What is the shortest path, what is the path to take with minimum loss? Say that computer programs solve these problems regularly. The person who develops these programs should know graph theory. |
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