

2019

Full Marks : 60

Time : 3 hours

The figures in the right-hand margin indicate marks

Answer all the questions from Sections  
as directed

Section—A

1. Fill in the blanks :  $12 \times 1$
- (a) The basic unit of memory is the \_\_\_\_\_.
  - (b) The \_\_\_\_\_ operation associated with data structure is used to access data elements within a data structure.
  - (c) Definiteness is a criterion of an \_\_\_\_\_.
  - (d) The computing time  $O(\log_2 n)$  is called \_\_\_\_\_.
  - (e) A \_\_\_\_\_ is a variable which contains the address of a memory location of another variable.

(Turn Over)

(2)

- (f) \_\_\_\_\_ stores data in the memory locations row by row.
- (g) In 'C' \_\_\_\_\_ function is used to allocate required memory to pointer variable.
- (h) In \_\_\_\_\_ list one can traverse in both forward and backward directions.
- (i) \_\_\_\_\_ is also called Last In First Out list.
- (j) When inserted node is in the left subtree of left subtree of node A, it is called \_\_\_\_\_ rotation.
- (k) The maximum number of nodes on level  $i$  of a binary tree is \_\_\_\_\_.
- (l) \_\_\_\_\_ notation provides asymptotic lower bound.

2. State True or False of the following :  
12×1

- (a) In a circular list every node is accessible from a given node.
- (b) The stack can contain float, char or any other type of elements.
- (c) B-tree is not a binary tree.

K/9(191)

(Continued)

(3)

- (d) An empty binary tree is an AVL tree.
- (e) Height of any node is the number of edges to the farthest leaf node in left or right subtree.
- (f) A max heap is a complete binary tree.
- (g) Recursion is a library function.
- (h) In nonlinear data structures, the data elements are not in sequence.
- (i) The list with no nodes is called the null list.
- (j) The structure is a user-defined data type.
- (k) The statement `ptr=ptr->next` moves the pointer to the second node.
- (l) The pop operation is related to queue.

## Section—B

3. Answer any four questions of the following : 4×3

- (a) Convert the following infix expression into postfix and prefix expression :

$$(A + B ^ D) / (E - F) + G$$

K/9(191)—400

(Turn Over)

(4)

(b) A two-dimensional array  $x[5][6]$  is stored with base address 201. What is the address of  $x[2][4]$  in (i) column major order and (ii) row major order?

(c) Draw the binary tree using the following inorder and postorder traversal of a binary tree :

Inorder	2	6	7	1	4	8	3	5	9
Postorder	7	6	2	8	4	9	5	3	1

(d) Compare linear search and binary search.

(e) Write an algorithm to traverse a binary tree in preorder.

### Section—C

4. Answer *any four* questions of the following : 4×6

(a) Write a 'C' program for sorting the list of integers using merge sort.

(b) Write an algorithm to insert an element in a queue.

K/9(191)

(Continued)

(5)

(c) What is AVL tree? Insert the following integers to an initially empty AVL tree of integers :

1, 2, 3, 4, 6, 7, 8, 9, 10, 11, 5

(d) Write functions to create doubly linear linked list and traverse it.

(e) Write an algorithm to perform insertion sort.

(f) Write a function to traverse the linear linked list in reverse order.

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K/9(191)—400

Voc (H-3) – BCA (10)

c.  
d. Describe various

Answer all questions

a. Write a function to perform push operation

b. Write a function to

COPYRIGHT RESERVED VOC(H-3) — BCA (10)

DS

2018

Time : 3 hours

Full Marks : 60

Pass Marks : 27

Candidates are required to give their answers in  
their own words as far as practicable.

The figures in the margin indicate full marks.

Answer from all the Sections as directed.

Section – A  
(Compulsory)

$1 \times 12 = 12$

1. Fill in the blanks :

(i) Assuming int is of 4 bytes, the size of  
int arr [15] is 60 bytes

(ii) A binary search tree whose left subtree and  
right subtree differ in height by at most 1 unit  
is called AVL.

(iii) The best case time complexity of bubble sort  
algorithm is  $O(n)$ .

- (iv) The data structure required to evaluate a postfix expression is Stack
- (v) When new data are to be inserted into a data structure, but there is not available space, this situation is usually called overflow.
- (vi) Array data structure cannot store the non-homogeneous data elements.
- (vii) Input restricted deque is the data structure which, allows deletion at both ends of the list but insertion at only one end.
- (viii) Tree data structure is used to represent hierarchical relationship between elements.
- (ix) A linear array does not keep track of address of every element in the list.
- (x) The top value of the stack changes after insertion.
- (xi) The disadvantage in using a circular link list is to get into infinite loop.
- (xii) If the number of records to be sorted is small, then insertion sorting can be efficient.
2. State 'True' or 'False' of the following :  $1 \times 12 = 12$
- T (i) Pointer declaration does not allocate memory for data.
  - F (ii) Nodes that are not root and not leaf are called as internal nodes.
  - T (iii) An empty tree is also binary tree.
  - T (iv) The time complexity of a C program containing single statement is  $O(1)$ .
  - T (v) In a circularly linked list, all nodes are linked in a continuous circle without using NULL.
  - F (vi) If in a matrix most of the elements are nonzero, then it is called sparse matrix.
  - F (vii) Sorting method can be done just using deletion.
  - T (viii) NULL is actually a value, whereas Void is a data type identifier.

