BRAINWARE UNIVERSITY

Course – BCA

Data Structure and Algorithm (BCAC-202)

(Semester – 2)

Time allotted: 3 Hours **Full Marks: 70**

[The figure in the margin indicates full marks. Candidates are required to give their answers in their own words as far as practicable.]

Group - A

(Multiple Choice Type Question) 10x1=10

1. Choose the correct alternative for the following (*Any ten*) :

i) What is the worst case time complexity of linear search algorithm?
   a) O(1) c) O(n)
   b) O(log n) d) $O(n^2)$

ii) Maximum number of nodes in a binary tree with height k, where root is height 0, is
   a) 2^k-1 c) $2^{k+1}-1$
   b) $2^{k-1}+1$ d) 2^k

iii) A procedure that calls itself is called
   a) illegal call c) reverse polish
   b) recursive d)none of the above

iv) Which of the following searching techniques do not require the data to be in sorted form
   a) binary sort c) interpolation sort
   b) linear sort d) all the above

v) A circular linked list can be used for
   a) stack c) queue
   b) both stack and queue d) none of the above

vi) What is the length of an array we need to represent a binary search tree of depth 5?
   a) 31 c) 63
   b) 15 d) 127

vii) Minimum number of queues required for priority queue implementation?
- a) 5
- b) 3
- c) 4
- d) 2

viii) Which of the following is example of in-place algorithm?
- a) Bubble Sort
- b) Insertion Sort
- c) Merge Sort
- d) All of the above

ix) Re-balancing of AVL tree costs
- a) O(1)
- b) O(n)
- c) O(log n)
- d) O(n2)

x) Stack is used for
- a) CPU Resource Allocation
- b) Recursion
- c) Breadth First Traversal
- d) None of the above

xi) In binary heap, whenever the root is removed then the rightmost element of last level is replaced by the root. Why?
- a) It is the easiest possible way.
- b) To make sure that it is still complete binary tree.
- c) Because left and right subtree might be missing.
- d) None of the above!

Group - B

(Short Answer Type Question) 3x5=15

Answer *any three* questions of the following :

2.

DATA	HAT		CAT	EAT			WAT	BAT	FAT		VAT
LINK	15		4	9			0	3	1		7

a) Draw the Linked List for the given table, where DATA field and LINKED filed are assigned. 1

b) Insert a DATA element 'GAT' in proper alphabet space of English dictionary, with proper link field and re-generate the table. 2

c) Delete a DATA element 'FAT' from the linked list by removing the proper link field and re-generate the table. 2

3. Consider the following list of numbers X={10,12,20,32,39,44,56,65,77}, search the element 65. Describe the procedure by using the binary search algorithm. 5

4. Critically comment with proper example that, every AVL tree is a binary search tree but all the binary search trees need not to be AVL trees. 5

5.	a)	Write the steps to convert the infix string to postfix string	3
	b)	Convert the infix string: X=A+B*C-D*E+F to postfix string by using a Stack.	2
6.	a)	Write two properties of heap data structures.	2
	b)	Write the steps of the deletion of root node operation in heap data structure.	3

Group – C

(Long Answer Type Question) 3x15=45

Answer *any three* questions of the following :

7.	a)	Define binary search tree.	1
	b)	Construct a Binary Search Tree by inserting the following sequence of numbers X= {25, 20, 22, 36, 10, 12, 40, 30, 5, 38, 48, 15, 28, 45, 50, 8, 1}.	5
	c)	Show the array representation by calculating the length of the array.	2+1
	d)	Show the linked list representation of this tree.	3
	e)	Insert an element 39 and delete an element 45 (show by different colour or rewrite the tree).	3
8.		There is an unsorted array of the elements X={4,1,3,2,16,9,10,14,8,7}.	
	a)	Draw a binary tree with the given array elements.	2
	b)	Build the MAX heap for the drawn binary tree.(properly describe by drawing each steps)	5
	c)	Do the heap sort with proper steps and describe the process in brief.	8
9.	a)	Define AVL tree.	1
	b)	How to calculate the balance factor of the nodes of a binary tree. Explain with an example.	3
	c)	Write the nomenclature of the rotations to make an unbalanced tree to a balanced tree?	2
	d)	Construct an AVL tree by inserting numbers from 1 to 8.	9
10.		Write an algorithm / C function to perform the following operations in singly linked list i) Inserting At Beginning of the list ii) Inserting At End of the list iii) Inserting At Specific location in the list	5+5+5

11.	a)	Write the algorithm of Insertion sort.	2
	b)	Consider the following unsorted sequence X= {15, 20, 10, 30, 50, 18, 5, and 45}. Solve this by explaining the procedure.	5
	c)	To sort an unsorted list with **'n'** number of elements how many number of comparisons we need in worst case?	2
	d)	"If the list is already sorted, then it requires **'n'** number of comparisons". - Whether this statement is right or wrong? Justify your answer. Write the average case complexity for insertion sort.	2+1
	e)	What is linear queue data structure? Why we need Circular queue over linear queue	3