

## 浙江大学2020-21秋冬《数据结构基础》期末模拟练习

开始时间 2016/01/01 08:00:00 结束时间 2018/01/18 08:00:00 得分 83 总分 100

### 判断题

得分: 16 总分: 20

R1-1 Consider two programs with time complexities being  $T_1 = O(2^n)$  and  $T_2 = O(n)$ . then program 2 must run faster than program 1. (2分)

T  F

评测结果 答案正确 (2分)

R1-2 The storage size of a graph using the adjacency list is only related to the number of vertices but has nothing to do with the number of edges. (2分)

T  F

评测结果 答案正确 (2分)

R1-3 The average run time and the extra space of Heapsort for sorting  $n$  elements are  $O(n \log n)$  and  $O(1)$ , respectively. (2分)

T  F

评测结果 答案正确 (2分)

R1-4 In hashing with open addressing to solve collisions, the operation FIND will be seriously slowed down if there are too many deletions intermixed with insertions. (2分)

T  F

评测结果 答案正确 (2分)

R1-5 In most restaurants, we follow one principle called "First come, first served". This principle can be implemented by a queue. (2分)

T  F

评测结果 答案正确 (2分)

R1-6 For a binary tree, if its pre-order travel sequence is (4, 2, 1, 3, 6, 5, 7), and its in-order travel sequence is (1, 2, 3, 4, 5, 6, 7), then 4 is the parent of 2. (2分)

T  F

评测结果 答案正确 (2分)

R1-7 During sorting (25, 21, 47, 15, 27, 68, 35, 20) in ascending order (升序) with the iterative version of Mergesort, (15, 21, 25, 47, 20, 27, 35, 68) is the result of the second run. (2分)

T  F

评测结果 答案错误 (0分)

R1-8 For a connected graph, if there are exactly two vertices having odd degree, we can find an Euler tour that visits every vertex exactly once by starting from one of its odd-degree vertices. (2分)

T  F

评测结果 答案错误 (0分)

R1-9 The inorder traversal sequence of any max-heap must be in sorted order. (2分)

T  F

评测结果 答案正确 (2分)

R1-10 If a general tree T is converted into a binary tree BT, then the BT's post-order traversal has the same sequence as that of the pre-order traversal of T. (2分)

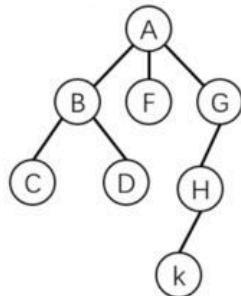
T  F

评测结果 答案正确 (2分)

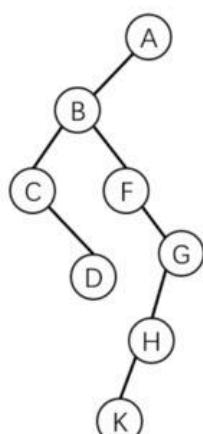
### 单选题

得分: 51 总分: 60

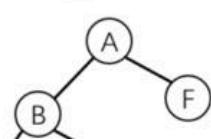
R2-1 The following figure shows a tree. Which one is its corresponding binary tree with the "first child/next sibling" representation? (3分)

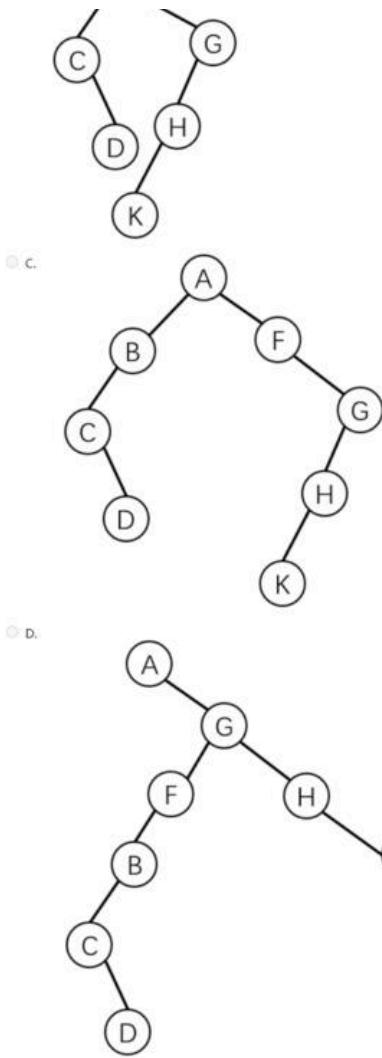


A.



B.





