CSCI 3333 Practice Quiz FLOW2

Problem 1. Fill in the blanks with answers based on the graph in Figure 1.

The maximum flow from $v_1$ to $v_6$ is ______ number.

The maximum flow from $v_2$ to $v_5$ is ______ number.

Removing the edge (________, _______ ) causes the maximum flow from $v_2$ to $v_5$ to decrease to 2.

The two nodes with the smallest maximum flow between them are _________ and __________.

Figure 1: The graph for Problem 1.
Problem 2. Fill in the blanks with answers based on the graph in Figure 2.

The maximum flow from $v_1$ to $v_6$ is ______ number.

The maximum flow from $v_2$ to $v_5$ is ______ number.

Removing the edge (node, node) causes the maximum flow from $v_3$ to $v_4$ to decrease to 5.

The two nodes with the largest maximum flow between them are ______ node and ______ node.

Figure 2: The graph for Problem 2.
**Problem 3.** In Figure 3, complete the labelings of the edges of the residual graph for of the flow.

![Flow and Residual Graphs](image)

*Figure 3: The flow (top) and residual graph (bottom) for Problem 3.*
**Problem 4.** In Figure 4, complete the labelings of the edges of the residual graph for of the flow.

![Flow and Residual Graph](image)

Figure 4: The flow (top) and residual graph (bottom) for Problem 4.
Problem 5. A graph is 2-connected provided it remains connected after removing any edge. Complete the following implementation of a function that returns whether an input graph is 2-connected. The function max_flow assumes the weight/capacity of every edge in the graph $V$ is 1.

```cpp
bool two_connected(vector<Node*> &V)
{
    if (V.size() <= 2)
        return true;

    Node* s = V[0];
    for (Node* t : V)
    {
        // Uses Edmonds-Karp
        int f = max_flow(V, s, t);

        if (f < 1)
            return false;
    }
    return true;
}
```

Fill in the blank: the worst-case running time of two_connected is $\Theta(\text{function of } n,m)$