

```

1  /** Articulation Point & Bridges:
2  In a graph, a vertex is called an articulation point if removing it and all the edges
3  associated with it results in the increase of the number of connected components in the graph.
4  An edge in a graph between vertices say u and v is called a Bridge, if after removing it,
5  there will be no path left between u and v. here Articulation Point & Bridges Basic Code: */
6  #include<bits/stdc++.h>
7  using namespace std;
8  pair<int,int>pii;
9  int tim,root,dis[10005],low[10005],par[10005];
10 vector<int>ed[10005];
11 vector< pair<int,int> >bridge;
12 bool ap[10005],vis[10005];
13 void dfs(int u){
14     vis[u]=true;
15     dis[u]=++tim;
16     low[u]=tim;
17     int child=0;
18
19     for(int i=0; i<ed[u].size(); i++){
20         int v = ed[u][i];
21         if(vis[v]==false){
22             par[v]=u;
23             child+=1;
24             dfs(v);
25
26             low[u]=min(low[u],low[v]);
27
28             if(u==root && child>1)ap[u]=true;
29             if(u!=root && dis[u]<=low[v])ap[u]=true;
30             if(dis[u]<low[v]) bridge.push_back(make_pair(u,v));
31         } else if(v!=par[u]) { // backedge
32             low[u]=min(low[u],dis[v]);
33         }
34     }
35 }
36 int main(){
37     int tt; scanf("%d",&tt);
38     for(int ks=1; ks<=tt; ks++){
39         int n,m; scanf("%d%d",&n,&m);
40         for(int i=1; i<=m; i++){
41             int u,v; scanf("%d%d",&u,&v);
42             ed[u].push_back(v);
43             ed[v].push_back(u);
44         }
45
46         memset(ap,false,sizeof(ap));
47         tim=0;
48         root=1;
49         dfs(1);
50
51         printf("Articulation Points: ");
52         for(int i=1; i<=n; i++){
53             if(ap[i])printf("%d ",i);
54         }
55         printf("\n\n");
56
57         printf("Articulation Bridges:\n");
58         for(int i=0; i<bridge.size(); i++){
59             pii = bridge[i];
60             printf("%d %d\n",pii.first,pii.second);
61         }
62         printf("\n");
63
64         for(int i=1; i<=n; i++)ed[i].clear();
65     }
66
67     return 0;
68 }

```