

浙江大学宁波理工学院 2018–2019 学年 1 学期

《数据结构(A)》课程期末考试试卷 (B)

开课分院: 数据与计算机工程学院 , 考试形式: 闭 卷, 允许带_____入场

考试日期: 2019 年 1 月 16 日, 考试所需时间: 120 分钟

考生姓名_____学号_____考生所在分院: 数据学院 专业班级: _____.

术语表:

binary search tree 二叉搜索树	balance factor 平衡因子	complete binary tree 完全二叉树
sorted (non-decreasing) order (非递减) 有序	(worst-case) time complexity (最坏情况) 时间复杂度	single source shortest path 单源最短路径
preorder traversal 先序遍历	binary tree 二叉树	topological order 拓扑排序
inorder traversal 中序遍历	dummy head node 空表头结点	weighted path length 带权路径长度
postorder traversal 后续遍历	linear list 线性表	linear probe 线性探测
Singly/ doubly linked list 单/双向链表	ascending 递增	quadratic probe 平方探测
Circular Queue 循环队列	postfix expression 后缀表达式	Open addressing 开放定址
circularly linked list 循环链表	Shell/Heap/Quick/Insertion/Merge/bubble sort 希尔/堆/快速/插入/归并/冒泡排序	collision 冲突
circular array 循环数组	average search time 平均查找时间	loading factor 负载因子
hash table 散列表	adjacency matrix 邻接矩阵	sequence 序列
hash value 散列值	DFS/BFS 深度/宽度优先搜索	connected component 连通部件
adjacency lists 邻接表	connected graph 连通图	

命题 (组) 老师签名: _____

年 月 日

分院主管教学院长或首席主讲教授签名: _____

年 月 日

1. Answer the following questions with True or False, and make it on your answer sheet. (15 Points)

- ()1、 The Fibonacci number sequence $\{ F_N \}$ is defined as: $F_0 = 0, F_1 = 1, F_N = F_{N-1} + F_{N-2}$, $N = 2, 3, \dots$. The time complexity of the function which calculates F_N iteratively is $\Theta(F_N)$.
- ()2、 Circular Queue is defined to be a queue implemented by a circularly linked list or a circular array.
- ()3、 For a sequentially stored linear list of length N , the time complexities for query and insertion are $O(N)$ and $O(1)$, respectively.
- ()4、 Time complexity of merging two linked list with length m and n is $O(m+n)$.
- ()5、 In a complete binary tree, if a node has no left child, it must be a leaf.
- ()6、 When open addressing is used to solve collisions, to delete a key from the hash table we must clear the cell that was occupied by the key.
- ()7、 After the first run of Bubble Sort, it is possible that no element is placed in its final position.
- ()8、 In a binary search tree which contains several integer keys including 4, 5, and 6, if 4 and 6 are on the same level, then 5 must be their parent.
- ()9、 To sort N records by quick sort, the worst-case time complexity is $O(N \log N)$.
- ()10、 If A and B are both leaf nodes in a binary tree, then there exists a binary tree with preorder traversal sequence $\dots A \dots B \dots$ and inorder traversal sequence $\dots B \dots A \dots$.
- ()11、 To hash 10 elements into a hash table of 100000 cells, there may or may not be collisions.
- ()12、 Place M items in a hash table with an array size of S , the loading factor is $M \times S$.
- ()13、 Random access to any key value can be done in $O(\log N)$ in a max-heap of N elements.
- ()14、 If a graph is represented by adjacency lists, then the space taken depends only on the number of vertices, not the number of edges.
- ()15、 An algorithm may have no input, but it must have output.