UJ - 18/3

(2)

Contd.

UJ - 18/3

(3)

(Turn over)

- ✓ (ix) The amount of memory to be allocated depends on the data type of the variable.
- ✓ (x) The precise sequence of an In-order traversal of a binary tree is visit the left subtree, root and right subtree.
- ✓ (xi) The best case time complexity of merge sort, quick sort and heap sort is  $O(n \log_2 n)$ .
- ✓ (xii) Data structures are applied in simulation and compiler design.

### Section - B

Answer any four questions of the following :

$$3 \times 4 = 12$$

3. ✓ (i) Distinguish between linked list and array. *DS notes*
- ✓ (ii) List-out the areas in which data structures are applied extensively.
- ✓ (iii) Distinguish between a full binary tree and a complete binary tree.
- ✓ (iv) Convert the following prefix expression into infix expression and postfix expression :  
Prefix expression : +++ABCD  $O(n \log n)$

UJ - 18/3

(4)

Contd.

UJ - 18/3 (400)

(5) VOC(H-3) — BCA (10)

- ✓ (v) Draw the binary tree using the following sequence of nodes :

Pre-order : ABDGEHICFJ

In-order sequence : GDBHEIAFJC

### Section - C

Answer any four of the following :  $6 \times 4 = 24$

4. ✓ (i) Write a C program for sorting the list of integers using quick sort.
- ✓ (ii) Write an algorithm to evaluate a postfix expression and evaluate the postfix expression :  $6 \ 3 \ 2 \ 4 \ + \ * \ + \ 5$ .
- ✓ (iii) Write a function to delete the first node of a circular linked list. 0
- ✓ (iv) Write an algorithm to insert an element in a queue.
- ✓ (v) What are the applications of Stack and Queue ? Write a function to perform pop operation in a stack.
- ✓ (vi) Explain, with an example, the Heap sort algorithm.



2017 (D.S.) ~~2017~~

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Answer from ~~all~~ all the Sections as directed.

### Section - A

1. Fill in the blanks of the following :  $1 \times 12 = 12$   

(a) Double link list is also called a two-way chain  
(b) The first element of a link list is pointed by an external pointer  
(c) The elements in a queue are added at rear and removed from front.  
(d) An array occupies continuous memory locations.  
(e) In the postorder traversal the root is processed after the left and right

- (f) When we precede a structure name with struct then it becomes a new type.
- (g) In a circular linked list, the last node contains a pointer to the first node of the list.
- (h) A queue is also known as double linked list because elements can be added to or removed from the front or back.
- (i) Reverse polish notation is the other name of postfix expression.
- (j) Pre-order traversal is also called polish notation.
- (k) The get operator retrieves the level of the variable.
- (l) The pop operation is used to delete the topmost element from the stack.
2. State 'True' or 'False' of the following : 1 x 2 = 12
- (a) Pivot value is associated with Quick sort.
- (b) The execution time of insertion sort is  $O(\log_2 n)$ .
- (c) Queue is static data structure. both
- (d) In min-heap, elements at every node will be greater than its left and the right child.
- (e) In priority queue, two elements with the same priority are processed on FCFS basis.

VT - 2/3

SBI Me (2)  
1/1

Contd.

- 2
- (f) Every node in a linked list contains an integer part and a pointer.
- (g) The degree of root node is always zero.
- (h) A function pointer cannot be passed as a function's calling argument.
- (i) If TOP = NULL, then it indicates that the stack is full and if TOP = MAX, then the stack is empty.
- T (j) The START pointer of the linked list is used as the FRONT.
- (k) Height of an AVL tree is limited to  $O(\log_2 n)$ .
- (l) In B-tree all leaves are on the same level.

#### Section - B

3. Answer any four questions of the following :  $3 \times 4 = 12$

- (a) Discuss the advantages of an AVL tree.
- (b) Differentiate between static data structure and dynamic data structure.
- (c) Convert the following infix expression into prefix expression :
- (i)  $(A + 13) * C$
- (ii)  $(A + B) / (C + D) - (D * E)$
- (d) Define the following :
- (i) Characteristics of algorithm P-67
- (ii) Stable sort

VT - 2/3

(3)

(Turn over)

- (e) Write a program to delete a number from an array that is already sorted in ascending order.

### Section - C

4. Answer any four questions of the following :  $6 \times 4 = 24$

- (a) Write short notes on the following :

(i) Big-Oh Notation P-570, cop 4

(ii) AVL tree P-235

- (b) What do you mean by traversing of tree ?  
What are the different types of tree traversing mode ? Explain in brief. P-214

- (c) Create a binary search tree using the following data elements :

45, 39, 56, 12, 34, 78, 32, 10, 89, 54, 67, 81

- (d) Explain selection sort algorithm with a suitable example.

- (e) Construct a B tree of order 3 for the following data elements :

10, 20, 30, 40, 50, 60, 70, 80

- (f) Write programme to sort an array using insertion sort algorithm. ②



COPYRIGHT RESERVED Voc(H-3) — BCA (10)

APITYA  
ANAND

2016

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Time : 3 hours

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Pass Marks : 27

*Candidates are required to give their answers in their own words as far as practicable.*

*The figures in the margin indicate full marks.*

*Answer all the Sections as directed.*

### Section – A

1. Fill in the blanks of the following :  $1 \times 12 = 12$ 
  - (a) depth of a tree is the total number of edges leading to the farthest node.
  - (b) A binary tree of  $n$  nodes have exactly  $2n - 1$  edges.
  - (c) If the elements of a data structure are not stored in sequential order, then it is a non-linear data structure.

- (d) \_\_\_\_\_ allows random access of data.
- (e) A node that has no successors is called leaf node.
- (f) If FRONT = REAR = NULL, then it indicates the queue is empty.
- (g) Defining a variable means actually allocating memory for it.
- (h) The pointer to any type is of \_\_\_\_\_ size.
- (i) Stack data structure is required to evaluate a postfix expression.
- (j) Dynamic memory is allocated for a data structure by the function malloc.
- (k) In worst case the time complexity of Quick sort is \_\_\_\_\_.
- (l) A full binary tree with n leaves contains  $2^n - 1$  nodes.

2. State 'True' or 'False' of the following :

$$1 \times 12 = 12$$

- (a) A binary search tree is an AVL tree. F

AP - 7/3

(2)

Contd.

- (b) In B-tree of order M, when a new key is to be inserted into a full node, the node is split into two nodes. T
- (c) A deque is double-ended queue. F
- (d) The time complexity for binary search is  $O(\log_2 n)$ . T
- (e) Set newnode → next = start is conditional statement. F
- (f) Stack is also called Last in First out list. T
- (g) A queue can contain objects of different types by using 'C' unions. F
- (h) The element of the queue array is displayed from front to rear. T
- (i) The maximum number of nodes in a binary tree of depth K is  $2^K$  where  $K > 0$ . F  $2^{K-1}$
- (j) A binary search provides a significant speed increase over a linear search. T
- (k) An ordered array slows down insertion process. T
- (l) Deletions are slow in both ordered and unordered arrays. F

AP - 7/3

(3)

(Turn over)

### Section - B

3. Answer any four questions of the following :  
 $3 \times 4 = 12$

(a) Suppose the following numbers are inserted in order into an empty BST :

50 25 75 22 40 60 80 90 15 30

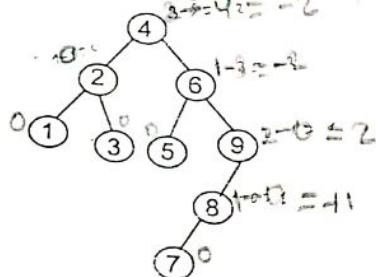
Draw the tree

(b) Convert the following infix expression into postfix and prefix expression

$((A - (B + C)) * D) \uparrow (E + F)$

(c) Distinguish between insertion sort and selection sort.

(d) Consider the following tree :



Compute the balancing factor of all the nodes in the above tree.

AP - 7/3

(4)

Contd.

~~(e) Explain the properties of a binary tree.~~

~~so notes~~

### Section - C

4. Answer any four questions of the following :

$$6 \times 4 = 24$$

~~(a) Insert the following elements in order-5 of B-tree :~~

1, 7, 6, 2, 11, 4, 8, 13, 10, 5, 19, 9, 18, 24, 3.

~~(b) Write an algorithm to insert a node in doubly linked list.~~

~~(c) Write a C program to perform Merge sort.~~

~~(d) Write a functions to perform enqueue operation in a queue.~~

~~(e) Write a function to delete an element at the specified position of an array.~~

~~(f) Write a function to find the height of a tree.~~

AP - 7/3 (500)

(5) Voc(H-3) — BCA (10)

2015 (Q.S.)

Time : 3 hours

15-1

Full Marks : 60

15

Pass Marks : 27

Candidates are required to give their answers in  
their own words as far as practicable.

The figures in the margin indicate full marks.

Answer all the Sections as directed.

