

```

1 class TarjansSCC
2 {
3     public static void main (String[] args)
4     {
5         Scanner sc = new Scanner(System.in);
6         int t = sc.nextInt();
7
8         while(t-- > 0)
9         {
10             // arraylist of arraylist to represent graph
11             ArrayList<ArrayList<Integer>> adj = new ArrayList<>();
12
13             int V = Integer.parseInt(sc.next());
14             int E = Integer.parseInt(sc.next());
15
16             for(int i =0; i < V; i++)
17                 adj.add(i, new ArrayList<Integer>());
18
19             for(int i = 1; i <= E; i++)
20             {
21                 int u = Integer.parseInt(sc.next());
22                 int v = Integer.parseInt(sc.next());
23
24                 // adding directed edges between
25                 // vertex 'u' and 'v'
26                 adj.get(u).add(v);
27             }
28
29             Solution ob = new Solution();
30             ArrayList<ArrayList<Integer>> ptr = ob.tarjans(V, adj);
31
32             for(int i=0; i<ptr.size(); i++)
33             {
34                 for(int j=0; j<ptr.get(i).size(); j++)
35                 {
36                     if(j==ptr.get(i).size()-1)
37                         System.out.print(ptr.get(i).get(j));
38                     else
39                         System.out.print(ptr.get(i).get(j) + " ");
40                 }
41                 System.out.print(",");
42             }
43             System.out.println();
44         }
45     } // } Driver Code Ends
46
47
48 //User function Template for Java
49
50 class Solution
51 {
52     static int id =1; // for assigning ids
53
54     public ArrayList<ArrayList<Integer>> tarjans(int V, ArrayList<ArrayList<Integer>> adj)
55     {
56         ArrayList<ArrayList<Integer>> result = new ArrayList<ArrayList<Integer>>();
57         boolean stack[] = new boolean[V]; //0(1) to check wheater its on stack or not
58         traversing original stack
59         int [] ids = new int[V]; //store the ids
60         int[] lowValues = new int[V];

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60     Stack<Integer> stackQue = new Stack<Integer>();//to add vertice while we recurse
61
62     for(int i=0;i<V;i++){
63         if(ids[i]==0){ // if not visited visit
64             dfs(i,adj,stack,ids,lowValues,stackQue,result);
65         }
66     }
67     //just sorting the result in order, but not neccessary
68     Collections.sort(result,new Comparator<ArrayList<Integer>>(){
69         public int compare(ArrayList<Integer> list1,ArrayList<Integer> list2){
70             return list1.get(0)-list2.get(0);
71         }
72     });
73     return result;
74 }
75
76
77     public static void dfs(int vertex,ArrayList<ArrayList<Integer>> adj, boolean
stack[],int[]ids,int[] lowValues,Stack<Integer> stackQue,ArrayList<ArrayList<Integer>>
result){
78
79         ids[vertex] = id;
80         lowValues[vertex]=id++;
81         stack[vertex]=true;
82         stackQue.push(vertex);
83
84         ArrayList<Integer> cl = adj.get(vertex);
85         int len = cl.size();
86         for(int i=0;i<len;i++){
87             int nextNode = cl.get(i);
88             if(ids[nextNode]==0){ // if nextNode not vistied, then visit
89                 dfs(nextNode,adj,stack,ids,lowValues,stackQue,result);
90             }
91             if(stack[nextNode]){ //if we encountered a node which is already visted,then if
its on stack only
92                 lowValues[vertex]=Math.min(lowValues[vertex],lowValues[nextNode]);
93             }//this implementations avoid cross edges, i.e leaking of lowValue. A corss
edge is edge which does not point to its ancestor.
94
95         }
96         //when lowvalue and id are same, it means we had looped back to original positon
and its a SCC
97         if(lowValues[vertex]==ids[vertex]){
98             ArrayList<Integer> list = new ArrayList<Integer>();
99             while(true){
100                 int node = stackQue.pop();
101                 list.add(node);
102                 stack[node]=false;
103                 if(node==vertex){
104                     break;}
105             }
106             //add these components to a list.
107             Collections.sort(list);
108             result.add(list);
109         }
110     }
111
112
113
114
115 }

```