Computer Science 241

In-Class Exercises

You have been given a copy of the implementation of Prim’s algorithm developed in class on Friday. Analyze the average-case runtime of each of the following methods, in terms of $v$, the number of vertices in the graph and $e$, the number of edges using the following procedure:

1. For each line of code that is not a loop header, determine how long it takes to run and write this next to the line. You can do this at the big-O level (e.g., $O(1)$, $O(e)$, $O(\log v)$), but be prepared to justify your answer.

2. For any line that is repeated, determine how many times it is repeated in terms of $v$ and $e$.

3. Multiply the runtime of each line by its number of repetitions.

4. Total the operations over the whole method.

5. Drop constants and lower-order terms to reduce the operation count to the big-O runtime class of the whole algorithm.

Assume that in the average-case, hash table operations happen in $O(1)$, and for all other operations the average case is the same as the worst case.

1. public Graph()

2. public void addNode(int nodeId)

3. public Edge getEdge(int node1, int node2)

4. public LinkedList<Edge> getEdges(int nodeId)
5. public int numNodes()

6. public Graph prim(int startNode)