浙江大学 2011－2012 学年冬季学期

《高级数据结构与算法分析》课程期末考试试卷

课程号：_____，开课学院：软件学院、计算机学院、竺可桢学院

考试试卷：√A 卷、B 卷（请在选定项上打√）

考试形式：√闭、开卷（请在选定项上打√），允许带___无____入场

考试日期：2011 年 1 月 12 日,考试时间：120 分钟

诚信考试，沉着应考，杜绝违纪。

考生姓名：_____学号：_____所属院系：_____

题序	一	二	三	四	总 分
得分					
评卷人					

Answer Sheet

Part I (20)				
1.	2.	3.	4.	5.
6.	7.	8.	9(a).	9(b).

Part II (18)	
1. ①_____ ②_____ ③_____	2. ①_____ ②_____ ③_____

Part III (47)
1.

2. (1)

2. (2)

3.(1)

3.(2)

3,

4.

5.

6.

Part IV (15)

NOTE: Please write your answers on the answer sheet.

注意：请将答案填写在答题纸上。

I. Please fill in the blanks (the answer for each blank is unique). (2 points each)

1. For an AVL tree, _____ is ***NOT*** correct.
 a. A complete binary search tree must be an AVL tree
 b. If the height of an empty tree is defined to be -1, an AVL tree of height 3 must contain exactly 7 nodes
 c. In an AVL tree, the height of the left and right subtrees can differ by at most 1
 d. The left and right subtrees of an AVL tree are also AVL trees

2. A B+ tree of order 3 with 11 numbers has at most ___ nonleaf nodes.
 a. 3 b. 5 c. 7 d. 8

3. Among the following statements, _____ is true.
 a. The relationship of skew heaps to leftist heaps is analogous to the relation between splay trees and B trees.
 b. For leftist heaps and skew heaps, the worst-case running time of a single insertion are both O(N).
 c. With the same operations, the resulting skew heap is always more balanced than the leftist heap.
 d. None of the above is true.

4. After insert 1,2,3,…,14,15 consequentially into an initially empty binomial queue, in which tree of this binomial queue that the number 9 will be?
 a. B1 b. B2 c. B3 d. undecidable

5. Which of the following algorithms doesn’t use Divide and Conquer?
 a. Quick sort b. Merge sort c. Bucket sort d. Binary search

6. An amortized time bound is _____.
 a. stronger than average-case time bound
 b. stronger than worst-case time bound
 c. weaker than best-case time bound
 d. None of the above

7. Which of the following algorithms is ***NOT*** related to the greedy algorithm?
 a. Dijkstra algorithm to find a shortest path of a graph.
 b. Kruskal algorithm to find a minimum spanning tree of a weighted graph.
 c. The algorithm to find the optimal binary search tree for static search.
 d. Huffman’s coding of a list of characters with given frequencies.

8. The turnpike reconstruction problem is to construct a point set from a given set of distances. Let D = {1,2,2,3,3,3,5,5,6,8} be the given set of distances. Assume that the first point x1 = 0. Then the number of points and the third smallest point may be _____.

a. 5 and 3 b. 5 and 6 c. 10 and 3 d. 10 and 6

9. For the following problems, (a)___ is undecidable and (b)____ is NP-complete.

a. Euler circuit problem b. Halting problem

c. All-pairs shortest paths problem d. All-pairs longest paths problem

II. Given the function descriptions of the following two (pseudo-code) programs, please fill in the blank lines. (18 points)

1. The function is to find X in a binomial queue H. (9 points)

```
BinTree  Find( BinQueue  H, ElementType  X )
/* To find whether X is in H. Return the node pointer if found, otherwise return NULL */
{   BinTree  T, result=NULL;
    int  i,j;
    for(i=0, j=1; j<=H->CurrentSize; i++, ①_______) {  /* for each tree in H */
        T= H->TheTrees[i];
        if ( ②_____________){  /* if need to search inside this tree */
            result=RecurFindInTree(T, X)
            if (result!=NULL) return result;
        }
    }
}

BinTree RecurFindInTree( BinTree T, ElementType X )
{   BinTree result=NULL;
    if (X==T->Element) return T;
    if (T->LeftChild !=NULL && X>=T->LeftChild->Element){
        result= RecurFindInTree(T->LeftChild, X);
        if (result!=Null) return result;
    }
    if ( ③_____________________________________________){
        result= RecurFindInTree(T->NextSibling, X);
        return result;
    }
}
```

