浙江大学2018-19春夏《高级数据结构与算法分析》期中模拟练习-陈越

开始时间	1/1/2016, 08:00:00	**结束时间**	1/18/2038, 08:00:00	**答题时长**	45分钟
考生	王子腾	**得分**	71	**总分**	100

判断题

总分：35　得分：31

1-1 In backtracking, if different solution spaces have different sizes, start testing from the partial solution with the largest space size would have a better chance to reduce the time cost. (3分)

○ T　● F

评测结果：答案正确（3 分）

1-2 In amortized analysis, a good potential function should always assume its maximum at the start of the sequence. (3分)

○ T　● F

评测结果：答案正确（3 分）

1-3 A perfectly balanced tree forms if keys 1 to $2^k - 1$ are inserted in order into an initally empty leftist heap. (4分)

○ T　● F

评测结果：答案错误（0 分）

1-4 Finding the minimum key from a splay tree will result in a tree with its root having no left subtree. (4分)

● T　○ F

评测结果：答案正确（4 分）

1-5 When measuring the relevancy of the answer set, if the precision is high but the recall is low, it means that most of the relevant documents are missing, but most of the retrieved documents are relevant. (4分)

● T　○ F

评测结果：答案正确（4 分）

1-6 For the recurrence equation $T(N) = aT(N/b) + f(N)$, if $af(N/b) = f(N)$, then $T(N) = \Theta(Nlog_bN)$. (4分)

○ T　● F

评测结果：答案正确（4 分）

1-7 In an AVL tree, it is possible to have this situation that the balance factors of a node and both of its children are all -1. (4分)

● T　○ F

评测结果：答案正确（4 分）

1-8 Making N insertions into an initally empty binomial queue takes $\Theta(NlogN)$ time in the worst case. (3分)

○ T　● F

评测结果：答案正确（3 分）

1-9 In a red-black tree, the number of rotations in the DELETE operation is O(1). (3分)

● T　○ F

评测结果：答案正确（3 分）

1-10 The time bound of the FIND operation in a B+ tree containing N numbers is $O(lonN)$, no matter what the degree of the tree is. (3分)

● T　○ F

评测结果：答案正确（3 分）

单选题

总分：40　得分：25

2-1 A queue can be implemented by using two stacks S_A and S_B as follows:

- To enqueue x, we push x onto S_A.
- To dequeue from the queue, we pop and return the top item from S_B. However, if S_B is empty, we first fill it (and empty S_A) by popping the top item from S_A, pushing this item onto S_B, and repeat until S_A is empty.

Assuming that push and pop operations take $O(1)$ worst-case time, please select a potential function ϕ which can help us prove that enqueue and dequeue operations take $O(1)$ amortized time (when starting from an empty queue). (5分)

○A. $\phi = |S_B|$
○B. $\phi = 2|S_B|$
○C. $\phi = |S_A|$
●D. $\phi = 2|S_A|$

评测结果：答案正确（5 分）

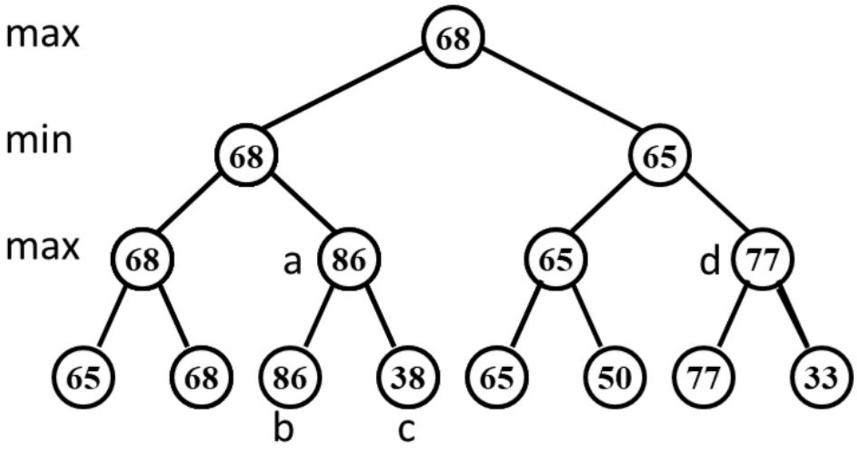
2-2 There are 8000 documents in the database. The statistic data for one query are shown in the following table. The recall is: __ (5分)

	Relevant	Irrelevant
Retrieved	1000	1000
Not Retrieved	2000	4000

○A. 12.5%
○B. 20%
●C. 33%
○D. 50%

评测结果：答案正确（5 分）

2-3 Given the following game tree, which node is the first one to be pruned with α-β pruning algorithm? (5分)



○A. a
○B. b
●C. c
○D. d

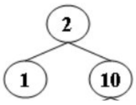
评测结果：答案正确（5 分）

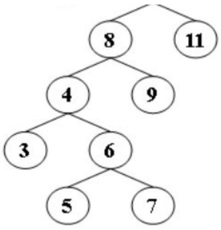
2-4 Insert { 5, 1, 7, 8, 21, 2, 12, 19, 13, 0 } into an initially empty 2-3 tree (with splitting). Which one of the following statements is FALSE? (5分)

