Frequency Assignment in cellular networks

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Agenda

- Problem statement
- Graph coloring
- Solution to the problem
- Explanation
Problem Statement

- High Demand for Cellular Mobile Services.
- Has already reached its Capacity Threshold.
- Different techniques can be used to increase the capacity. (give examples)
- Best solution: Frequency Reuse.
• Frequency assignment is an important problem in the operation of the mobile networks.

• So, I propose a solution using Graph Coloring Method.

• The solution is to assign a frequency for every call from the mobile device.
Agenda

Problem statement

Graph coloring

Solution to the problem

Explanation
Graph Coloring

Graph coloring is an assignment of colors to the elements of a graph.

- Graph coloring is composed of three types:
  - Vertex coloring
  - Edge coloring
  - Region coloring
Vertex Coloring:

**DEFINITION:** The vertex coloring of a graph is coloring of the vertices such that no 2 adjacent sides receive same color.

**USES:**
- Model many scheduling problems
- Optimal assignments of channels to radio stations and spectrum frequencies to mobile operations

**OBJECTIVE:**
- Find the minimum number of colors needed to color the vertices of a graph as possible.
- This minimum number to color the vertices of a graph is known as Chromatic number.
Edge coloring:

- The edge coloring is to color the edges of a given graph with fewest colors such that no two edges incident to a common vertex are assigned with the same color.
- The problem finds application in assigning classroom to course and in scheduling problems.
- The minimum number of colors needed to color a graph is known as chromatic index.
Region Coloring:

• Region coloring is generally used to color a map.
• The graph has a vertex for each region of the map and an edge connecting two vertices if and only if the regions share a common boundary.
• Region coloring is done in a way that no two regions sharing a common boundary are assigned with same color.
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Solution to the problem

• The problem is now divided into three sub problems :-
  • Graph Creation
  • Graph Coloring
Solution to the problem

- **Graph Creation**
  - The Graph $G = (V,E)$ where $V$ represents non-empty sets of vertices and $E$ represents non-empty set of edges which shows relationship among vertices.
Solution to the problem

Graph Creation

• The Graph which has to be colored is represented with 8 vertices.

• The graph G which is a collection of vertices and edges, where V = \{1, 2, 3, 4, 5, 6, 7, 8\} and E = \{(1,2),(1,4),(1,6),(1,7),(2,1),(2,4),(2,7),
(2,8),(3,4),(3,7),(3,8),(4,1),(4,2),(4,3),(5,1),(5,8),(6,1),(7,3),
(7,2),(7,1),(8,5),(8,3),(8,2)\}. 
Solution to the problem

• Here is the graph with coloring
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Explanation

- From the above graph, consider the frequencies allocating to network users as colors.
- The minimum number of colors i.e., the communication between users is obtained by using minimum number of frequencies.
- The nodes of a cellular graph connected with an edge must be assigned different colors i.e., users located close to each other.
By this our Agenda gets completed.

THANK YOU
Questions??