### Section - A

1. Fill in the blanks :  $1 \times 12 = 12$

- (a) The height of a binary tree with  $n$  nodes is at least  $n-1$  and at most \_\_\_\_\_.
- (b) Terminal node has a zero degree.
- (c) An ~~empty~~ binary tree is an AVL tree.
- (d) A heap is a balanced binary tree.
- (e) Tree represents hierarchical relationship.
- (f) Stack is also called recursion.

(Turn over)

FY - 2/3

- 2
- (g) The elements in a queue are added at one end called rear.
  - (h) An empty linked list consists of NULL.
  - (i) The root node is visited first in Pre-order traversal.
  - (j) The \_\_\_\_\_ complexity is the amount of memory it needs to run the program.
  - (k) Column manner the elements are stored column by column.
  - (l) Scanning is the process of finding the location of given element in the linear array.

2. State 'True' or 'False' of the following:

$$1 \times 12 = 12$$

- (a) A node that has no successors is called the root node. F
- (b) Modes with at least one child are non-terminal node. T
- (c) A linked list is a dynamic data structure. T
- (d) Queue is static data structure. T
- (e) The pointer field of the last node of the linked list is set to NULL. T

Contd.

(2)

FY - 2/3

13

- The
- 1.
- (f) In B tree all leaves of the tree are on the same level. T
  - (g) A binary tree can be empty whereas a tree cannot. T
  - (h) Insertion sort can be used if the number of elements in set is small. T
  - (i) An ordered array slows down insertion process. T
  - (j) Trees are non-linear data structures. T
  - (k) The depth of a node is the length of the path from the root to that node. T
  - (l) A sequence of consecutive edges are called a path. T

### Section - B

3. Answer any four questions :  $3 \times 4 = 12$

- ~~(a)~~ Construct an expression tree for the expression  $(-b + \sqrt{b^2 - 4ac}) / 2a$ .
- ~~c(b)~~ Write equivalent prefix expression for
- (i)  $(A + B^D) / (E - F) + G$
  - (ii)  $A * (B + D) / E - F * (G + H / K)$

15-4

- (c) Distinguish between array and linked list.  
(d) What is Sparse Matrix ? Give examples.  
(e) Explain characteristics of an algorithm.

### Section - C

4. Answer any four questions of the following :

$$6 \times 4 = 24$$

- (a) Write an algorithm for insertion sort.  
(b) What are various types of tree traversal ?  
(c) Write a C program to delete a node in the linear linked list.  
(d) Write a program to search an element of an array using binary search.  
(e) Write functions to perform push and pop operations in a stack. (using linked list)  
(f) Write a program to perform Quick sort.

FY - 2/3 (400)

(4) Voc(H-3) — BCA (10)

Deha

DS

14-1

2014

Full Marks : 60  
Pass Marks : 27

Time : 3 hours

figures in the right-hand margin indicate marks

Answer all questions

Section-A

B+LFill in the blanks : 12×1

- 1) The formula to calculate the individual array element address is  $B + (I-1) * S$   $B + w \Sigma n (I-1) f (I-1)$
- 2) Row major order stores data in the memory locations row by row.
- 3) Arrays are called data structures and are said to be linear data structures.
- 4) The last node of list contains a special value in the next address field known as NULL.
- 5) Merge sort time complexity (average and worst case) is  $O(n \log n)$ .

360

(Turn Over)

{2}

(f) If queue is empty, then q.front = -1 and q.rear = -1.

(g) Evaluation of arithmetic expression is an application of stack.

(h) It is necessary that link part of the last node in a linked list must contain NUL.

(i) In B-tree all the non-leaf nodes have at least M/2 children and at the most M children.

(j) The root node of the tree has level 0.

(k) An array of characters is often called a string.

(l) The queue is empty when both front and rear are set to -1.

2. State True or False of the following :

(a) The size of array can't be changed after its declaration. F

(b) Binary search tree does not allow duplicate values. T

(c) A nonempty binary tree is an AVL tree iff given  $|H_L - H_R| \leq 1$ . F

K/4(9)

(Conti)

- (d) In B-tree all leaves are on the same level.  $\checkmark$
- (e) The queue cannot contain float data type of elements.  $\times$
- front*      *rear*  
The condition of circular queue function is front = rear + 1.  $\checkmark$
- (g) The degree of root node is always zero.  $\times$
- (h) In strictly binary tree, the degree of every node is either 0 or 2.  $\checkmark$
- (i) A node is a parent node, if it has successor nodes.  $\checkmark$
- (j) passwd command is used to display and change the password.  $\checkmark$
- (k) The time complexity of binary search is  $O(\log n)$ .  $\times$   $O(n \log n)$
- (l) A linked list is a linear collection of self-referential structures, called nodes, connected by pointer links—hence, the term ‘linked’ list.

