A6-R4: DATA STRUCTURE THROUGH C++

अवधि: 03 घंटे
DURATION: 03 Hours

अधिकतम अंक: 100
MAXIMUM MARKS: 100

ओएमआर शीट सं.:
OMR Sheet No.:

रोल नं.:
Roll No.:

उत्तर-पुस्तिका सं.:
Answer Sheet No.:

परीक्षार्थी का नाम:
Name of Candidate: _____

परीक्षार्थी के हस्ताक्षर:
**; Signature of candidate:** _____

PART ONE
(Answer all the questions)

1. **Each question below gives a multiple choice of answers. Choose the most appropriate one and enter in the "OMR" answer sheet supplied with the question paper, following instructions therein. (1x10)**

1.1 Consider a linked list of n elements. The time taken to insert an element after an element pointed by some pointer is

A) O (1)
B) O ($\log_2 n^2$)
C) O (n)
D) O (n $\log_2 n^2$)

1.2 Given the inorder sequence, A, C, E, F, G, H, and the following binary trees,

I.

II.

III.
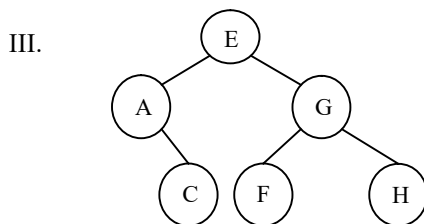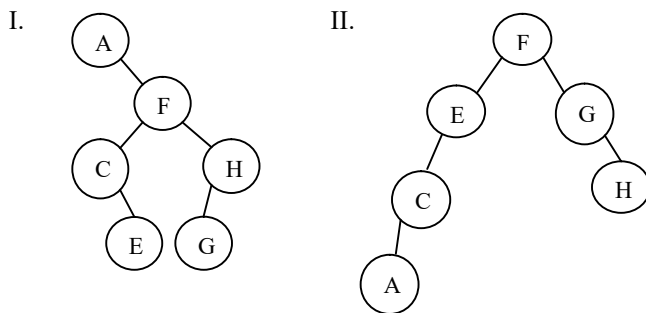
Which of the given trees corresponds exactly with the given inorder sequence:

A) I, II
B) II, III
C) I, II, III
D) None of the above

1.3 Suppose a queue is implemented by a circular array QUEUE [0..11].The number of elements in the queue ,if FRONT =10 and REAR =3,will be

A) 3
B) 4
C) 5
D) 6

1.4 If a node having two children is deleted from a binary search tree, it is replaced by its

A) Inorder predecessor
B) Inorder successor
C) Preorder predecessor
D) None of the above

1.5 The expression + 3 * 2 * / - 3 5 4 2 equals:

A) -1
B) 5
C) 1
D) 0

1.6 The most efficient search technique used in an ordered array is

A) Sequential search
B) Binary search
C) Interpolation search
D) None of the above

1.7 Following the heapify operation on the list: 4, 92, 65, 19, 52, 23, 75, the order (left to right) of the values in the leaves

A) 19, 23, 4, 65, 75
B) 4, 19, 52, 23, 65
C) 4, 19, 23, 65
D) None of the above

1.8 What does the following code segment do?

```
void fn( ){
char c;
cin.get(c);
if (c != '\n') {
fn( );
cout.put(c);}}
```

A) The string entered is printed as it is.
B) The string entered is printed in reverse order.
C) It will go in an infinite loop.
D) It will print an empty line.

1.9 Using linear probing to resolve collision when applying the hash function (key %10) to the following keys: 1, 15, 75, 81, 65, 32, 120, 19, 156, 23, the order of the storage of entries is

A) 1, 15, 19, 23, 32, 65, 75, 81, 120, 156
B) 120, 1, 81, 32, 23, 15, 75, 65, 156, 19
C) 1, 15, 75, 81, 65, 32, 120, 19, 156, 23
D) None of the above

1.10 Consider a list of elements: 3, 24, 29, 55, 78, 62, and 96. The no of interchanges required to sort the list in ascending order using quick sort.

A) 1
B) 0
C) 49
D) 36

ROUGH WORK SPACE:

2. **Each statement below is either TRUE or FALSE. Choose the most appropriate one and enter your choice in the "OMR" answer sheet supplied with the question paper, following instructions therein. (1x10)**

2.1 +AB*/CD-%EF equals (A+B*C)/D-E%F.

2.2 Insertion into a random binary search tree with n nodes requires O(log n) steps, but may degenerate to n steps.

2.3 The searching technique that takes O (1) time to find an element from a set is Linear Search.

2.4 Friend keyword can be used on *main()*.

2.5 The leaves of a B – tree are at the same depth.

2.6 A dequeue is a queue from which items may be deleted at either end and into which elements may be inserted at either end.

2.7 The maximum number of nodes on level 'l' of a binary tree is 2^l-1.

2.8 For a large table of size l, the average number of probes required for a successful retrieval in a table organized using linear rehashing is approximately (2*l – n+1)/(2*l – 2 * n+2), where n = number of items currently in the table.