2. Read each of the following questions carefully; choose the best answer (from among items A, B, C, or D) and make it on your answer sheet. (30 Points)

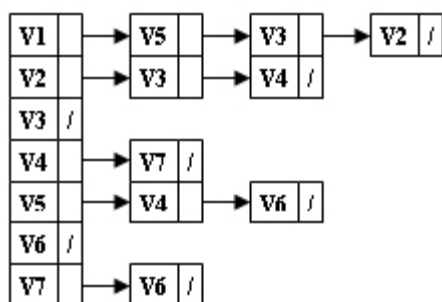
- ()1、 Suppose that an array of size 6 is used to store a circular queue, and the values of front and rear are 0 and 4, respectively. Now after 3 dequeues and 2 enqueues, what will the values of front and rear be?
A. 3 and 0 B. 3 and 2

C. 3 and 4

D. 3 and 6

- ()2、 Let h be the head of a singly linked list without a dummy head node. To insert a new node t as the first node, we must do:
- A. $h=t; t->next=h->next;$ B. $t->next=h->next; h=t;$
C. $h=t; t->next=h;$ D. $t->next=h; h=t;$
- ()3、 For two linear lists La and Lb , to link the tail of La with the head of Lb , with which one of the following data structures that we can take $O(1)$ time and minimize the extra space?
- A. singly linked list
B. singly linked circular list
C. singly linked circular list with a tail pointer
D. doubly linked circular list with a dummy head node
- ()4、 Given an empty stack S and an empty queue Q . Push elements $\{1, 2, 3, 4, 5, 6, 7\}$ one by one onto S . If each element that is popped from S is enqueued onto Q immediately, and if the dequeue sequence is $\{3, 2, 6, 5, 7, 4, 1\}$, then the minimum size of S must be:
- A. 2 B. 3 C. 4 D. 5
- ()5、 If a binary search tree of N nodes is also a complete binary tree, then among the following, which one is FALSE?
- A. The average search time is $O(\log N)$
B. The largest key must be on the last level
C. The smallest key must be at a leaf node
D. The median key must be at either the root or in the left subtree of the root
- ()6、 The structure of a heap must be a:
- A. binary search tree B. full binary tree
C. non-binary tree D. complete binary tree
- ()7、 11. Construct a Huffman tree from four leaf nodes with weights 9, 2, 5 and 7. Then the weighted path length of this Huffman tree is:
- A. 23 B. 44 C. 37 D. 46

- ()8、 Given the adjacency lists of a directed graph as shown by the figure. Then starting from V1, a possible DFS sequence is:



- A. V1,V5,V4,V7,V6,V2,V3
 B. V1,V2,V3,V4,V7,V6,V5
 C. V1,V5,V4,V7,V6,V3,V2
 D. V1,V5,V6,V4,V7,V2,V3

- ()9、 There are 10000 elements in a sequence, the best way to get the very smallest 8 elements in the sequence is ().

- A. Quicksort B. Heapsort C. Insertion sort D. Merge sort

- ()10、 Given input {15, 9, 7, 8, 20, -1, 4}. If the result of the 1st run of Shell sort is {15, -1, 4, 8, 20, 9, 7}, then the initial increment must be:

- A. 1 B. 2
 C. 3 D. 4

- ()11、 Construct a Huffman tree from four leaf nodes with weights 7, 2, 5 and 9. Then the weighted path length of this Huffman tree is:

- A. 37 B. 23 C. 46 D. 44

- ()12、 In a directed graph, the sum of in- and out-degrees of all the vertices is ___ times the number of edges.

- A. 1/2 B. 1 C. 2 D. 4

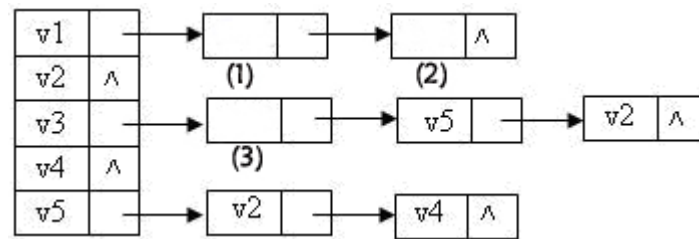
- ()13、 To hash 10 elements into a hash table of 100000 cells, will there still be collisions?

- A. Yes there will be.
 B. May or may not be.
 C. No there won't be.
 D. Yes the probability is one out of ten thousand.