## Section-B

3. Answer any four of the following :

- (a) A two-dimensional array arr[5][6] is stored with base address 201. What is the address of arr[2][4] in column major order and row major order?

K/4(9)—360

(Turn)

( 4 )

- (b) Write preorder, inorder and postorder traversal algorithm for a binary tree.
- (c) Write programs to insert, delete and locate an element on a sorted list using pointers.
- (d) Write a program to merge two sorted lists.
- (e) Write short notes on any two of the following:
- (i) Circular queue *tution notes*
  - (ii) Doubly linked list //
  - (iii) B-tree
  - (iv) Quicksort

## SECTION—C

4. Answer any four of the following:  $6 \times 4 = 24$ 

- (a) Consider the following arithmetic expression in postfix notation

$$7\ 5\ 2\ +\ *4\ 1\ 5\ -\ /$$

- (i) Obtain the value of it.
- (ii) Find prefix form of the above.
- (iii) Obtain the value of prefix form expression from it.

- (b) Find  $Q(5, 3)$  and  $Q(15, 2)$  for the recursion  $Q(J, K)$  defined as:

$$Q(J, K) = 5 \quad \text{if } J < K$$

$$Q(J, K) = Q(J-K, K+2) \quad \text{if } J \geq K$$

(Contd.)

MS.

MSA-300/80

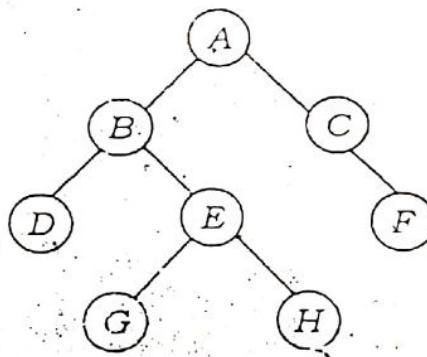
$$\begin{aligned}
 & Q(5, 3) = Q(5-2, 3+2) = Q(3, 5) \\
 & Q(3, 5) = Q(3-2, 5+2) = Q(1, 7) \\
 & Q(1, 7) = Q(1-2, 7+2) = Q(-1, 9) \\
 & Q(-1, 9) = 5
 \end{aligned}$$

~~(c)~~ Write an algorithm for concatenation of two given strings

~~(d)~~ Write an algorithm SWAP (INFO, LINK, START, K) which interchanges the Kth and K + 1st elements in the list without changing any values in INFO.

~~(e)~~ Write an algorithm for insertion and deletion of an element in the queue.

~~(f)~~ From the given binary Tree T in the figure below :



~~(i)~~ Find the leaf nodes of T.

~~(ii)~~ List the nodes of the tree T in preorder, inorder and postorder.

~~(iii)~~ What is the depth of this binary tree T?

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2013

13-1

BCA

Full Marks : 60  
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Figures in the margin indicates full marks.

Answer all questions.

## SECTION - A

1. Fill in the blanks

- (a) Doubly linked list contains ... ~~for~~ ... 2 ..... pointers  $1 \times 12 = 12$   
 (b) Tree is a ~~non linear~~ list. ~~non-linear~~ / Random  
 (c) Worst case time complexity is represented by ... ~~O(D)~~ ... Big O  
 (d) Time complexity of Binary search is ... ~~O(log n)~~ .....  $O(\log n)$   
 (e) Recursion require ... ~~stack~~ ... for implementation.  
 (f) Queue is a ..... ~~linear~~ ..... list.  
 (g) The worst case time complexity of insertion sort is ... ~~O(n^2)~~ ...  $O(n^2)$   $O(n)$   
 (h) Queue support ... ~~enqueue~~ ..... and ... ~~dequeue~~ .. operations.  
 (i) AVL tree is also called as ~~Balanced Height Balanced Tree~~ .....  
 (j) B-tree is called ~~Balanced M-way~~ tree. ~~Balanced Search Tree~~  
 (k) Binary tree can be represented through ... ~~array~~ ..... and ... ~~linked list~~ .....  
 (l) Two types of heap can be ... ~~Max heap~~ and ... ~~Min heap~~ .....

2. State TRUE or FALSE

$1 \times 12 = 12$

- (a) Binary Search Algorithm is efficient for small set of numbers. ~~F~~  
 (b) PUSH operation check whether stack is full or hot. ~~T~~  
 (c) Nodes in full Binary tree can be calculated easily. ~~T~~  
 (d) Dequeue is also called as Double Ended Queue. ~~F~~

- ~~(e)~~ Time complexity of Quick sort is logarithmic. ~~F~~ T
- ~~(f)~~ Binary Search tree is Unordered binary tree. F
- ~~(g)~~ Balance Factor in AVL tree is calculated as +2 to -2. F
- ~~(h)~~ Merge sort uses Divide & Conquer method. T
- ~~(i)~~ Stack is a linear data structure. T
- ~~(j)~~ Bubble sort has time complexity  $O(n)$ . ~~T~~  $n \in O(n)$
- ~~(k)~~ Queue can be used as Abstract Data type. ~~F~~ F
- ~~(l)~~ Binary Tree has three pointers in each node. F

