Monday, 14 Feb 2022 8:30 PM

Graph Coloring

→ Scheduling final exams

Info is to efficient not but to use as (Course dep) same exam slot as possible.

G → eg pen
V → students pen
E → si pen
V1 → Eng
V2 → Maths

Eg. G2
Maths, Social Sci
Week

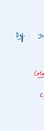
Graph Coloring:

Given a graph G and k colors, assign a color to every node so U most adjacent nodes get different colors.

colors of course

Eg. The nodes were without of the part which such a coloring exists is called the chromatic number $\chi(G)$

Colors → ??



$\chi(G) = 3$

3 colors ??

→ No way to determine chromatic no of a graph.

NP-complete problems

→ NP complete problems are problems whose solution is unknown

→ no polynomial time algorithm has been discovered for any of NP complete problems

→ It is also not established that no poly time algo will ever exists.

Hypergraph Coloring

* Check whether bipartite degree nodes. (Check Perfect Matching)

Algorithm:

1. Make the nodes $V_1, V_2, \ldots, V_m$
2. Make the colors $C_1, C_2, \ldots, C_n$
3. For each thing you ask a color.

for $i = 1, 2, \ldots$ (n)
Assign the lowest legal color to v_i

(5)

(4)

Basic coloring → greedy

Theorem: If every node in a n-node graph has degree d, then degree greedy uses at most d+1 colors.

Eg → Assume 1000 nodes (1)
3 → degree (max)
max colors needed are (4)

degree → n-1
max colors → (2)

$\chi(G) = 2$

2 colors

$\chi(G) = 2$

2n nodes → 2 colors

Bipartite graph

A graph $G = (V, E)$ is called bipartite if V can be split into V_1 & V_2 so that all the edges connect a node in V_1 to a node in V_2.

Examples of graph coloring

1. Scheduling home tasks
2. Sudoku puzzle
3. Map coloring

Check whether a graph is bipartite or not.

Bipartite

1. Assign a color (red) to source vertex.
2. Color all the neighbours (green).
3. Color all the neighbours's neighbours with red color (green).
4. BFS → assign color to all nodes.
5. Return false if coloring conflict if one neighbor a neighbour which is colored then return no instead order.

X graph

Chromatic no for cyclic graphs

* If the no of vertices is even, then it is a cycle graph, and no colors but 2 colors.

* If the no of vertices is odd, then it is a odd cycle, need 3 colors color a graph, use sequence (3) colors.

Bipartite graph

Bipartite → Bipartite graph can be colored with 2 colors.

Coloring → also know bipartite graph.