北京郵電大學

Queen Mary University of London

EBU4208 A

Joint Programme Examinations 2022/23

EBUxxxx Advanced Network Programming

Paper A

Time allowed 2 hours

Answer ALL questions

For examiners' use only

1	
2	
3	
4	
5	
6	
7	
8	
Total	

Complete the information below about yourself very carefully.

QM student number	
BUPT student number	
Class number	

NOT allowed: electronic calculators and electronic dictionaries.

INSTRUCTIONS

1. **You must NOT take answer books, used or unused, from the examination room.**
2. Write only with a black or blue pen **and in English**.
3. Do all rough work in the answer book – **do not tear out any pages**.
4. If you use Supplementary Answer Books, tie them to the end of this book.
5. Write clearly and legibly.
6. **Read the instructions on the inside cover.**

Examiners

Dr Zhang Xi, Dr Xu Ke, Dr Hao Jie

Filename: 2223_EBU4208_A No answer book required

Instructions

Before the start of the examination

1) Place your BUPT and QM student cards on the corner of your desk so that your picture is visible.

2) Put all bags, coats and other belongings at the back/front of the room. All small items in your pockets, including wallets, mobile phones and other electronic devices must be **placed in your bag in advance**. **Possession of mobile phones, electronic devices and unauthorised materials is an offence.**

3) Please ensure your mobile phone is switched off and that no alarm will sound during the exam. **A mobile phone causing a disruption is also an assessment offence.**

4) Do not turn over your question paper or begin writing until told to do.

During the examination

1) You must not communicate with or copy from another student.

2) If you require any assistance or wish to leave the examination room for any reason, please raise your hand to attract the attention of the invigilator.

3) If you finish the examination early you may leave, but not in the first 30 minutes or the last 10 minutes.

4) For 2 hour examinations you may **not** leave temporarily.

5) For examinations longer than 2 hours you **may** leave temporarily but not in the first 2 hours or the last 30 minutes.

At the end of the examination

1) You must stop writing immediately – **if you continue writing after being told to stop, that is an assessment offence.**

2) Remain in your seat until you are told you may leave.

Question 1 **[30 marks, 2 marks for each]**

1. When function call, the data structure used to process parameters and return addresses is _____
A. Stack B.Array
C. Queue D.List

2. In a single linked list head, if to insert a new node p after head, the following codes _____should be executed.
A. head=p; p->next=head B. p->next=head; head=p
C. p->next=head; p=head; D. p->next=head->next; head->next=p;

3. When searching for an element in an AVL tree, the time approximate complexity is _____
A.O(1) B.O(n) C.O(log(n)) D.O(n^2)

4. The size of a circular queue is m, the pointer 'front' points to the queue head element, and the pointer 'rear' points to the next position of the queue last element, when inserting a new element into the queue, the operation to modify the pointer is _____
A.rear=(rear-1)%m; B.front=(front+1)%m;
C.front=(front-1)%m; D.rear=(rear+1)%m;

5. If the input sequence of a stack is a, b, c, then the impossible output sequence of a stack is _____
A. b c a B. c b a C. c a b D. a b c

6. If the number of nodes in a binary tree with degree l is 3 and the number of nodes with degree 2 is 4, then the number of leaf nodes in the binary tree is_____
A.4 B.5 C.7 D.8

7. Huffman tree is generated from leaf nodes with weights of 3, 8, 6, 2 and 5 respectively, and its weighted path length is _____
A 24 B 71 C 48 D 53

8.If the preorder traversal sequence of a binary tree with n (n>0) nodes is exactly opposite to its postorder traversal sequence, then the binary tree must be _____
A. Binary tree with no left child at any node
B. Binary tree with no right child at any node
C. Binary tree with height n
D. Binary tree with node with degree 2

9. Searching in a 3-order B-tree with 10 keywords, the maximum nodes to be visited is _____
A.2 B.3 C.4 D.5

10. If the in-order traversal sequence of a binary tree is ABCD and the pre-order traversal sequence is CABD, then the post-order traversal of the binary tree is _____
A. BADC B. BCDA
C. CDAB D. CBDA

11. If a complete undirected graph have n vertices, then the graph has _____edges。
A.n(n-1)/2 B.n(n-1) C. n^2 D.n^2-1

12. In the following statements, what is the wrong _____
A. The traversal of a graph is to visit every vertex only once from a given source point.
B. Graph traversal includes depth first traversal and breadth first traversal.
C. The breadth first traversal of graphs is only applicable to undirected graphs.
D. Depth first traversal of graphs is a recursive process.