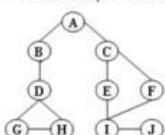
评测结果 答案正确 (3分)

R2-2 Given a binary tree, if its Pre-order traversal is (A,B,C,D,E,G,F) and the Post-order traversal is (B,D,G,F,E,C,A), then which one is its In-order traversal? (3分)

- A. BADCGEF
- B. BAGEFDC
- C. BGAEFCD
- D. BDACGEF

评测结果 答案正确 (3分)

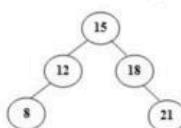
R2-3 The articulation points of the given graph are: (3分)



- A. A, B, C, D
- B. F, E, D
- C. A, B, I
- D. A, B, C, D, I

评测结果 答案正确 (3分)

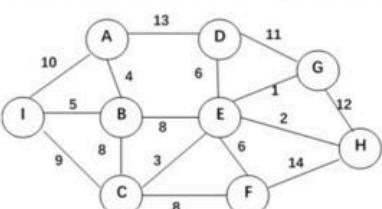
R2-4 Which one of the following is **impossible** to be the insertion sequence of the given binary search tree? (3分)



- A. 15, 18, 21, 12, 8
- B. 15, 12, 21, 8, 18
- C. 15, 12, 8, 18, 21
- D. 15, 18, 12, 21, 8

评测结果 答案正确 (3分)

R2-5 Given a weighted graph as shown by the figure. Which one of the following statements is TRUE about its minimum spanning tree? (3分)



- A. The minimum spanning tree is unique and the total weight is 35.
- B. The minimum spanning tree is not unique and the total weight is 36.
- C. If the weight of edge (B,E) was 7, then the minimum spanning tree would be unique.
- D. If the weight of edge (B,C) was 7, then the minimum spanning tree would not be unique.

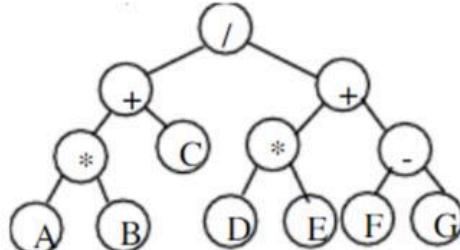
评测结果 答案正确 (3分)

R2-6 Given a hash table of size 13 (indexed from 0 to 12) with the hash function  $H(Key) = Key \% 11$ . Quadratic probing  $H_i(key) = (H(key) + i^2) \% 13$  is used to resolve collisions when the  $i$ -th ( $i > 0$ ) collision occurs. Then after inserting {9, 21, 20, 33, 31, 5} one by one into the initially empty hash table, which one of the following statements is false? (3分)

- A. the loading density is less than 0.5
- B. the key 5 is at position 6
- C. the key 20 is at position 0
- D. the average search time is less than 2

评测结果 答案错误 (0分)

R2-7 The following binary tree is called an expression tree. Which one is the arithmetic expression that this tree represents? (3分)



- A.  $A * B + C / (D * E) + (F - G)$
- B.  $(A * B + C) / (D * E) + (F - G)$
- C.  $(A * B + C) / (D * E + (F - G))$
- D.  $A * B + C / D * E + F - G$

评测结果 答案正确 (3分)

R2-8 An inversion in an array  $A[ ]$  is any ordered pair  $(i, j)$  having the property that  $i < j$  but  $A[i] > A[j]$ . Given array  $A: [3, 87, 12, 61, 70, 26, 45]$ , after the first partition of Quicksort with Median3 pivot selection, the number of inversions will be decreased by \_\_\_\_\_. (3分)

- A. 1
- B. 3
- C. 6
- D. 9

评测结果 答案错误 (0分)

R2-9 In hashing with open addressing method, rehashing is definitely necessary when \_\_\_\_\_. (3分)

- A. an insertion fails
- B. the hash table is half full
- C. primary clustering occurs
- D. the hash function is not uniform

评测结果 答案正确 (3分)

R2-10 In a weighted undirected graph, if the length of the shortest path from  $v_1$  to  $v_0$  is 13, and there exists an edge of weight 2 between  $v_2$  and  $v_1$ , then which one of the following is correct? (3分)

- A. The length of the shortest path from  $v_2$  to  $v_0$  must be no greater than 11.
- B. The length of the shortest path from  $v_2$  to  $v_0$  must be no less than 11.
- C. The length of the shortest path from  $v_2$  to  $v_0$  must be less than 15.
- D. The length of the shortest path from  $v_2$  to  $v_0$  must be greater than 15.

