北京邮电大学 2022-2023 学年第 1 学期

《数据结构》线上期末考试（A 卷）

考试注意事项	一、学生参加考试须带学生证或学院证明，未带者不准进入考场。学生必须按照监考教师指定座位就坐。 二、书本、参考资料、书包等物品一律放到考场指定位置。 三、学生不得另行携带、使用稿纸，要遵守《北京邮电大学考场规则》，有考场违纪或作弊行为者，按相应规定严肃处理。 四、学生必须将答题内容做在试题答卷上，做在试题及草稿纸上一律无效。

考试课程	数据结构			考试时间		2022 年 12 月 22 日 上午 9:00—11:00			
题号	一	二	三	四	五	六	七	八	总分
满分	30	10	30	30					
得分									
阅卷教师									

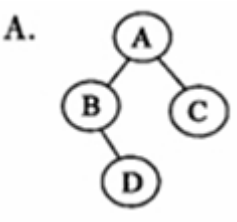
I. Single Selection (30 marks, 2 marks/each).

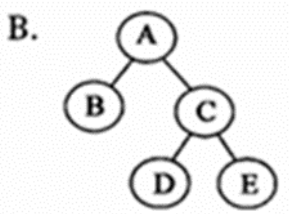
1. Time frequency of some statements is $T(n)=n^2+n^2log_2n+n^3$, the Time Complexity is ( ).

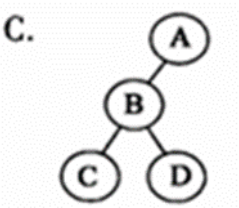
A. $O(nlog_2n)$ B. $O(n^2)$ C. $O(n^2log_2n)$ D. $O(n^3)$

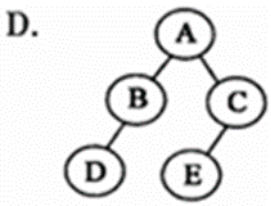
2. In the following four Binary Trees, ( ) is not a Complete Binary Tree.

3. In following binary trees, the **unbalanced** tree is ( ).

A. 

B. 

C. 

D. 

4. We use L to represent the operation of pushing an element into a stack, use M to represent the operation of popping an element from the stack. If the pushing operation sequence is 1234, in order to obtain the popping operation sequence 1342, which is the possible operation sequence of L and M? ( ).

A. LMLLMLMM B. LLLMMLMM C. LMLLMMLM D. LMLMLLMM

5. Assuming the root node is on the first level, the maximum number of nodes on level *i* of a binary tree is ( ).

A. 2^{i-1} B. 2^{i} C. 2i D. 2^{i}-1

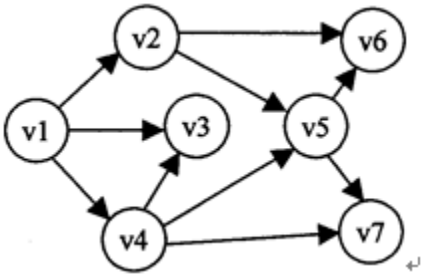
6. The worst search length of a Binary Search Tree (BST) with *n* nodes is ( ).

A. *O(1)* B. $O(n\log_2 n)$ C. $O(\log_2 n)$ D. *O(n)*

7. With a weight of {3,6,7,2,5} leaf nodes to generate a Huffman tree, its Weighted Path Length(WPL) is ( ).

A. 51 B. 23 C. 53 D. 74

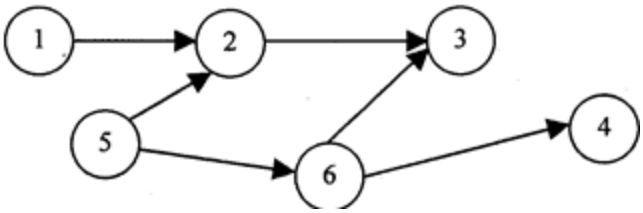
8. V1 is used as the starting node for the Depth First Search (DFS) of the following graph, and the correct search sequence is ( ).