13.In the following four sorting methods, _____has the largest space complexity.
A. Bubble sort B. Quick sort
C. Heap sort D. Hill sort

14.For hash storage of sequences (7, 34, 55, 25, 64, 46, 20, 10), if H (K)=K% 9 is selected as the hash function, there are _____ elements with hash address 1,
A. 1 B. 2 C. 3 D. 4

15.The stable sorting algorithm with an average time complexity of O (n log(n)) is_____
A. Quick sort B. Heap sort
C. Merge sort D. Bubble sort

Answers to Question 1

	Do not write in this column
1) 2)	
3) 4)	
5) 6)	
7) 8)	
9) 10)	
11) 12)	
13) 14)	
15)	**30 marks**

Question 2 Fill in the blanks [20 marks, 2 marks for each]

1. The time complexity of the following algorithm is_____

```
for(i=1，t=1，s=0；i<=n；i++)
    {t=t*i；s=s+t；}
```

2. Given a directed graph G as G=(V, E), V={1,2,3,4,5}, E={<1,2>,<2,4>,<4,5>,<1,3>,<3,2>,<3,5>}, then a topological ordering sequence of the graph is _____

3. There are n vertices in an undirected graph G, then the maximum degree of the vertex in the graph is _____

4. If there are 100 nodes in a complete binary tree, the number of its leaf nodes is _____

5.In heap sorting and quick sorting, _____ (which one) has the fastest average sorting speed.

6. In a binary search tree with n nodes, and the depth h, the maximum number of comparisons to find any node is_____

7. For a linked list with a length of n, the time complexity of inserting elements in the head is_____

8. The function of Prim algorithm is to obtain the_____ of a weighted connected graph. (Give the data structure name)

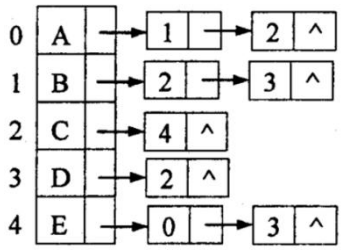
9. There are elements l, 3, 5 in a queue already . At first, in-queue a sequence of 2, 4, 6, 8, 10 in turn, then out-queue 6 times, at last , we can result a sequence _____ out queue. (Give the digit sequence)

10. The two ways to resolve conflicts in hash tables are_____ and separated chaining.

		Do not write in this column
1)	2)	
3)	4)	
5)	6)	
7)	8)	
9)	10)	
		20 marks

Question 3 Answer the Questions **[30 marks, 6 marks for each]**

1. The adjacency table of a known directed graph is shown in the figure. Please answer the following questions:
(1) Draw the graph;
(2) Draw the adjacency matrix of the graph ;
(3) Starting from node A, write the depth first traversal sequence of the graph.



[6 marks]

	Do not write in this column

2. The define of a stack is as following:

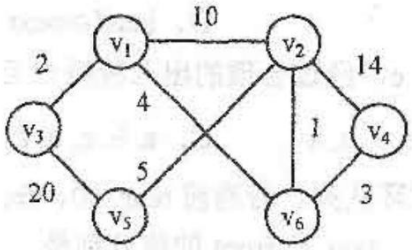
```
typedef struct {
    DataType data[ MaxSize ];
    int  top;
} SeqStack;
SeqStack S;
```

The bottom of the stack is MaxSize-1, please answer the following questions:
(1) Give the expression code to judge the stack is empty
(2) Give the expression code to judge the stack is full?
(3) Give the code to express the operation of putting element X in the stack.

[6 marks]

	Do not write in this column
	6 marks

3. Given the weighted graph G as shown in the following figure, use Dijkstra algorithm to find the shortest path from vertex v1 to other vertices, and list the vertices and path length on each path.



[6 marks]

	Do not write in this column
	6 marks

4. Create a 3 order B-tree from empty, the input sequence is 3,1,4,5,9,2,6,8,7,0
(1) Draw the finally result tree.
(2) Delete node with 0, draw the result tree.
(3) Delete node with 9, draw the result tree.

[6 marks]

	Do not write in this column
	6 marks

5. Read the program and answer the following questions

```
typedef   int   KeyType;
typedef   struct {
      KeyType   key;
      InfoType   otherinfo;
} RecType;
typedef   RecType   SeqList[ MAXSIZE + 1 ];

int f33( SeqList R,   KeyType K,   int low,   int high )
{     int mid;
      while ( low < high )
      {     mid = ( low + high ) / 2;
            if ( R[mid].key >= K )   return f33( R, K, low, mid );
            else   return f33( R, K, mid+1, high );
      }
      if ( R[low].key == K )   return low;
      else return 0;
}
```

Suppose that the elements of a sequence are stored in the array elements, K=7, low=1, high=8.
(1) Sequence keywords are {1, 2, 3, 4, 5, 6, 7, 8). What is the return value of function f33?
(2) Sequence keywords are {7, 7, 7, 7, 7, 7, 7, 7). What is the return value of function f33?
(3) Briefly describe the function of the program.

[6 marks]

	Do not write in this column
	6 marks

Question marking: $\frac{}{6} + \frac{}{6} + \frac{}{6} + \frac{}{6} + \frac{}{6} = \frac{}{30}$

Question 4 Algorithm Design

1. **In-order traversal a binary tree in two ways.**

1) Use recursive method (5 marks);

2) Use iterative method (5 marks)

[10 marks]

	Do not write in this column
	10 marks

2. Dijkstra algorithm may get more than one shortest paths from a same pair of source and destination. Design an algorithm to count the number of different shortest paths from v to w.

[10 marks]

	Do not write in this column
	10 marks

Question marking: $\frac{}{10} + \frac{}{10} = \frac{}{20}$

Do not write in this column

Do not write in this

2022-2023 Rough Working

Do not write in this

2022-2023 Rough Working