Week 6

Q1) Given a (directed/undirected) graph, design an algorithm and implement it using a program to find if a path exists between two given vertices or not. (Hint: use DFS)

Input Format:

Input will be the graph in the form of adjacency matrix or adjacency list. Source vertex number and destination vertex number is also provided as an input.

Output Format:

Output will be 'Yes Path Exists' if path exists, otherwise print 'No Such Path Exists'.

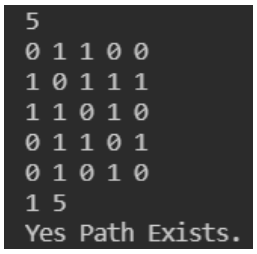
```
#include <bits/stdc++.h>
using namespace std;
void dfs(vector<int> arr[], int source, int V, bool *visited)
{
   visited[source] = true;
   for (int i = 0; i < V; i++)
   {
      if (arr[source][i] != 0 && !visited[i])
      {
         dfs(arr, i, V, visited);
      }
   }
}

bool checkPath(vector<int> arr[], int V, int source, int destination)
{
   bool visited[V];
   for (int i = 0; i < V; i++)
      visited[i] = false;
   dfs(arr, source, V, visited);
   return visited[destination];
}

int main()
{
   int n;
   cin >> n;
   vector<int> arr[n];
   int temp;
   for (int i = 0; i < n; i++)
   {
      for (int j = 0; j < n; j++)
      {
         cin >> temp;
```

```
            arr[i].push_back(temp);
        }
    }
    int source, destination;
    cin >> source >> destination;
    if (checkPath(arr, n, source - 1, destination - 1))
    {
        cout << "Yes Path Exists.\n";
    }
    else
    {
        cout << "No Such Path Exists.\n";
    }
    return 0;
}
```

OUTPUT



Q2) Given a graph, design an algorithm and implement it using a program to find if a graph is bipartite or not. (Hint: use BFS)

Input Format:

Input will be the graph in the form of adjacency matrix or adjacency list.

Output Format:

Output will be 'Yes Bipartite' if graph is bipartite, otherwise print 'Not Bipartite'.

```
#include <bits/stdc++.h>
using namespace std;
bool isBipartiteUtil(vector<int> G[], int src, int colorArr[], int V)
{
   colorArr[src] = 1;
   queue<int> q;
   q.push(src);
   while (!q.empty())
   {
      int u = q.front();
      q.pop();
      if (G[u][u] == 1)
         return false;
      for (int v = 0; v < V; ++v)
      {
         if (G[u][v] != 0 && colorArr[v] == -1)
         {
            colorArr[v] = 1 - colorArr[u];
            q.push(v);
         }
         else if (G[u][v] != 0 && colorArr[v] == colorArr[u])
            return false;
      }
   }
   return true;
}

bool isBipartite(vector<int> G[], int V)
{
   int colorArr[V];
   for (int i = 0; i < V; ++i)
      colorArr[i] = -1;
   for (int i = 0; i < V; i++)
      if (colorArr[i] == -1)
         if (isBipartiteUtil(G, i, colorArr, V) == false)
            return false;
   return true;
}

int main()
```

```
{
   int n;
   cin >> n;
   vector<int> G[n];
   int temp;
   for (int i = 0; i < n; i++)
   {
      for (int j = 0; j < n; j++)
      {
         cin >> temp;
         G[i].push_back(temp);
      }
   }
   if (isBipartite(G, n))
   {
      cout << "Yes Bipartite\n";
   }
   else
   {
      cout << "Not Bipartite\n";
   }
   return 0;
}
```

OUTPUT

Q3) Given a directed graph, design an algorithm and implement it using a program to find whether
cycle exists in the graph or not.

Input Format:

Input will be the graph in the form of adjacency matrix or adjacency list.

Output Format:

Output will be 'Yes Cycle Exists' if cycle exists otherwise print 'No Cycle Exists'.

```
#include <bits/stdc++.h>
using namespace std;
bool CheckCycle(int node, vector<int> adj[], int vis[], int dfsvis[])
{
   vis[node] = 1;
   dfsvis[node] = 1;
   for (auto it : adj[node])
   {
      if (!vis[it])
      {
         if (CheckCycle(it, adj, vis, dfsvis))
            return true;
      }
      else if (dfsvis[it])
         return true;
   }
   dfsvis[node] = 0;
   return false;
}
bool isCycle(vector<int> adj[], int N)
{

   int vis[N + 1], dfsVis[N + 1];
   memset(vis, 0, sizeof(vis));
   memset(dfsVis, 0, sizeof(dfsVis));
   for (int i = 1; i <= N; i++)
   {
      if (!vis[i])
      {
         if (CheckCycle(i, adj, vis, dfsVis))
            return true;
      }
   }
   return false;
}
int main()
{
   int n, m;
   cin >> n >> m;
   vector<int> adj[n + 1];
```

```
    for (int i = 1; i <= m; i++)
    {
        int u, v;
        cin >> u >> v;
        adj[u].push_back(v);
    }

    if (isCycle(adj, n))
        cout << "Cycle Exists" << endl;
    else
        cout << "No Cycle Exists" << endl;
    return 0;
}
```

OUTPUT