Homework Assignment #4

Note

This assignment is due 2PM Thursday, May 7, 2009. Please write or type your answers on A4 (or similar size) paper. Drop your homework by the due time in Yih-Kuen Tsay's mail box on the first floor of Management College Building II. Late submission will be penalized by 20% for each working day overdue. You may discuss the problems with others, but copying answers is strictly forbidden.

Problems

1. Solve the following exercise problems in Manber's book: 6.10 (follow "Note on Chapter 2 of Manber: Proving a Loop Invariant"; 10 points), 6.16 (for the string *abbaaabbaabbaaab*; 10 points), 6.17 (with $A = abbcbaa$ and $B = abcbab$; 10 points), 6.21 (10 points), 6.24 (10 points), 6.32 ("balanced binary tree" in the problem description is the same as "complete binary tree"; 10 points), 6.40 (10 points).

2. (a) Apply the partition algorithm in `Quicksort` to the following array (assuming that the first element is chosen as the pivot).

10	15	6	11	13	12	2	9	1	7	16	3	5	8	14	4

   Show the result after each exchange (swap) operation. (5 points)

   (b) Apply the `quicksort` algorithm to the above array. Show the result after each partition operation. (5 points)

3. You are given a set of n coins, among which at least $n-1$ are identical "true" coins and at most one coin is "false", i.e., it is either lighter or heavier than the other true coins. Also, you are given a balance scale, which you may use to compare the total weight of any m coins with that of any other m coins. The n-coins problem is to find the "false" coin, or show that there is no such coin, by making some sequence of comparisons using the balance scale.

   Show that in the worst case it is impossible to solve the n-coins problem with k comparisons if $n > \frac{1}{2}(3^k - 1)$. (10 points)

4. Draw a Huffman code tree for the following frequency distribution of characters obtained from some given file:

A	B	C	D	E	F	G	P	Q	R
45	20	30	40	70	10	50	35	5	25

(10 points)