○A. 13 and 19 are in the same node
○B. the parent of the node containing 8 has 3 children
○C. the first key stored in the root is 12
○D. there are 5 leaf nodes

评测结果：未作答（0 分）

2-5 For the result of accessing 5 in the splay tree in the following figure, besides saying that 5 must be the root, which one of the following statements is also TRUE? (5分)





○A. 2 and 10 are siblings
○B. 4 and 10 are siblings
●C. 6 and 10 are siblings
○D. 6 is a leaf node

评测结果：答案正确（5 分）

2-6 Delete a node v from an AVL tree T_1, we can obtain another AVL tree T_2. Then insert v into T_2, we can obtain another AVL tree T_3. Which one(s) of the following statements about T_1 and T_3 is(are) true? (5分)

- I、If v is a leaf node in T_1, then T_1 and T_3 might be different.
- II、If v is not a leaf node in T_1, then T_1 and T_3 must be different.
- III、If v is not a leaf node in T_1, then T_1 and T_3 must be the same.

○A. I only
○B. II only
●C. I and II only
○D. I and III only

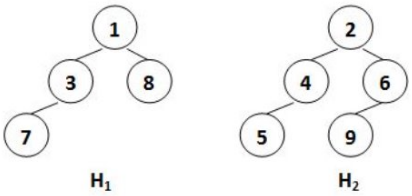
评测结果：答案错误（0 分）

2-7 3-way-mergesort : Suppose instead of dividing in two halves at each step of the mergesort, we divide into three one thirds, sort each part, and finally combine all of them using a three-way-merge. What is the overall time complexity of this algorithm ? (5分)

○A. $O(n(\log^2 n))$
○B. $O(n^2 \log n)$
●C. $O(n \log n)$
○D. $O(n)$

评测结果：答案正确（5 分）

2-8 Merge the two skew heaps in the following figure. Which one of the following statements is FALSE? (5分)



○A. the null path length of 6 is the same as that of 2
○B. 1 is the root with 3 being its right child
○C. Along the left most path from top down, we have 1, 2, 6, and 8
○D. 5 is the right child of 4

评测结果：未作答（0 分）

程序填空题

总分：25　得分：15

5-1 The functions `IsRBT` is to check if a given binary search tree `T` is a red-black tree. Return `true` if `T` is, or `false` if not.

The red-black tree structure is defined as the following:

```
typedef enum { red, black } colors;
typedef struct RBNode *PtrToRBNode;
struct RBNode{
    int Data;
    PtrToRBNode Left, Right, Parent;
    int BlackHeight;
    colors Color;
};
typedef PtrToRBNode RBTree;
```

Please fill in the blanks.

```
bool IsRBT( RBTree T )
{
    int LeftBH, RightBH;
    if ( !T ) return true;
    if ( T->Color == black ) T->BlackHeight = 1;
    else {
         if ( T->Left && (T->Left->Color==red)(5分)) return false;
         if ( T->Right && (T->Right->Color == red) ) return false;
    }
    if ( !T->Left && !T->Right ) return true;
    if ( IsRBT(T->Left)&&IsRBT(T->Right)(5分)) {
       if ( T->Left ) LeftBH = T->Left->BlackHeight;
       else LeftBH = 0;
       if ( T->Right ) RightBH = T->Right->BlackHeight;
       else RightBH = 0;
       if ( LeftBH == RightBH ) {
          T->BlackHeight+=LeftBH(5分);
          return true;
       }
       else return false;
    }
    else return false;
}
```

评测结果：答案正确（15 分）

序号	结果	得分
0	答案正确	5
1	答案正确	5
2	答案正确	5

5-2 The functions `BinQueue_Find` and `Recur_Find` are to find `X` in a binomial queue `H`. Return the node pointer if found, otherwise return NULL.

```
BinTree BinQueue_Find( BinQueue H, ElementType X )
{
    BinTree T, result = NULL;
    int i, j;

    for( i=0, j=1; j<=H->CurrentSize; i++, j*=2) {  /* for each tree in H */
        T= H->TheTrees[i];
        if ( X                                (5分) ){  /* if need to search inside this tree */
            result = Recur_Find(T, X);
            if ( result != NULL ) return result;
        }
    }
    return result;
}

BinTree Recur_Find( BinTree T, ElementType X )
{
    BinTree result = NULL;
    if ( X==T->Element ) return T;
    if ( T->LeftChild!=NULL ){
        result = Recur_Find(T->LeftChild, X);
        if ( result!=NULL ) return result;
    }
    if (                                (5分) )
        result = Recur_Find(T->NextSibling, X);
    return result;
}
```

评测结果：未作答（0 分）

序号	结果	得分
0	未作答	0
1	未作答	0