Graph Coloring Problem

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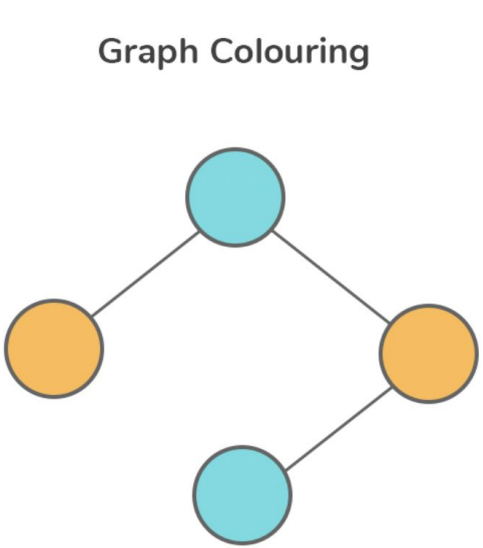
What is Graph Coloring Problem?



THE QUESTION

A GRAPH REPRESENTED IN A 2D ARRAY FORMAT SIZE OF V*V AND AN INTEGER M WHICH DENOTES THE MAXIMUM NUMBER OF COLORS WHICH CAN BE USED ARE GIVEN.

WE ARE EXPECTED TO RETURN AN ARRAY color[] OF SIZE V WHICH HAS NUMBERS FROM 1 TO N.

NOTE:

COLOR[i] REPRESENTS THE COLOR ASSIGNED TO THE iTH VERTEX.

Naive Method

In this approach using the brute force method, we find all permutations of color combinations that can color the graph.

If any of the permutations is valid for the given graph and colors, we output the result otherwise not.

This method is not efficient in terms of time complexity because it finds all colors combinations rather than a single solution.

Backtracking Algorithm

Algorithm

1)Different colors:

A-Confirm whether it is valid to color the current vertex with the current color (by checking whether any of its adjacent vertices are colored with the same color).

B-If yes then color it and otherwise try a different color.

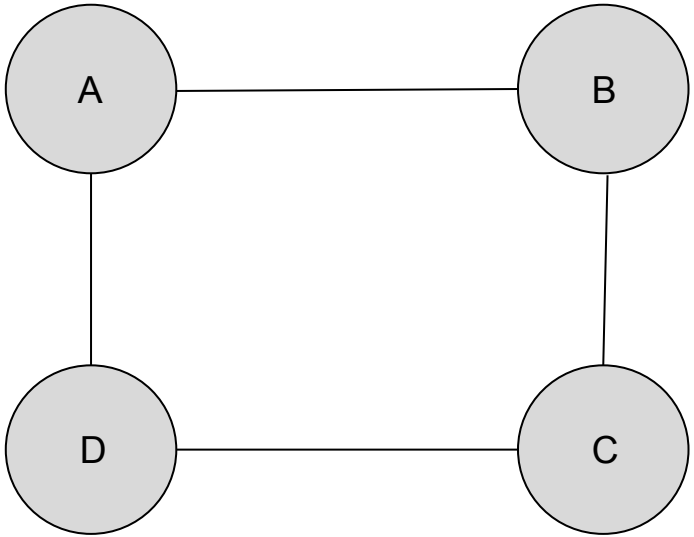
C-Check if all vertices are colored or not.

D-If not then move to the next adjacent uncolored vertex.

2)If no other color is available then backtrack (i.e. un-color last colored vertex).

