Homework Assignment 2

This assignment is due by Tuesday February 14 (in class). Assignments should be handed in before the class begins.

**Problem 1**: Solve exercises 7.1-3, 7.1-4 (page 174), 7.2-4 (page 178), and 7.4-4 (page 184) in the textbook.

**Problem 2**: Solve the following recurrences using the master theorem. Clearly justify using the various cases of the theorem.

- \( T(n) = 9T\left(\frac{n}{3}\right) + n^2 + \frac{n}{2} + 1 \)
- \( T(n) = 5T\left(\frac{n}{2}\right) + n^2 \)
- \( T(n) = 12T\left(\frac{n}{4}\right) + n^2 \)

**Problem 3**: Solve exercise 4.5-2 (page 97) in the textbook.

**Problem 4**: Explain why the recurrence \( T(n) = 2T\left(\frac{n}{2}\right) + n \log n \) cannot be analyzed using the Master Theorem. Then show using induction that \( T(n) = O(n \log^2 n) \).

**Problem 5**: 
(i) Analyze the recurrence \( T(n) = \sqrt{n} T(\sqrt{n}) + n \) using unfolding or recursion trees (use \( n = 2 \) for the base case). You may be better able to track the terms by noting that \( \sqrt{n} = n^{1/2} \).
(ii) Now give an inductive proof that your bound from (i) is indeed correct. You may assume that \( T(n) \leq C \) for \( n \leq 16 \).