- ()14、 Let P stands for push and O for pop. When using a stack to convert the infix expression $3*2+8/4$ into a postfix expression, the stack operation sequence is:

A. PPPOOO B. POPOPO C. POPPOO D. PPOOPO

()15、 Given the adjacency lists of a directed graph as shown by the figure. If starting from v1, the BFS sequence is {v1, v3, v2, v4, v5}, then the blanks in the figure shall be filled by:



A. v2, v3, v4 B. v3, v2, v4 C. v3, v4, v2 D. v4, v3, v2

3. Read each of the following programs (originate from the textbook) carefully, fill in the blanks and make it on your answer sheet. (2 points for each blank, 20 points total)

1) Given the following function for Maximum Subsequence Sum Problem:

```

int MaxSubseqSum( int List[], int N){
    int i, ThisSum, MaxSum;
    ThisSum = MaxSum = 0;
    for( i=0; i<N; i++){
        ThisSum += List[i];
        if( ThisSum>MaxSum)
            _____ (1) _____;
        else if( ThisSum<0)
            _____ (2) _____;
    }
    return MaxSum;
}

```

2) Given the following program to initialize a array implementation queue.

```

typedef int Position;
typedef struct QNode *PtrToQNode;
struct QNode{
    ElementType *Data;
    Position Front, Rear;
}

```

```

    int MaxSize;
};
typedef PtrToQNode Queue;
Queue CreateQueue( int MaxSize){
    Queue Q = (Queue)malloc( sizeof( struct QNode)); ;
    Q->Data = (ElementType*) malloc( MaxSize*sizeof(ElementType)) ;
    _____(3)_____ ;
    _____(4)_____ ;
    return S;
}

```

3) Given the following program to print the nodes with degree 2 of a binary tree.

```

int PrintD2( BinTree BT){
    int HL, HR, MaxH;
    if(BT){
        if(BT->Left&&BT->Right)
            printf(“%d\n”, BT->Data);
            _____(5)_____ ;
            _____(6)_____ ;
        }
    else return 0;
}

```

4) Given the following program for the Simple Selection Sort.

```

void SimpleSelectionSort( ElementType A[], int N){
    int i, j, min;
    for( i=0; i<N; j++) {
        _____(7)_____ ;
        if(_____ (8) _____)
            min = j;
        Swap( &A[i], &A[min]);
    }
}

```

5) Given the following program for non-recursion in-order traversal of a binary tree:

```
void InorderTraversal( BinTree BT){
    BinTree T;
    Stack S;
    T = BT;
    while(T||!IsEmpty(S)){
        while(T){
            Psush(S, T);
            _____(9)_____;
        }
        T = Pop(S);
        printf("%d", T->Data);
        _____(10)_____;
    }
}
```

4. Please write or draw your answers for the following problems on the answer sheet. (35 points)

1) (7 points) The following input level sequence: A, E, C, D, 0, B, G, 0, 0, F, 0, 0, 0, 0, 0, please build a binary tree, and write the tree and the content of the Queue while reading D and G.

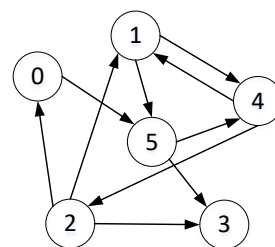
2) (7 points) The sequence: a b e c f i h g d and b e a i f h c g d are the preorder traversal sequence and in-order sequence of a binary tree respectively, please draw the binary tree and post-order traversal sequence.

3) (7 points) Assume keys={35, 10, 12, 1, 20, 27, 18, 33, 24, 19, 49, 52}, Hash function is $h(\text{key}) = \text{key} \% 17$. The linear probe open addressing is used to resolve collisions. Please try to calculate the value of Hash for each key and give the final hash table, and calculate the ASL(Average Search Length) of the hash table.

4) (7 points) For the following directed graph:

a) What is the Adjacency Lists?

b) Draw the sequence traversal by BFS(Breadth First Search) from vertex 0.



5) (7 points) For the following sequence, please sort it by heapSort algorithm. Write the initial max-Heap (初始最大堆) and the heap after deleting the second large element.

24, 2, 45, 6, 25, 59, 38, 61, 17, 73