评测结果 答案正确 (3分)

R2-11 Given an array of integers {15, 22, 30, 18, 3, 8, 28}. Build a min-heap using the linear algorithm and then call DeleteMin twice. Which of the following is the level-order traversal sequence of the remaining heap? (3分)

- A. 15, 18, 28, 30, 22
- B. 15, 18, 28, 22, 30
- C. 15, 28, 18, 30, 22
- D. 15, 28, 22, 18, 30

评测结果 答案错误 (0分)

R2-12 Given the adjacency list of a directed graph. (3分)

```

a: e,f,g
b: Empty
c: Empty
d: b,c
e: Empty
f: d
g: c
  
```

which one below is NOT a valid topological order of the graph?

- A. a, e, f, g, d, b, c
- B. a, f, e, d, g, b, c
- C. a, e, f, g, c, f, d, b
- D. a, g, f, e, d, c, b

评测结果 答案正确 (3分)

R2-13 Suppose A is an array of length  $N$  with some random numbers. What is the time complexity of the following program in the worst case? (3分)

```

void function( int A[], int N ) {
    int i, j = 0, cnt = 0;
    for ( i = 0; i < N; ++i ) {
        for ( ; j < N && A[j] <= A[i]; ++j );
        cnt += j - i;
    }
}
  
```

- A.  $O(N^2)$
- B.  $O(N \log N)$
- C.  $O(N)$
- D.  $O(N^{1.5})$

评测结果 答案正确 (3分)

R2-14 The following list is a series of operations for a stack: (3分)

- push 1
- push 2
- push 3

- pop
- pop
- push 4
- push 5
- pop
- push 6
- push 7
- pop
- pop
- push 8
- pop
- push 9
- pop
- pop

Which is the correct pop-up sequence?

- A. 1 2 3 4 5 6 7 8 9
- B. 9 8 7 6 5 4 3 2 1
- C. 3 2 5 7 6 4 8 9 1
- D. 3 2 5 7 4 6 9 8 1

评测结果 答案正确 (3分)

R2-15 Given  $S = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11\}$  and 9 equivalence relations: 3~4, 6~8, 9~11, 2~3, 1~11, 3~11, 5~8, 1~7, 11~4. After invoking successively these relations with union-by-size (if the two sizes are equal, the smaller element will be the root) and path compression, which one of the following statements is false? (3分)

- A. there are 3 equivalence classes
- B. the parent of element 1 is element 3
- C. all elements are either a root or a child of a root
- D. the parent of element 11 is element 9

评测结果 答案正确 (3分)

R2-16 It is known that the sixth layer of a complete binary tree (the root is the first layer) has 8 leaf nodes, then the number of nodes of the complete binary tree is at most \_\_\_\_\_. (3分)

- A. 39
- B. 52
- C. 111
- D. 119

评测结果 答案正确 (3分)

R2-17 One of the following algorithms: Selection sort, Shell sort, Insertion sort, is applied to sort the sequence {2, 12, 16, 88, 1, 5, 10} in ascending order. If the resulting sequences of the first two runs are {2, 12, 16, 10, 1, 5, 88} and {2, 12, 5, 10, 1, 16, 88}, then the algorithm must be \_\_\_\_\_. (3分)

- A. Selection sort
- B. Shell sort
- C. Insertion sort
- D. uncertain

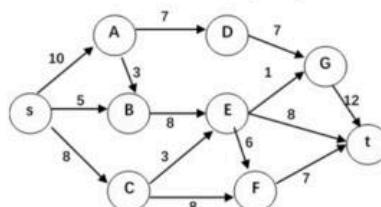
评测结果 答案正确 (3分)

R2-18 Let's traverse a complete binary tree in level-order, and define the level-order index of the root to be 1. Then for the  $i$ -th node visited, if its left child exists, then the index of this left child is \_\_\_\_\_. (3分)

- A.  $2i$
- B.  $i + 1$
- C.  $2i - 2$
- D.  $2(i + 1) + 2$

评测结果 答案正确 (3分)

R2-19 The maximum flow in the network of the given Figure is: (3分)

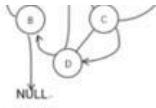


- A. 20
- B. 21
- C. 22
- D. 23

评测结果 答案正确 (3分)

R2-20 Among the following threaded binary trees (the threads are represented by arrows), which one is the in-order threaded tree? (3分)

- A.
- B.
- C.
- D.