2.9 The straight selection sort implements the descending priority queue as an unordered array.

2.10 The Heap sort technique is far superior compared to the Quick sort in the worst case.

ROUGH WORK SPACE:

3. **Match words and phrases in column X with the closest related meaning/ word(s)/phrase(s) in column Y. Enter your selection in the "OMR" answer sheet supplied with the question paper, following instructions therein.** (1x10)

	X		Y
3.1	The phenomenon where two keys that hash into different values compete with each other in successive rehashes	A.	Array
3.2	Diagonal of an adjacency matrix has all ones	B.	Front = Rear
3.3	Empty condition in a queue	C.	Graph has self loops
3.4	A digraph in which the out degree equals the in degree	D.	Primary Clustering
3.5	Allows direct access of elements	E.	Symmetric
3.6	Radix sort ['m' digits and 'n' elements]	F.	Internal path ength
3.7	You have to sort a list L consisting of a sorted list followed by a few "random" elements. Which of the following sorting methods would be especially suitable for such a task?	G.	Expert path length
3.8	Sum of all the levels of all the nodes in a binary tree	H.	Balanced
3.9	Merging 4 sorted files containing 50, 10, 25 and 15 records will have time	I.	Graph has parallel edges
3.10	The process of building new classes from existing one	J.	O(m*n)
		K.	O(100)
		L.	Inheritance
		M.	Insertion sort

4. **Each statement below has a blank space to fit one of the word(s) or phrase(s) in the list below. Choose the most appropriate option, enter your choice in the "OMR" answer sheet supplied with the question paper, following instructions therein.** (1x10)

A.	Linear Probing	B.	Stack	C.	$O(\log_2 n)$
D.	Better	E.	14	F.	$2^{(p-1)}$
G.	Worse	H.	$(2^{p+1}-1)$	I.	5
J.	O(1)	K.	Queue	L.	$O(\log_2 \log_2 n)$
M.	1				

4.1 The maximum number of nodes in a binary tree of depth 'p' is _____.

4.2 Time complexity of interpolation search having n elements is _____.

4.3 In the implementation of priority queues using linked lists, insertions at the front can be done in _____ time.

4.4 The _____ function may be applied successively until an empty position is found where an item may be inserted, on the occasion of a hash collision.

4.5 New operators allocate memory blocks from the _____.

4.6 Algorithm A requiring n^2 days is _____ than Algorithm B requiring n^3 secs, to solve a problem, for $n=10^6$.

4.7 The number of binary trees with 3 nodes which when traversed in post order gives the sequence A, B, C is _____.

4.8 The number of swapping needed to sort numbers 8, 22,7,9,31,19,5,13 in ascending order using bubble sort is _____.

4.9 The data structure used in traversing a given graph by breadth first search is _____.

4.10 In a balanced binary tree the height of two sub-trees of every node cannot differ by more than _____.

ROUGH WORK SPACE:

PART TWO
(Answer any FOUR questions)

5.

a) Consider the following set of keys: 26,5,77,1,61,11,59,15,48,19. Perform Insertion Sort to sort the keys and illustrate every step.

b) What is operator overloading? Explain its importance with an example.

c) Define adjacency matrix and adjacency list? Illustrate with an example.

(6+6+3)

6.

a) Given the following connected graph, extract the Minimum Spanning Tree using Kruskal's Algorithm. Show the intermediate steps.
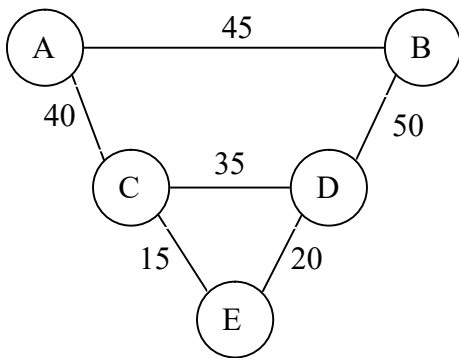
b) Illustrate how a polynomial can be represented using a linked list. Write an algorithm for adding 2 such polynomials.

(8+7)

7.

a) Apply Breadth First Search technique from vertex A on the following graph and show each step.
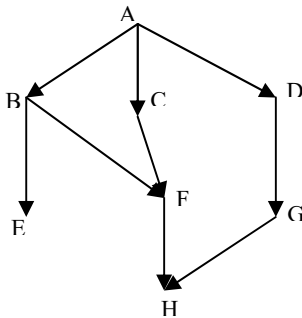
b) Evaluate the following postfix expression using a stack : a+b*(c*(d+e)-f)/g.

c) Let i and j be nonnegative integers, suppose NUM be function defined recursively as

$$NUM(i, j) = NUM(j, i) \qquad if\ I < j$$
$$= i \qquad\qquad\quad if\ j = 0$$
$$= NUM(j, MOD(i, j)) \qquad otherwise$$

Using the above recursive definition, find the values of NUM(5,9) and NUM(10,5). Illustrate the values at each step of recursion.

(5+5+5)

8.

a) Write an algorithm to simulate the deletion of a node, at any position, in a singly linked list. Clearly state assumptions, if any.

b) Write an algorithm to insert, delete and display the elements of a queue.

(8+7)

9.

a) What do you mean by time complexity and space complexity of an algorithm? Suppose you have two functions n^2 and $(2*n+4)$ for various values of n. Determine when second becomes larger than first.

b) Taking an initially empty hash table with 10 locations, with hash function f(x) = x mod 10 and linear probing as the collision resolution mechanism; illustrate what happens when we insert the following keys into it: 15,42,66,25,22,73,44

([4+4]+7)

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ROUGH WORK SPACE: