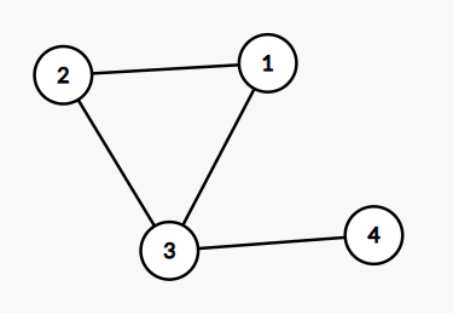
Lab Exam Problems

1. Write code to solve the single source shortest path problem on a **DAG** using **DFS**. Take both the **DAG** and the **source node** as input and output the **distance of each node**.
   (You can choose any graph representation or input format of your choice)
   15

2. Write code to solve the following grid traversal problem. **You don't need to print the path.** https://cses.fi/problemset/task/1194
   10

3. Write code to solve **cycle detection** in a **directed graph** using **BFS.**
   15

4. We have seen cycle detection in a **directed** graph .
   Now we are interested in detecting cycles in an **undirected** graph using **DFS**. A cycle in an undirected graph has **at least 3** nodes in it. For example, the following graph has a cycle consisting nodes **1, 2 & 3.**
   15

   You can find the pseudocode for detecting cycles in an **undirected graph** using **DFS** in this link: https://ideone.com/ZdPwm3

   Now, write code to solve the problem: https://cses.fi/problemset/task/1669
   You don't need to print the path.

5. Write code to solve the problem https://cses.fi/problemset/task/1669 again using **BFS.** Can you come up with your own algorithm?
   15

6. Write code to solve the topological sorting problem https://cses.fi/problemset/task/1679/ using **BFS**.

   10

   You can find the pseudocode for implementing topsort using **BFS** in this link: https://ideone.com/6L967A

   Can you give an intuitive description of why this algorithm works?

7. We solved the flood fill problem https://cses.fi/problemset/task/1192 with the following code: https://github.com/phitronio/Algorithm-Batch1/blob/main/module%2009/flood_fill.cpp

   10

   What is the time complexity of this code? Can you come up with something better?
   Hint: maybe the `while(true)` loop for finding an **unvisited cell** is overkill?

8. Write code to solve the following problem: https://cses.fi/problemset/task/1666

   10