Example 1

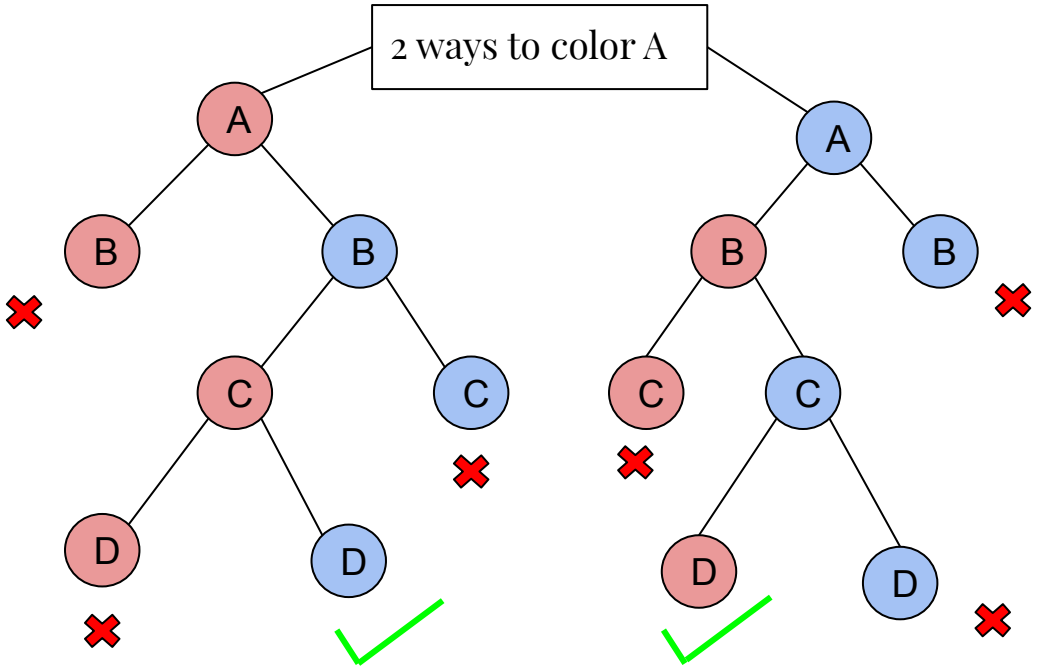
Let us take this graph

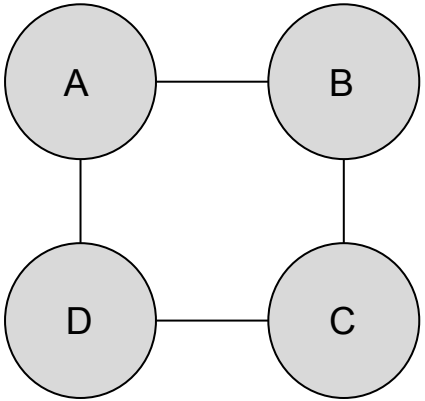


Given,
m=2
(m is number of color given, also known as Chromatic Number)
Colors - Red, Blue