### SECTION - B

3. Answer any four of the following

$3 \times 4 = 12$

- ~~(a)~~ Write Algorithm for insertion sort along with example.
- ~~(b)~~ Write a program using function to find whether a string is palindrome or not.
- ~~(c)~~ Write a function to reverse a given linked list. *Tuition notes*
- ~~(d)~~ Write a program to Multiply two Matrices of different order.
- ~~(e)~~ Create AVL tree for following:  
15 30 20 10 40 60 25 18
- ~~(f)~~ Write a function to insert an element in a Queue.

### SECTION - C

4. Answer any four of the following:-

$6 \times 4 = 24$

- ~~(a)~~ Write a program to create, display, insert a node in circular linked list.
- ~~(b)~~ Write Algorithm to sort numbers using Quick sort with example.
- ~~(c)~~ Create Binary Search Tree of given numbers:  
2 5 15 10 9 8 18 7 12 13
- ~~(d)~~ Write a program to search value through Binary Search.
- ~~(e)~~ Explain Stack. What are operations applicable to stack. Explain various applications of Stack. Write Algorithm for PUSH & POP operation. *Tuition notes*
- ~~(f)~~ Explain with example storage representation of Binary tree. What is Complete Binary tree.  
*copy*

2012

BCA

## TENTH PAPER

Full Marks : 60Pass Marks : 27Time : 3 hours

*The figures in the margin indicate full marks  
for the questions*

*Answer all questions*

*Candidates are required to give their answers in their  
own words as far as practicable*

## SECTION—A

1. Fill in the blanks

 $1 \times 12 = 12$ 

- (a) The memory address of the first element of an array is called base address
- (b) A node in a singly linked list contains a data element and a pointer reference
- (c) The data structure that allows the access of only the most recently stored data at any given time is called queue

12SA—500/196

(Turn Over)

- (a) A dynamically implemented stack uses linked list data structure for storage.
- (b) Non-homogeneous data elements can be stored in " data structure. structure
- (c) The data structure used for recursive calculation is stack.
- (d) A tree in which every node has a maximum of two branches is called a full binary tree.
- (e) In a circular linked list, the last node points to first.
- (f) A queue is empty if its front end does not have any element.
- (g) In every node of a doubly linked list there are two pointers.
- (h) The maximum number of children that can exist for a node is called the degree of that node.
- (i) In a binary tree, a leaf is a node without any child.

## 2. State True or False :

$1 \times 12 = 12$

- (a) A linked list has indexed structure. F
- (b) Data elements in a linked list need not be stored in adjacent memory spaces. T

(c) Pointers store the next data element in a list.  F

(d) Binary search algorithm cannot be applied to sorted linked list.  T

(e) A circular header linked list is a two-way list.  F

(f) Stacks are FIFO lists.  F

(g) A data structure where elements can be added or removed at either ends but not in the middle is called a deque.  F T

(h) Array elements can be stored in random memory locations.  F

(i) Stacks are used for parsing arithmetic expressions.  T

(j) The push operation is used to insert an element in a stack.  T

(k) The elements of a static list are stored in successive locations.  T

(l) A full binary tree with 7 nodes contains 3 non-leaf nodes.  T

$$L = \frac{N+1}{2}$$

( Turn Over )

## SECTION-B

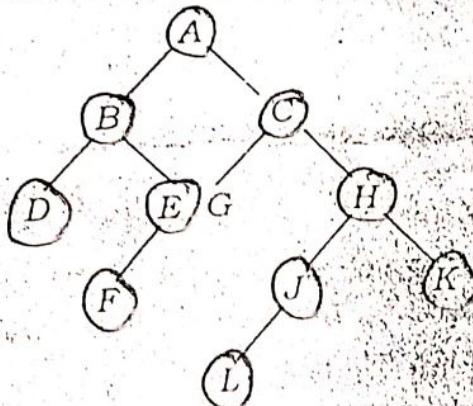
3. Answer any four of the following :  $3 \times 4 = 12$

- (a) Define data and data structure. What do you understand by a primitive data structure? List the primitive data structures in C. Also give an example for creating and using a non-primitive data structure.
- (b) Write a program in C to create and initialize a three-dimensional array of integers ( $3 \times 3 \times 3$ ) and then print it row-column-layerwise.
- (c) Write a program to enter an ASCII string of maximum 80 characters. Define function for finding the length of that string.
- (d) Write a program to enter 10 integers from keyboard and arrange them in descending order using bubble sort algorithm.
- (e) Write a program in C to create and initialize a 256-byte stack. Write functions for PUSH and POP operations for 2-byte data (Integer).
- (f) Write a program to read name, age, class and marks of maximum 10 students and store them as a database.

