DAA [Day - 4]

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Question 1: Imagine a building or street network represented as a graph:

- Nodes (vertices): Intersections, rooms, or key areas.
- Edges: Paths, corridors, or streets connecting the nodes.

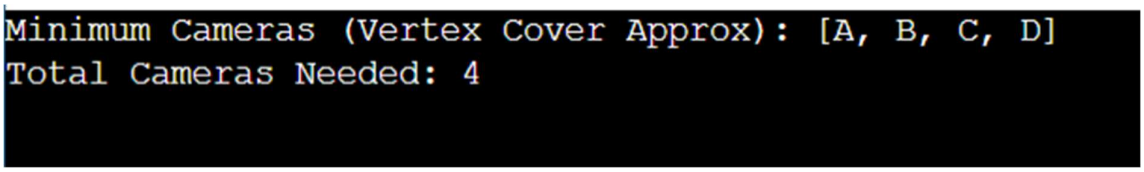
Install the minimum number of surveillance cameras such that every connection (edge) is monitored — meaning at least one of its endpoints (nodes) has a camera.

Answer:

```
import java.util.*;
public class MinimumVertexCover {
   static Map<String, List<String>> graph = new HashMap<>();
   static Set<String> visitedEdges = new HashSet<>();
   static Set<String> vertexCover = new HashSet<>();
   public static void addEdge(String u, String v) {
      graph.computeIfAbsent(u, k -> new ArrayList<>()).add(v);
      graph.computeIfAbsent(v, k -> new ArrayList<>()).add(u);
   }
   public static void findVertexCover() {
      Set<String> covered = new HashSet<>();
      for (String u : graph.keySet()) {
         for (String v : graph.get(u)) {
            String edge = u + "-" + v;
            String reverseEdge = v + "-" + u;
            if (!visitedEdges.contains(edge) && !visitedEdges.contains(reverseEdge)) {
               vertexCover.add(u);
               vertexCover.add(v);
               for (String adj : graph.get(u)) {
                  visitedEdges.add(u + "-" + adj);
               }
               for (String adj : graph.get(v)) {
                  visitedEdges.add(v + "-" + adj);
               }
            }
         }
      }
   }
   public static void main(String[] args) {
      addEdge("A", "B");
      addEdge("A", "C");
```

```
        addEdge("B", "D");
        addEdge("C", "D");
        addEdge("D", "E");
        findVertexCover();
        System.out.println("Minimum Cameras (Vertex Cover Approx): " + vertexCover);
        System.out.println("Total Cameras Needed: " + vertexCover.size());
    }
}
```

Output:

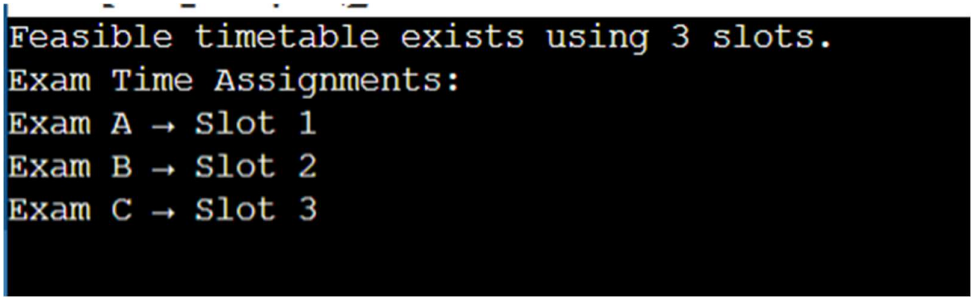


Question 2: Verify whether a feasible exam timetable exists such that no student has overlapping exams.

Answer:

```
import java.util.*;

public class ExamTimetable {

   static boolean isSafe(int v, int[][] graph, int[] color, int c) {
      for (int i = 0; i < graph.length; i++)
         if (graph[v][i] == 1 && color[i] == c)
            return false;
      return true;
   }

   static boolean graphColoring(int[][] graph, int m, int[] color, int v) {
      if (v == graph.length)
         return true;

      for (int c = 1; c <= m; c++) {
         if (isSafe(v, graph, color, c)) {
            color[v] = c;
            if (graphColoring(graph, m, color, v + 1))
               return true;
            color[v] = 0;
         }
      }
      return false;
   }

   public static void main(String[] args) {
      // Graph based on conflict: A-B, B-C, A-C
      int[][] conflictGraph = {
         {0, 1, 1}, // A
         {1, 0, 1}, // B
         {1, 1, 0}  // C
      };

      int numberOfSlots = 3; // try with 2 and then 3
      int[] color = new int[conflictGraph.length];

      if (graphColoring(conflictGraph, numberOfSlots, color, 0)) {
         System.out.println("Feasible timetable exists using " + numberOfSlots + " slots.");
         System.out.println("Exam Time Assignments:");
         for (int i = 0; i < color.length; i++)
            System.out.println("Exam " + (char)('A' + i) + " → Slot " + color[i]);
      } else {
         System.out.println(" No feasible timetable with " + numberOfSlots + " slots.");
      }
   }
}
```

Output:


Feasible timetable exists using 3 slots.
Exam Time Assignments:
Exam A → Slot 1
Exam B → Slot 2
Exam C → Slot 3