**CSCI 3333 Practice Quiz GRPH1**

- The actual quiz consists of one question and a 10-minute duration.
- The actual quiz question may or may not be one of the questions here.

**Problem 1.** Complete the following implementation of a function that returns whether the undirected graph with vertex set $V$ contains a triangle: a cycle of length 3.

```cpp
bool triangle(vector<Node*> &V)
{
    for (Node* v : V)
    {
        for (Node* vn : _____->neighs)
        {
            for (Node* vnn : _____->neighs)
            {
                for (Node* vnnn : _____->neighs)
                {
                    if (vnnn == _____ )
                        return _____;
                }
            }
        }
    }
    return _____;
}
```

Fill in the blanks about the function `triangle`:

The worst-case running time is $\Theta(\_\_\_\_\_\_\_\_\_\_\_\_\_\text{function of } |V|, |E|)$.

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If every node has less than 6 neighbors, then the worst-case running time is $O(\_\_\_\_\_\_\_\_\_\_\_\_\_\text{function of } |V|)$.

If every node has at least $\sqrt{|V|}$ neighbors, then the worst-case running time is $\Omega(\_\_\_\_\_\_\_\_\_\_\_\_\_\text{function of } |V|)$. 
**Problem 2.** Complete the labeling of the nodes in the graphs below according to the order they are “visited” (removed from the queue) during the search specified in the caption.

Figure 1: Breadth-first search ordering (Problem 2).

Figure 2: Depth-first search ordering (Problem 2).
Problem 3. Draw the remaining edges of the weighted connected undirected graph below so that it has the following properties:

- All edges have positive integer weights.
- Any BFS from $v_1$ reaches $v_6$ last.
- $d(v_1, v_4) = d(v_1, v_5) = 4$.

Figure 3: The (partially drawn) graph for Problem 3.