## SECTION C

4. Answer any four of the following. 6x4=24

- (a) What is a doubly linked list? Write a set of functions to create a doubly linked list, to obtain total number of nodes, to traverse  $n$  steps left and  $m$  steps right.
- (b) Discuss the implementation of queue using linked lists. Give a program to illustrate your answer. Include functions to remove and add items to a queue and issue warning if the queue is full.
- (c) Write down algorithm for selection sort and comment on its complexity.
- (d) What is pre- and post-order traversal? Consider this binary tree. Give sequences for (i) pre-order traversal and (ii) post-order traversal :



- (e) Distinguish between FIFO and LIFO. Give two examples for each.

(Turn Over)

( 6 )

(f) Write short notes on any two of the following :

- (i) Recursion and stacks
- (ii) Binary search tree
- (iii) Data, information and knowledge
- (iv) Limitations of sequential searching

\* \* \*

2011

DS

BCA

## TENTH PAPER

Full Marks : 60Pass Marks : 27

Time : 3 hours

*The figures in the margin indicate full marks  
for the questions*

Answer all questions

*Candidates are required to give their answers in their  
own words as far as practicable*

## SECTION—A

1. Fill in the blanks :

 $1 \times 12 = 12$ 

- (a) Data structure defined at logical level is called — ADT (Abstract Data type)
- (b) DS refers to the collection of computer variables that are connected in some specific manner.

(Turn Over)

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(c) One example of structured data type can be System defined data type

(d) A recursive function can be implemented using Stack data structure.

(e) Array has elements of Linear data type.

(f) A data structure is said to be Linear if its elements form a sequence.

(g) A 2-dimensional array is also called matrix.

(h) If elements of a row are stored next to one ~~row~~ <sup>row major</sup> another, the array is said to be stored in ~~row~~ <sup>row major</sup> ~~column~~ <sup>column</sup> wise.

(i) The next address field is known as Pointer / Link.

(j) List pointer variable contains the address of next pointer.

(k) Push operation in stack may result in overflow.

(l) A stack may be represented by a linear linked list.

## 2. State True or False :

(a) A data type is the collection of values and the set of operations on values. T

(b) Recursive functions must be called directly. T

- (c) Pointer is used to initialize list as empty list.  $\text{F}$
- (d) Pointer is used to provide the linear order in linked list.  $\text{T}$
- (e) Push operation in stack is performed at the rear end.  $\text{F}$
- (f) A stack may be represented by a linear linked list.  $\text{T}$
- (g) Queue is a useful data structure for any simulation applications.  $\text{T}$
- (h) Queues are often referred to as Last In First Out data structure.  $\text{F}$
- (i) Every tree can be uniquely represented by a binary tree.  $\text{F}$
- (j) In a tree, a node with no sub-tree is called a leaf node.  $\text{T}$
- (k) In an AVL tree, left and right sub-trees will always have the same height.  $\text{T} \text{ F}$
- (l) Insertion sort is also called bubble sort.  $\text{F}$

## SECTION-B

 $3 \times 4 = 12$ 

3. Answer any four of the following

- (a) What is a data structure and what are the differences between data type, abstract data type and data structure?
- (b) Write a program in C to find the maximum and second maximum from an array of integers.
- (c) Write a program in C that reads the name, age and salary of 10 persons and maintains them in a linked list stored by name.
- (d) Write an algorithm which, upon user's choice, either pushes or pops an element from the stack implemented as an array. (The elements are not shifted after a push or pop.)
- (e) Write short notes on any two of the following :
- (i) AVL tree
  - (ii) Heap sort *both features of alg.*
  - (iii) Pointers
  - (iv) Applications of stack

## SECTION - C

4. Answer any four of the following : 6x4=24

(a)

Determine what the following recursive C function computes. Write an iterative function to accomplish the same purpose.

```
Int func(int n)
{
    If(n==0)
        return 0;
    return(n + func(n - 1));
}
```

(b)

There are two arrays A and B. A contains 25 elements, whereas B contains 30 elements.

~~not  
Solve  
may be wrong~~

Write a function to create any array C that contains only those elements that are common to A and B.

(c)

Consider the following stack, where STACK is allocated  $N = 6$  memory cells :

STACK : AAA, DDD, EEE, FFF, GGG ...

Describe the stack as the following operations take place :

(i) PUSH(STACK, KKK)

(ii) POP(STACK, ITEM)

(iii) PUSH(STACK, LLL)

(iv) PUSH(STACK, SSS)

( 6 )

(v) POP(STACK, ITEM)

(vi) PUSH(STACK, TTT)

[Consider the overflow condition.]

(d) Write an algorithm to determine if a binary tree is—

(i) strictly binary tree,

(ii) complete binary tree.