Example 1

Solution





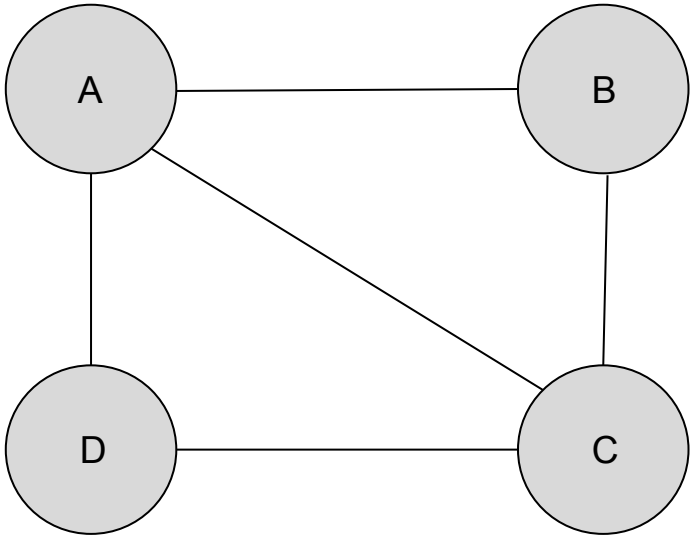
Example 1

Final Answer

A	B	C	D
Red	Blue	Red	Blue
Blue	Red	Blue	Red

Example 2

Let us take this graph



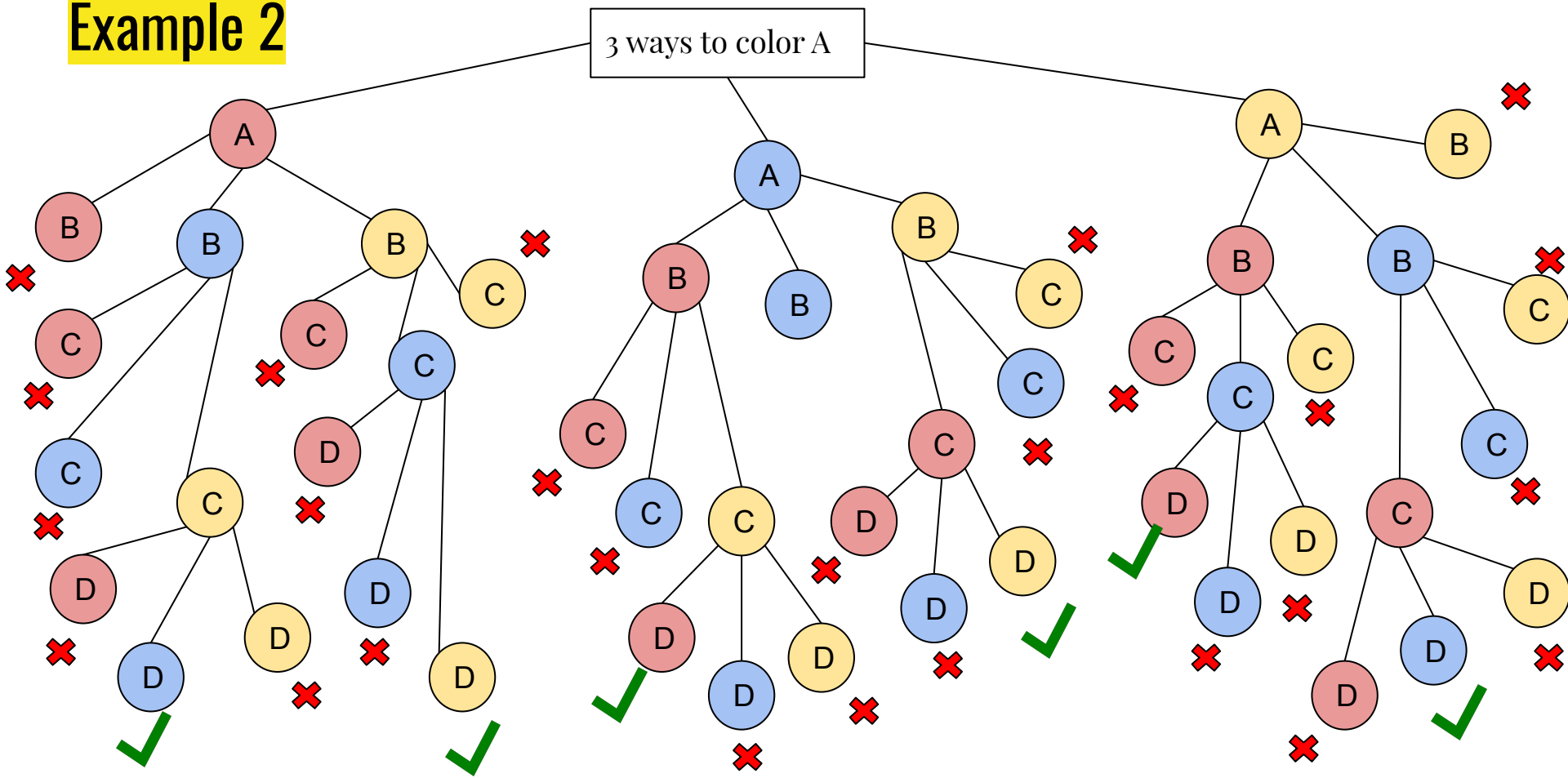
Colors - Red, Blue

Now 2 colors are not enough!

Therefore we need bigger chromatic number

Let us take Colors - Red, Blue, Yellow

Example 2



Example 2

A	B	C	D
Red	Blue	Yellow	Blue
Red	Yellow	Blue	Yellow
Blue	Red	Yellow	Red
Blue	Yellow	Red	Yellow
Yellow	Red	Blue	Yellow
Yellow	Blue	Red	Blue

Application

1. Making Schedule or Time Table
2. Mobile Radio Frequency Assignment
3. Sudoku
4. Register Allocation
5. Map Coloring

Thank You!