浙江大学 2012－2013 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：2013 年 1 月 24 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(a).	7(b).	7(c).	8.

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

Part III (47)
1.

2.

3.

4.

5.	**6.**
7.	
8.	

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 a splay tree, _____ is correct.
   a. Any single operation might take O(N) time, thus a splay tree has an O(N) amortized cost per operation.
   b. AVL trees and splay trees both maintain balance information of the tree, but splay trees are much simpler to program than AVL trees.
   c. The relation of splay trees to AVL trees is analogous to the relation between binomial queues and priority queues.
   d. After applying splaying strategy on a node, the height of the resulting tree maybe larger than the original one.

2. If a B+ tree of order 3 has 13 nodes with 9 of them being leaves, then there must be _____ nodes of degree 3.
   a. 4 b. 3 c. 2 d. Undecidable

3. A leftist tree with R nodes on the right path must have _____ nodes.
   a. at most 2^R-1 b. at least 2^R-1 c. at most 2^{R-1} d. at least 2^{R-1}

4. For a skew heap, _____ is correct.
   a. Skew heap is a kind of leftist heap.
   b. The right path of a skew heap can be arbitrarily long.
   c. When running a sequence of merging operations, comparing to leftist heaps, skew heaps are always more efficient in running time for every merge.
   d. Comparing to leftist heaps, skew heaps are not always more efficient in space.

5. Which of the following statements is true?
   a. If no DecreaseKey operation is performed, the Fibonacci heap is the same as the binomial heap.
   b. The Fibonacci heap supports DeleteMin in O(1) amortized time, while the binomial heap takes O(logN).
   c. The Fibonacci heaps perform better than the binomial heaps in Merge and DecreaseKey operations, but not in DeleteMin and Delete in the amortized time bounds.
   d. None of the above

6. Given a binomial queue with 16 nodes. How many trees are left after calling DeleteMin twice?
   a. 14 b. 4 c. 3 d. 2

7. To pack the given 9 items of sizes 0.2, 0.9, 0.3, 0.1, 0.7, 0.5, 0.6, 0.8, 0.4 into the bins with unit capacity by the on-line algorithms, the *next-fit* uses (a)__ bins, the *first-fit* uses (b)__ bins and the *best-fit* uses (c)__ bins.
   a. 5 b. 6 c. 7 d. 8

8. Which of the following is NOT an NP problem?

a. Halting problem b. Euler circuit problem

c. Bin packing problem d. Closest points 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 merge two binomial queues H1 and H2. (9 points)

```
BinQueue  Merge( BinQueue H1, BinQueue H2 )
{   BinTree T1, T2, Carry = NULL;
    int i, j;
    H1->CurrentSize += H2-> CurrentSize;
    for ( i=0, j=1; j<= H1->CurrentSize; i++, j*=2 ) {
       T1 = H1->TheTrees[i]; T2 = H2->TheTrees[i];
       switch( 4*!!Carry + 2*!!T2 + !!T1 ) {
        case 0: case 1: break;
        case 2: H1->TheTrees[i] = T2; H2->TheTrees[i] = NULL; break;
        case 3: Carry = CombineTrees( T1, T2 );
                H1->TheTrees[i] = H2->TheTrees[i] = NULL; break;
        case 4: ①_____; Carry = NULL; break;
        case 5: ②_____; H1->TheTrees[i] = NULL; break;
        case 6: Carry = CombineTrees( T2, Carry ); H2->TheTrees[i] = NULL; break;
        case 7: H1->TheTrees[i] = Carry; ③_____;
                H2->TheTrees[i] = NULL; break;
       } /* end switch */
    } /* end for-loop */
    return H1;
}
```

2. The function is to do a right-left double rotation of K in an AVL tree. (9 points)

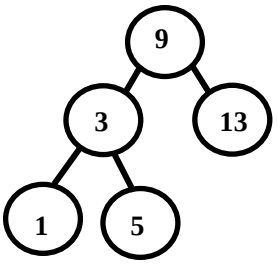
```
struct  AvlNode
{
  ElementType  Element;
  AvlTree Left;
  AvlTree Right;
  int Height;
}
Typedef struct AvlNode *Position;
Typedef struct AvlNode *AvlTree;
```

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

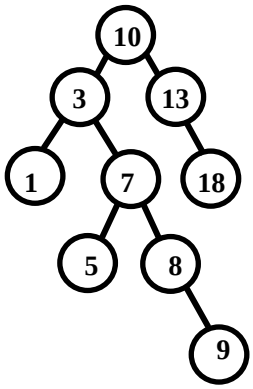
III. Please write or draw your answers for the following problems on the answer sheet. (47 points)

1. Given an AVL tree with height 6 (assuming that the height of a leaf is zero). What is the minimum number of the root's null path length? Please explain your answer. (5 points)

2. Please draw the results of inserting { 7, 18, 20, 19, 14 } into the given AVL tree. (7 points)



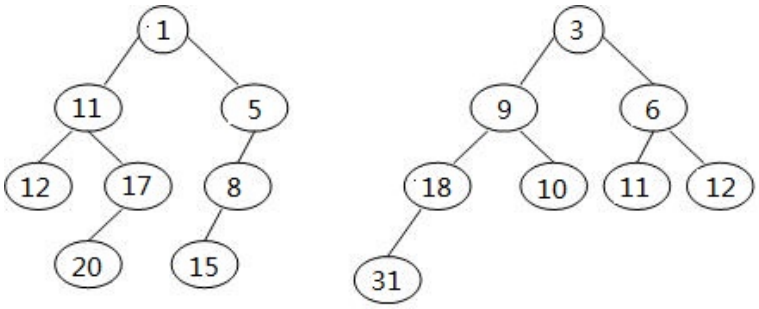
AVL tree for problem 2



Splay tree for problem 3

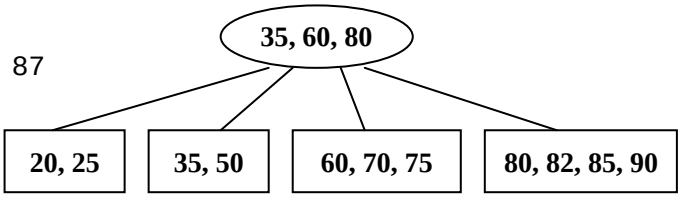
3. Please draw the results of splaying 5 and then 8, starting from the given splay tree. (4 points)

4. Please draw the result of merging two given skew heaps. (5 points)



Skew heaps for problem 4

5. Please draw the result of inserting 87 into the given B+ tree of order 4. (4 points)



B+ tree for problem 5

6. Please solve the following instance of the turnpike reconstruction problem with given distances {1,1,3,3,4,4,4,5,7,8}. (6 points)

7. What are the differences between dynamic programming and divide-conquer algorithms? (4 points)

8. Suppose that the metric of the document similarity is defined to be the number of common terms in the two documents.

(1) Which pair of the given 4 documents are the most similar? (Assume that the stop words are *a*, *in*, and *of.*) (3 points)

Doc	Text
1	Gold truck arrived
2	Shipment of gold damaged in a fire
3	Delivery of silver arrived in a silver truck
4	Shipment of gold arrived in a truck

(2) Please discuss the pros and cons of this metric. (3 points)

(3) Try to give at least two better methods to measure the similarity. You must explain why your methods are *better*. (6 points)

IV. Hamiltonian Tour (15 points)

A Hamiltonian tour is a single cycle that contains every vertex in a given graph. Please design a backtracking algorithm for deciding if a given undirected graph has a Hamiltonian tour.