Professors to Coffee Lounge Problem

By

ASHOK CHAKRAVARTHY BITRA

Problem Definition

- At the typical institute of Mathematical Sciences (TIMS) each new faculty member visits the coffee lounge and meets everyone who is there once during the first day of the semester. Here the challenge is to assign the new faculty members who comes to alcoves of the coffee lounge in such a way that no one ever meets a new person during the entire remainder of the semester .

Problem Definition

- Let us consider the new faculty members as a, b, c, d, e. Let the old faculty members be x, y, z, l, j, k.

On first day:

- “a” came to coffee lounge and met x, y, j . So they became a group as G1.

  G1={a, x, y, j}

  “b” came to the lounge when y, l, z were there so they became a group as G2.

  G2={b, y, l, z}

  “c” came to lounge when x, j, k were there so they became a group as G3

  G3={c, x, j, k}

Problem Definition

- Like the same wise other groups formed like G4, G5 .

G4={d, z, l, k}

G5={e, x, l, j}

Graph Construction

- For each faculty member , they have their class timing every day but each group has their own meet up time preferences like:

- G1: 11am to 12 pm
- G2: 11am to 1 pm
- G3: 11 am to 12 pm
- G4: 11 am to 1 pm
- G5: 12 pm to 2 pm

G5

G4

G3

G2

G1

9 10 11 12 1 2 3 4

- According to the requested meet up timing , make a table to check if there are any clashes:

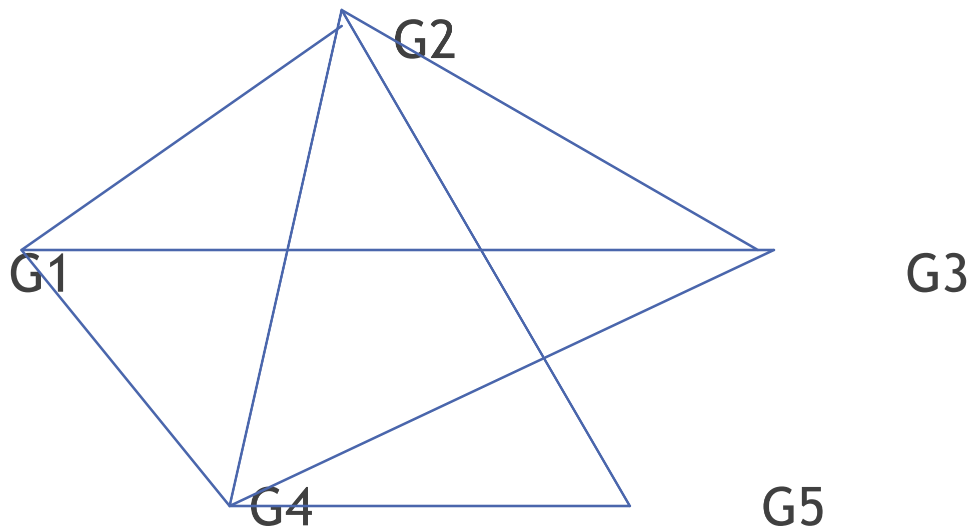
	G1	G2	G3	G4	G5
G1		X	X	X	
G2	X		X	X	X
G3	X	X		X	
G4	X	X	X		X
G5		X		X	

- G1: 11am to 12 pm
- G2: 11am to 1 pm
- G3: 11 am to 12 pm
- G4: 11 am to 1 pm
- G5: 12 pm to 2 pm

According to the above table we see some clashes in here with the requested timing.

