ECE G205 Fundamentals of Computer Engineering
Fall 2003

Homework 4: Due by Wednesday October 8 2003

- This test contains 3 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 problem # 2 an e-mail to the TA should be sent that contains the code and the executable of a (single) program that implements the solutions to the problems as functions.

Write your name here: _____

- **Problem # 1 [50 points]**. Let $A[1,\ldots,n]$ an array of n distinct numbers. If $i < j$ and $A[i] > A[j]$ then the pair (i, j) is called an *inversion* of A. **a)** List the five inversion of the array $[2,3,8,6,1]$. **b)** What array with elements from $\{1,2,\ldots,n\}$ has the most inversions? How many does it have? **c)** Give an algorithm (pseudo-code) that determines the number of inversions in any permutation on n elements in $\Theta(n \log n)$ worst-case time.

- **Problem # 2 [25 points]**. Implement Counting-Sort in C++ using the C++ Standard Template Library.

- **Problem # 3 [25 points]**. Show how to sort n integers in the range $0, \ldots, n^2 - 1$ in $O(n)$ time.