ECE G205 Fundamentals of Computer Engineering
Fall 2004

Homework 5: Due by Monday November 8 2004

- This test contains 4 problems. They allow you to earn 100 points.
- Show your work, as partial credit can be given. You will be graded not only on the correctness of your answer, but also on the clarity with which you express it. **Be neat**.
- **No late submissions will be accepted.**
- Only homework returned in a 9in $\times$ 12in envelope will be accepted. (If you cannot find such envelope, ask the Instructor.) Please, write your name and the class name (ECE G205) on the envelope (write clearly, please).
- For the problems that requires coding an e-mail to BOTH TAs should be sent that contains the code and the executable of a (single) program that implements the solutions to the problem as functions.

Write your name here: _____

- **Problem # 1 [30 points]**. Describe (pseudo-code or C++) a Boolean algorithm that given as input an undirected graph $G = (V, E)$ preprocesses its input in $O(V + E)$ time and in $O(1)$ time returns whether the graph is connected or not, i.e., whether there is a path between any two nodes in G. (No program is needed for this problem.)

- **Problem # 2 [40 points]**. Implement BFS, DFS and the Dijkstra algorithm in C++ using the C++ Standard Template Library containers `vector` and `deque`. (A program is needed for this problem.)

- **Problem # 3 [20 points]**. What is the worst-case time complexity (in terms of *n*, the number of the nodes in the graph) of Kruskal's algorithms when it is executed on a graph *G* that is *complete* (i.e., in which there is an edge between each pair of nodes)? Justify your answer. (No program is needed for this problem.)

- **Problem # 4 [20 points]**. Are there graphs for which Prim's algorithm for MST is slower than Kruskal's algorithm? Justify your answer. (No program is needed for this problem.)