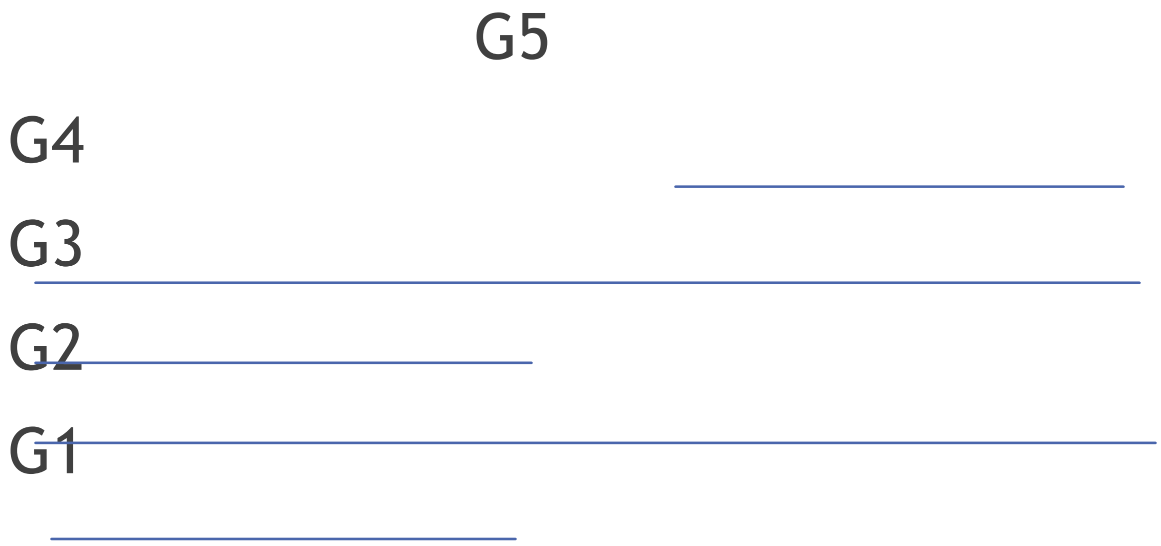
General Graph

- According to the table, the graph is drawn below:



Interval Graph

According to the problem it turns out to be interval graph problem.



Relation to a graph problem

This Real world problem is converted to "interval graph coloring problem".

An "interval graph" is the graph showing intersecting intervals on a line. So, we associate a set of intervals I={I1,…,In} on a line with the interval graph G=(V,E),where V={1,…,n} and two vertices, x and y, are linked by an edge if and only if $I_x \cap I_y \neq \emptyset$.

Relation to a graph problem

- $E(G) = \{\{v_i, v_j\} \mid I_X \cap I_Y \neq \emptyset\}$

Special property

Umbrella Free Ordering:

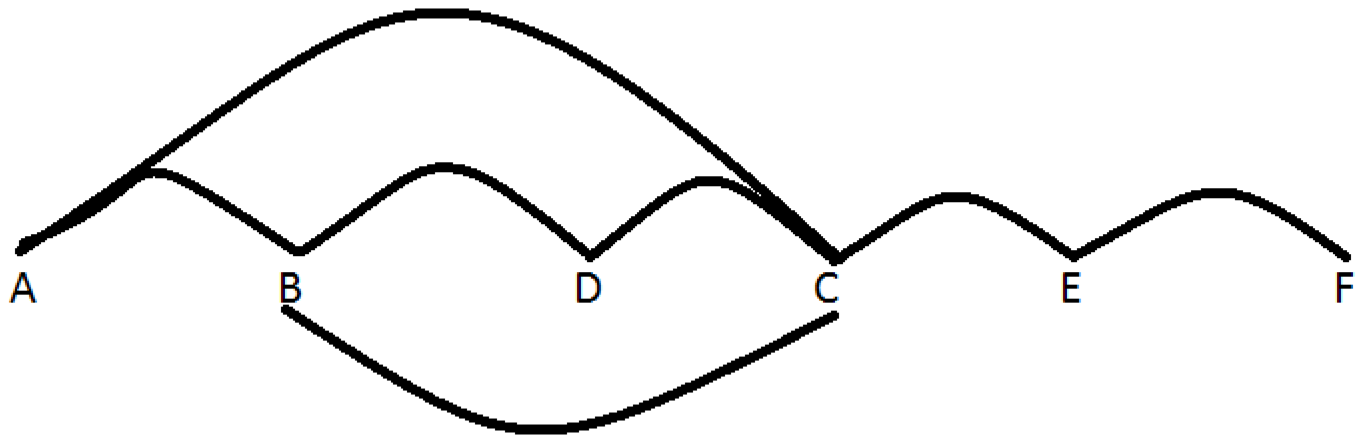
For every interval graph there will be an Umbrella Free-Ordering it states that, arranging the vertices in an order such that if there is an edge between two vertices then any edge that lies between the two vertices must be adjacent to the right vertex in the ordering.