A. v1，v2，v3，v4，v5，v6，v7 B. v1，v2，v5，v4，v3，v7，v6

C. v1，v2，v3，v4，v7，v5，v6 D. v1，v2，v5，v6，v7，v3，v4

9. Four possible topological sequences are given to the following digraph, which one is **NOT** correct ? ( )



A. 1，5，2，6，3，4　　B. 1，5，6，2，3，4

C. 5，1，6，3，4，2　　D. 5，1，2，6，4，3

10. If the vertex number of a connected graph G is 20, the edge number of the spanning tree of G is ( ).

A. 18　　B. 21　　C. 20　　D.19

11. In the Hash function H (key) = key Mod *m*, in general, *m* may be chosen to be ( ).

A. odd number　　B. even number

C. prime number　　D. sufficiently large number

12. Sorting the following keyword sequences with QuickSort method, ( ) sequence will be the slowest one.

A. {19, 23, 3, 15, 7, 21, 28}　　B. {23, 21, 28, 15, 19, 3, 7}

C. {19, 7, 15, 28, 23, 21, 3)　　D. {3, 7, 15, 19, 21, 23, 28}

13. Assume the root is at level 1. Which of the following statements is **FALSE**? ( )

A. In a MinHeap, the second smallest key entry is always at level 2.

B. In a MinHeap, the largest key element is always at level *h*, where *h* is the height of the heap.

C. In an AVL tree, the largest and the smallest key elements could be at the same level.

D. In an AVL tree, the smallest key entry may have a leaf child.

14. In following operations on a list, which operation may change the relationship between elements? ( )

A. searching B. sorting C. traversing D. none of above

15. In a circular queue, the first element is pointed by *f* , the last element is pointed by *r*, the maximal size of the queue is *n*, then how many elements in the queue? ( )

A. *r-f* B. *r-f+1* C. *(r-f) mod n +1* D. *(r-f+n) mod n*

II. Fill in the blank with an appropriate word or sentence (10 marks, 2 marks/each).

1. Assuming there is a directed graph with *n* vertices and *e* edges, the graph is stored in adjacency lists. When we delete all the edges , the time complexity is_____.

2. In using Hash Table, the situation for more than one item map to the same location in the Hash Table is called as _____.

3. Among HeapSort, QuickSort and MergeSort, _____is stable.

4. The data set (54, 28, 16, 34, 73, 62, 95, 60, 26, 43) will be sorted with ShellSort in ascending order. After one time 5-group sorting, the data sequence is_____.

5. In KMP matching algorithm, Assuming T = 'abcaabcaaabc', the Next Array of T is _____.

III. Short Answer Questions (30 marks, 6 marks/each).

1. The sequence using Level Tranversal Sequence of a binary tree is ABCDEFGHIJ， the sequence using Inorder Tranversal is BGDHAECIFJ. Please draw the binary tree.

2. With Weighted graph G in Figure 1, please draw the Minimum Cost Spanning Tree (MST) of graph G with Prim algorithm.

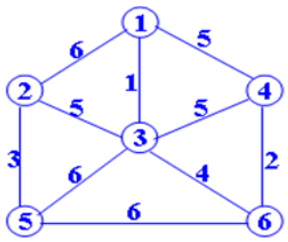


Figure 1. graph G

3. Read the integer sequence (7,16,4,8,20,9,6,18) with its original order and complete the following steps:

(1) Construct a Binary Search Tree (BST);

(2) Calculate the Average Search Length(ASL) .

4. Consider a Hash Table of size 11 storing entries with integer keys. Suppose the hash function is *h(k) = k mod 11* . Insert, in the given order, entries with keys 0, 2, 3, 7, 13, 26, 31 into the Hash Table, using:

(1) Linear probing to resolve collisions. Show all the work.

No.	0	1	2	3	4	5	6	7	8	9	10
Keys											

(2) Quadratic probing to resolve collisions. Show all the work.

No.	0	1	2	3	4	5	6	7	8	9	10
Keys											

(3) Please give the advantage of the quadratic probing comparing with the linear probing strategy.

5. Read algorithm F2, and answer the following questions:

(1) What is the function of F2 algorithm?

(2) If the using tree in Figure 2 as the input parameter of this algorithm, what is the output result?

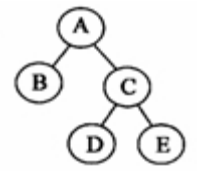


Figure 2

```
void F2(BiTree T)
{
   InitStack(S);
   p=T;
   while(p || !StackEmpty(S))
   { if(P)
       { push(S，p)；p=p->lchild；}
     else
          { pop(S，p)；
            printf(p->data)；
            p=p->rchiid；
          }
   }
}
```

V. Algorithm Design (30 marks, 15 marks/each).

1. Write out the QuickSort algorithm with C language.

Data structure is defined as:

```
#define MAXZSIZE 100
 typedef  struct {
       int  key;                //表示排序关键字
       elemtype   otherinfo; //排序记录中的其他数据项
   } RedType;

typedef  struct  {
    RedType  r[Maxsize+1];   //存放待排序全体记录
    int  length;   //排序记录个数
 } SqList;
```

2. Describe recursive algorithm of Binary Search using C language.

Data structure is defined as:

```
typedef struct {
    KeyType key;
   OtherType other_data;
} ElemType;

typedef struct {
  ElemType *elem;
  int length;
} SSTable;
```