2. The function is to do a single rotation between node K1 and its right child in an AVL tree. (9 points)

```
struct  AvlNode
{
  ElementType  Element;
  AvlTree Left;
  AvlTree Right;
  int Height;
}
Typedef struct AvlNode *Position;
Typedef struct AvlNode *AvlTree;
```

```
static Position
SingleRotateWithRight ( Position K1 )
{
    Position K2;
    ①_____ _____________________________;
    ②_____________________________;
    ③_____________________________;
    K1->Height =
        Max(Height(K1->Left),Height(K1->Right))+1;
    K2->Height =
        Max(Height(K2->Right),K1->Height)+1;
    return K2;
  }
```

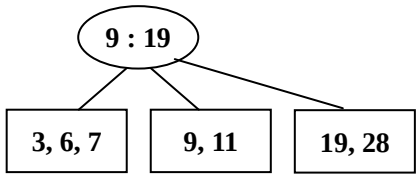
III. Please write or draw your answers for the following problems on the answer sheet. (47 points)

1. Given the keywords and searching frequencies, Please draw the optimal binary search tree in order to minimize the expected total access time. (9 points)

keywords	for	switch	do	while
frequencies	0.30	0.18	0.25	0.27

2. Please draw the results of inserting { 42, 26, 8, 70, 102, 56, 2} into:
(1) (5 points)an initially empty AVL tree; and
(2) (5 points)an initially empty splay tree.
(Tip: Drawing the trees step by step might help you getting partial credits.)

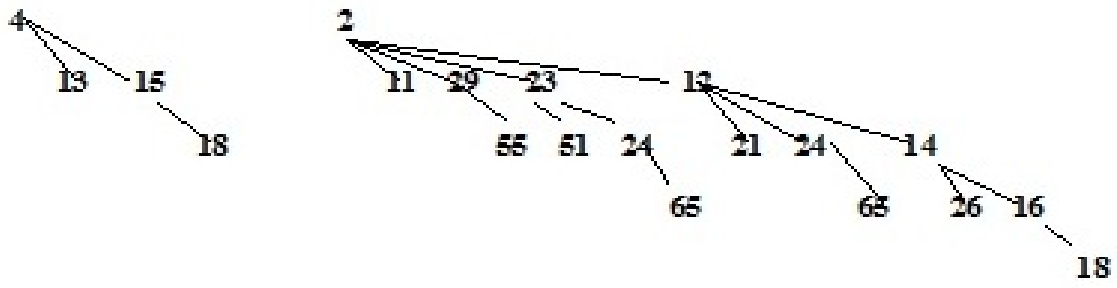
3. Given a 2-3 tree as shown in the figure.



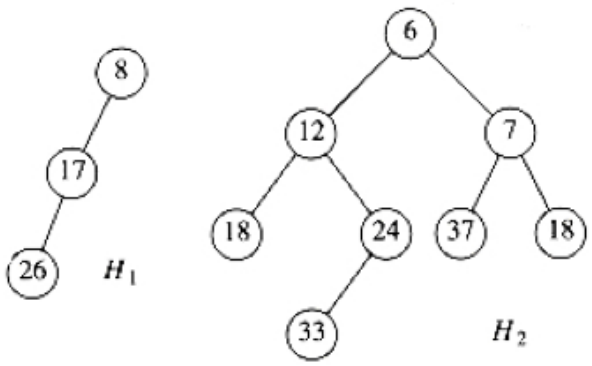
Please:
(1) show the result of inserting 4 with splitting strategy; (3 points)
(2) show the result of deleting 19 and then 7 from the tree obtained in (1). (3 points)

4. (1) Please briefly describe the *Document distribution architecture* for index construction and maintenance for full text search in distributed environments. (5 points)
(2) Please list the pros and cons of this strategy. (5 points)

5. Please draw the result of deleting the minimum element from the given binomial queue. (6 points)



6. Please show the result of merging two given leftist heaps H1 and H2. (6 points)



IV. The Longest Peak Line

Given K numbers N_1, N_2, …, N_K. They are said to form a *peak line* of length K if there exists an index i ($1 \le i \le K$) such that $N_1 < N_2 < \ldots < N_i > N_{i+1} > \ldots > N_K$. Now given any M distinct numbers N_1, N_2, …, N_M, we may remove some of them to keep the rest of the numbers in a peak line. Please design an algorithm to find the longest peak line we can possibly obtain from the given set of numbers. (12 points) How much can you say about the time complexity of your algorithm? (3 points)