(e) Compare bubble sort with insertion sort and find out which one is preferable.

(f) Suppose an array is declared as follows :

Char A[U<sub>1</sub>] [U<sub>2</sub>] ... [U<sub>m</sub>]

If this array is stored in 'column' major fashion, then what is the addressing formula for the element

A[i<sub>1</sub>] A[i<sub>2</sub>] ... A[i<sub>m</sub>] ?

\*\*\*

A[i<sub>1</sub>] + m \*

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## TENTH PAPER

Full Marks : 60Pass Marks : 27

Time : 3 hours

*The figures in the margin indicate full marks  
for the questions*

There are three Sections of the question paper A, B and C in which Section—A is compulsory

*Candidates are required to give their answers in their own words as far as practicable*

## SECTION—A

1. Fill in the blanks  $1 \times 12 = 12$

(a) A \_\_\_\_\_ is a list of a finite number of homogeneous data elements.

*linked list*

(b) A \_\_\_\_\_ is a linear collection of data elements called nodes, where the linear order is given by means of \_\_\_\_\_.

*Postfix*

(c) \_\_\_\_\_ refers to the notation in which the operator is placed after its two operands.

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- (d) A ~~linear~~<sup>D-q e v e</sup> list is a linear list in which elements can be added or removed at either end but not in the middle.
- (e) The memory address of the first element of an array is called ~~base address~~
- (f) The complexity of bubble sort algorithm is  $O(n^2)$
- (g) The indirect change of the values of a variable in one module by another module is called function calling
- (h) The data structure which cannot store the non-homogeneous data elements is ~~linked~~ array
- (i) The operation of processing each element in the list is known as Traversal
- (j) Finding the location of the element with a given value is Searching
- (k) Two main measures for the efficiency of an algorithm are Best case and worst case
- (l) ~~array~~ are best data structure for relatively permanent collection of data.

2. State True or False :  $1 \times 12 = 12$ 

- (a) Trees are linear data structure. F.
- (b) ~~Deque~~ is a data structure where elements cannot be added or removed at either end but in the middle. T

{Continued)}

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( 3 )

- (c) The term push and pop operation is related to the queue. F
- (d) The situation when in a linked list START = NULL is underflow. F T
- (e) Finding the location of the elements with a given value is traversal. F your choice
- (f) The complexity of binary search algorithm is  $O(n)$ . F  $O(\log n)$
- (g) The time complexity of bubble sort algorithm is  $O(n \log n)$ . F  $O(n^2)$
- (h) The operation of processing each element in the list is known as sorting. F your choice
- (i) The average case occur in linear search algorithm when item is somewhere in the middle of the array. T
- (j) The data elements in linked list need not be stored in adjacent space in memory. T
- (k) The linked lists are collection of the nodes that contain information part and next pointer. T
- (l) The pointers store the next data elements of a list. F

## SECTION-B

3. Answer any four of the following :  $3 \times 4 = 12$ 

- (a) Write an algorithm to reverse all the elements in a queue.

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( Turn Over )

( 5 )

- (b) Write preorder, inorder and postorder traversal algorithm for a binary tree.
- (c) Write programs to insert, delete and locate an element on a sorted list using pointers.
- (d) Write a program to merge two sorted lists.
- (e) Write short notes on any two of the following:
- (i) Circular queue
  - (ii) Doubly linked list
  - (iii) B-tree
  - (iv) Quicksort

SECTION—C

4. Answer any four of the following  $6 \times 4 = 24$

- (a) Consider the following arithmetic expression in postfix notation:
- $$7\ 5\ 2\ +\ * \ 4\ 1\ 5\ -\ / -$$
- (i) Obtain the value of it.
  - (ii) Find prefix form of the above.
  - (iii) Obtain the value of prefix form expression from it.

- (b) Find  $Q(5, 3)$  and  $Q(15, 2)$  for the recursion  $Q(J, K)$  defined as :

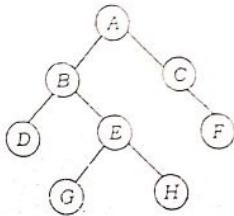
$$Q(J, K) = 5 \quad \text{if } J < K$$

$$Q(J, K) = Q(J-K, K+2) \quad \text{if } J \geq K$$

(Continued)

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- (c) Write an algorithm for concatenation of two given strings
- (d) Write an algorithm SWAP (INFO, LINK, START, K) which interchanges the Kth and K + 1st elements in the list without changing any values in INFO.
- (e) Write an algorithm for insertion and deletion of an element in the queue.
- (f) From the given binary Tree T in the figure below :



- (i) Find the leaf nodes of T.
- (ii) List the nodes of the tree T in preorder, inorder and postorder.
- (iii) What is the depth of this binary tree T?

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BCA—X-Part-III