Special property

- An umbrella-free representation of a graph G is a concatenation (in any order) of all its connected component umbrella-free representations.
- UF be an umbrella-free representation of G, the vertices of two distinct connected components are not interleaved in UF.

Special property

- UMBRELLA FREE-ORDERING



Problem Solution

- The problem is to assign faculty members group to the alcoves of coffee lounge.
- Here we give the same color to the non-overlapping timings so that we can assign them to the same alcove. The different colors to the other alcoves. So by using graph coloring we can assign the alcoves.
- In this Umbrella Free-Ordering, we place the colours in a certain order.

After coloring the graph using Umbrella Free-Ordering

G5 1

G4 2

G3 1

G2 3

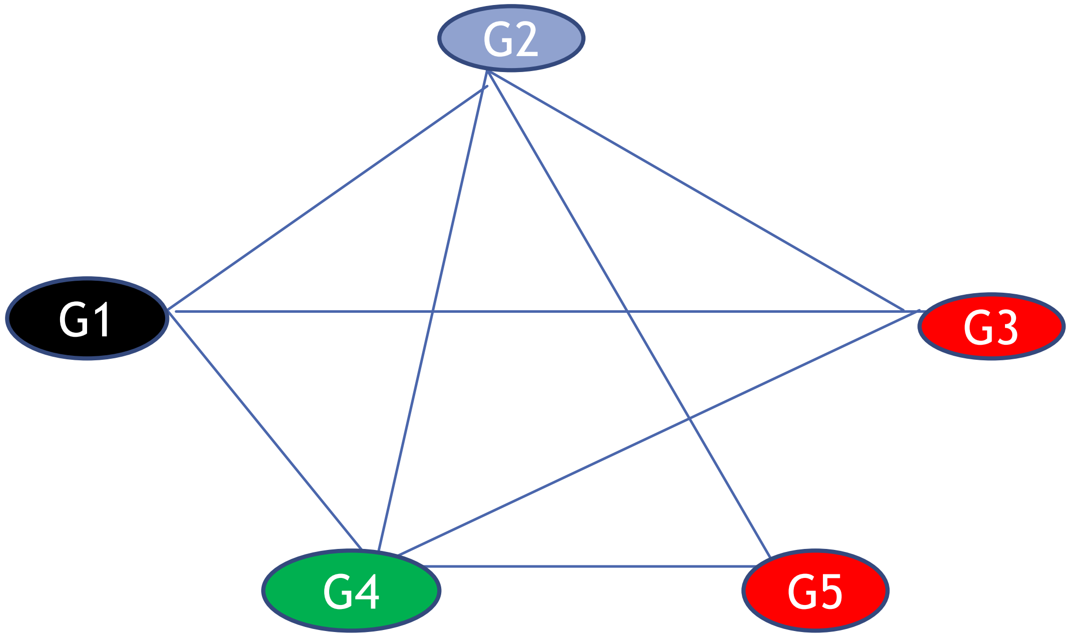
G1 4

Problem Solution

- By looking at the above colored graph , we can assign all those five groups G1, G2, G3, G4, G5 into four alcoves according to their meet up preference timings.

- we can assign same colored(red) G5 and G3 groups into first alcove. Then 2nd colored (green) G4 group into next consecutive alcove. Likewise 3rd colored (blue) G2 group into next one. Finally Group G1 group into last alcoves.

Problem Solution



Problem solution

- The minimum colors required to color the graph is 4. So we need 4 alcoves to assign the faculty members in their preferences timings.

- Below is the alcoves assigned to the groups:

1	2	3	4
G3 (11 am -12 pm)	G4 (11 am – 1pm)	G2 (11 am -1 pm)	G1 (11 am -12 pm)
G5 (12 pm – 2 pm)			

References

- http://en.wikipedia.org/wiki/Interval_graph
- http://en.wikipedia.org/wiki/Graph_coloring
- http://www.academia.edu/2479839/Applications_of_Graph_Coloring_in_Modern_Computer_Science
- http://people.mpi-inf.mpg.de/~rraman/papers/maxcoloring.pdf