评测结果 答案正确 (3分)

#### 程序填空题

得分: 9 总分: 12

R5-1 Following function Shellsort(int A[], int N) is the implementation of Shellsort Algorithm with increment sequence {1,3,7,11}. Please fill in the blanks.

```
void Shellsort( int A[], int N )
{
    int i, j, k, Increment, Inc[]={1,3,7,11};
    int Temp;

    for ( k=3; k>0; k-- ) {
        Increment=Inc[k]; (3分);
        for ( i = Increment; i < N; i++ ) {
            Temp = A[ i ];
            for ( j = i; j >= Increment; j -= Increment )
                if( Temp < A[ j - Increment ] )
                    A[j]=A[j-Increment]; (3分);
                else break;
            A[ j ] = Temp;
        }
    }
}
```

评测结果 答案正确 (6分)

测试点得分	序号	结果	得分
0		答案正确	3
1		答案正确	3

R5-2 The function `NumShortestPaths` is to find the number of shortest paths from `Vertex S` to every other vertices in a given graph (positive weights only). The distances and the numbers of shortest paths are stored in `dist[]` and `num[]`, respectively. The `Graph` is defined as follows:

```
typedef struct GNode *PtrToGNode;
struct GNode{
    int Nv; /* Number of vertices */
    int Ne; /* Number of edges */
    int AdjMat[NaxVertexNum][MaxVertexNum]; /* adjacency matrix */
};
typedef PtrToGNode Graph;
```

Please fill in the blanks.

```
void NumShortestPaths(Graph G, Vertex S, bool known[], int dist[], int num[])
{
    for (int i = 0; i < G->Nv; ++i)
    {
        known[i] = false;
        dist[i] = INFINITY;
        num[i] = 0;
    }

    dist[S] = 0;
    num[S]=1 (3分);

    while (true) {
        Vertex V = FindSmallestUnknown(G, known, dist);
        if (V == -1) break;

        known[V] = true;
        for (Vertex W = 0; W < G->Nv; ++W) {
            int weight = G->adjMat[V][W];
            if (weight && !known[W]) {
                if (dist[V] + weight < dist[W]) {
                    dist[W] = dist[V] + weight;
                    num[W] = num[V];
                } else if (dist[V] + weight == dist[W]) {
                    num[W]=num[V]+1 (3分);
                }
            }
        }
    }
}
```

评测结果 部分正确 (3分)

测试点得分	序号	结果	得分
0		答案正确	3
1		答案错误	0

#### 函数题

得分: 7 总分: 8

R6-1 `Height_of_BST` (8分)

You are supposed to write a function of finding the height of a binary search tree with the given preorder sequence.

##### Format of function:

```
int Height_of_BST( int preorder[], int N );
```

where the preorder sequence is stored in `int preorder[]`, and the integer `N` is the number of nodes in the tree, which is guaranteed to be positive. The function `Height_of_BST` is supposed to return the height of the binary search tree.

Note:

- It is guaranteed that the preorder sequence consists of distinct integers and does correspond to a binary search tree.
- You may assume that `MAXN` is a small number (less than 100) in the judge's program.

##### Sample program of judge:

```
#include <stdio.h>
#include <stdlib.h>

#define MAXN 10

int Height_of_BST( int preorder[], int N );

int main()
{
    int preorder[MAXN], N, i;

    scanf("%d", &N);
    for (i=0; i<N; i++) scanf("%d", &preorder[i]);
    printf("%d\n", Height_of_BST(preorder, N));

    return 0;
}

/* Your function will be put here */
```

**Sample Input:**

```
9  
10 6 2 9 8 25 20 22 30
```

**Sample Output:**

```
3
```

编译器    GCC  
代码

```
int Height_of_BST( int preorder[], int N )
{
    int array[65536] = {0};
    int judge[20] = {0, 1, 2, 4, 8, 16, 32, 64, 128, 256, 512, 1024, 2048, 4096, 8192, 16384, 32768, 65536};
    int i;
    int maximum = 0;
    for(i=0; i<N; i++){
        int cnt = 1;
        while(1){
            if(array[cnt] == 0){
                array[cnt] = preorder[i];
                break;
            }
            else{
                if(array[cnt] > preorder[i]) cnt *= 2;
                else cnt = cnt * 2 + 1;
            }
        }
        if(cnt > maximum) maximum = cnt;
    }
    for(i=0; i<20; i++){
        if(maximum >= judge[i] && maximum < judge[i+1]) break;
    }
    return i-1;
}
```

评测结果    部分正确 (7 分)

编译器输出

```
a.c: In function 'main':  
a.c:12:5: warning: ignoring return value of 'scanf', declared with attribute warn_unused_result [-Wunused-result]  
    scanf("%d", &N);  
a.c:13:25: warning: ignoring return value of 'scanf', declared with attribute warn_unused_result [-Wunused-result]  
    for (i=0; i<N; i++) scanf("%d", &preorder[i]);
```

测试点得分	测试点	结果	得分	耗时	内存
0		答案正确	3	2.00 ms	600 KB
1		答案正确	1	2.00 ms	600 KB
2		答案正确	1	2.00 ms	440 KB
3		段错误	0	3.00 ms	568 KB
4		答案正确	1	2.00 ms	440 KB
5		答案正确	1	2.00 ms	440 KB