Important: This is an open book test. You can use any books, notes, or paper. Any calculations and rough work can be done on the back side of the test pages. You will loose five points for not writing your name.

1. [5 pt] Show the contents of the array after each `union` operation when you use the quick-find algorithm to solve the connectivity problem for the sequence 0-2, 1-4, 2-5, 3-6, 0-4, 6-0, and 1-3. Also give the number of times the program accesses the array for each input pair.

2. [5 pt] For what values of N is $10n \lg N > 2N^2$?

3. [5 pt] Show that $N \ln N = O(N^{3/2})$.

4. [5 pt] Solve the recurrence

$$C_N = \begin{cases} C_{N/2} + N^2 & \text{for } N \geq 2 \\ 0 & \text{for } N = 1 \end{cases}$$

when N is a power of 2.

5. [5 pt] Write a function (in pseudocode or C or C++) that moves the node containing the largest item in a given linked list to the last node on the list. Your code should be $O(n)$ or better.

6. [5 pt] Convert the following expression to postfix:

$$(5 \times ((9 \times 8) + (7 \times (4 + 6))))$$

7. [5 pt] Write a recursive program (pseudocode or C or C++) to count the number of nodes in a binary search tree.