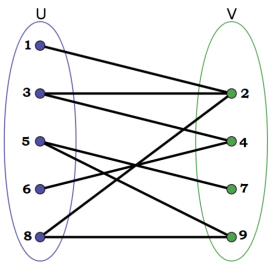
Graphs-1

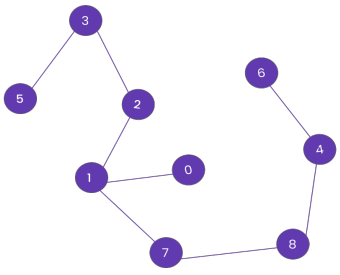
Assignment Questions

PW SKILLS

Q1. Given an undirected graph, check if it is bipartite or not. A bipartite graph (or bigraph) is a graph whose vertices can be divided into two disjoint sets U and V such that every edge connects a vertex in U to one in V The following graph is bipartite as we can divide it into two sets, U and V, with every edge having one endpoint in set U and the other in set V:



Input:



Output:

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Graph is bipartite
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Q2. Given a list of departure and arrival airports, find the itinerary in order. It may be assumed that departure is scheduled from every airport except the final destination, and each airport is visited only once, i.e., there are no cycles in the route.

For example,

Input:

HKG —> DXB
FRA —> HKG
DEL —> FRA

Output: DEL —> FRA —> HKG —> DXB

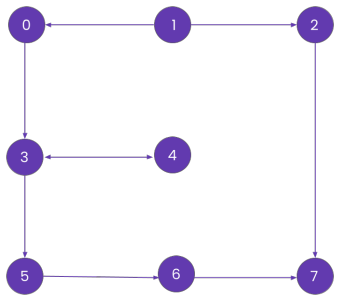
Input:

LAX —> DXB
DFW —> JFK
LHR —> DFW
JFK —> LAX

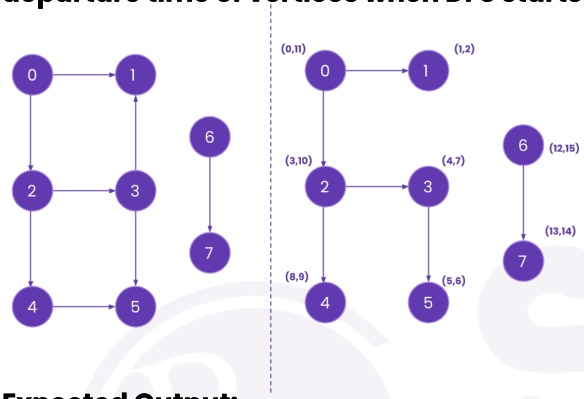
Output: LHR —> DFW —> JFK —> LAX —> DXB

Q3. Given a directed graph and two vertices (say source and destination vertex), determine if the destination vertex is reachable from the source vertex or not. If a path exists from the source vertex to the destination vertex, print it.

For example, there exist two paths [0—3—4—6—7] and [0—3—5—6—7] from vertex 0 to vertex 7 in the following graph. In contrast, there is no path from vertex 7 to any other vertex.



Q4. Given a graph, find the arrival and departure time of its vertices in DFS. The arrival time is the time at which the vertex was explored for the first time in the DFS, and departure time is the time at which we have explored all the neighbors of the vertex, and we are ready to backtrack.
The following directed graph has two connected components. The right-hand side shows the arrival and departure time of vertices when DFS starts from vertex 0.



Expected Output:

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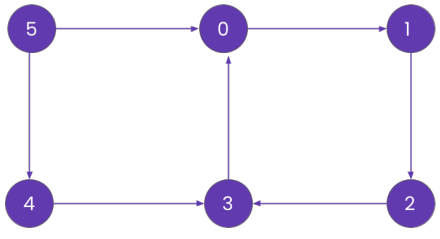
Vertex 0 (0, 11)
Vertex 1 (1, 2)
Vertex 2 (3, 10)
Vertex 3 (4, 7)
Vertex 4 (8, 9)
Vertex 5 (5, 6)
Vertex 6 (12, 15)
Vertex 7 (13, 14)
```

Q5. A root vertex of a directed graph is a vertex u with a directed path from u to v for every pair of vertices (u, v) in the graph. In other words, all other vertices in the graph can be reached from the root vertex.

A graph can have multiple root vertices. For example, each vertex in a strongly connected component is a root vertex. In such cases, the solution should return anyone of them. If the graph has no root vertices, the solution should return -1.

The root vertex is 4 since it has a path to every other vertex in the following graph:



Expected output:

```
The root vertex is 4
```