

# MISCELLANEOUS

## Short Answer Type Questions

- a) Describe a string reversal algorithm.  
 b) What is difference between Union & Structure?

Answer:

- a) The C code is given below:

```
void reverse(char *str) {
    char *end = str;
    char tmp;

    if (str) {
        while (*end) {
            ++end;
        }
        --end;
        while (str < end) {
            tmp = *str;
            *str++ = *end;
            *end-- = tmp;
        }
    }
}
```

[WBUT 2012, 2015]  
 [WBUT 2012]

In the above code, in the innermost while loop in each iteration, the characters pointed to by str and end get swapped, str gets incremented to point to the next character, and end is decremented to point to the previous one.

- b) The differences between structure and union:

1. Union allocates the memory equal to the maximum memory required by the member of the union but structure allocates the memory equal to the total memory required by the members.

2. In union, one block is used by all the member of the union but in case of structure, each member has their own memory space.

While structure enables us treat a number of different variables stored at different in memory, a union enables us to treat the same space in memory as a number of different variables. That is a Union offers a way for a section of memory to be treated as a variable of one type on one occasion and as a different variable of a different type on another occasion. There is frequent requirement while interacting with hardware to access a byte or group of bytes simultaneously and sometimes each byte individually. Usually union is the answer.

**Long Answer Type Questions**

1. a) Write an algorithm to solve the Tower of Hanoi problem. Also calculate the time complexity of your algorithm. [WBUT 2007, 2013]

OR,

Write the Pseudocode or C code to implement Tower of Hanoi problem. Also find the complexity of your procedure. [WBUT 2014]

**Answer:**

Tower of Hanoi(n, source, auxiliary, destination)

```
{ If n=1 move disk from source to destination; (base case)
```

Else,

```
{ Tower of Hanoi(top n-1, from, to, using);
```

```
    Move the nth disk from 'from' to 'to';
```

```
    Tower of Hanoi(n-1, using, from, to);
```

}

First recursive call moves n-1 disks from 'from' to 'using' using 'to'. So after that call n-1 disks are in 'using' peg in order of size and the 'from' peg contains the nth disk i.e., the largest one. So, now move that disk from 'from' peg to 'to' peg. Then again by the 2<sup>nd</sup> recursive call move n-1 disk from 'using' peg to 'to' peg using 'from' peg. So, after all these, 'to' peg contains all disks in order of size.

Let the time required for n disks is T(n).

There are 2 recursive call for n-1 disks and one constant time operation to move a disk from 'from' peg to 'to' peg. Let it be k<sub>1</sub>.

Therefore,

$$T(n) = 2 T(n-1) + k_1$$

$$T(0) = k_2, \text{ a constant.}$$

$$T(1) = 2 k_2 + k_1$$

$$T(2) = 4 k_2 + 2k_1 + k_1$$

$$T(2) = 8 k_2 + 4k_1 + 2k_1 + k_1$$

Coefficient of k<sub>1</sub> = 2<sup>n</sup>

Coefficient of k<sub>2</sub> = 2<sup>n</sup>-1

Time complexity is O(2<sup>n</sup>) or O(a<sup>n</sup>) where a is a constant greater than 1. So, it has exponential time complexity.

b) Write the recursive function for the Tower of Hanoi problem. Also draw the recursion tree for any set of initial values. [WBUT 2007, 2010]

Write a recursive algorithm to solve tower of Hanoi problem.

OR,

[WBUT 2015]

**Answer:**

```
/* C function
void solveTower()
{
    if (count == 0)
        printf("Move");
    else {
        solveTower();
        solveTower();
        solveTower();
    } // end
} // end so
Recursive tree w
```

2 solveT

3 solveTowers(1,

4 solve

2. Write short note

- a) Index sequential
- b) Tail recursion

**Answer:**

- a) Building Index

The additional entries in file (as compared to

Length of Key Field

Record Address Type

with record keys

Type of File Organization

The records written

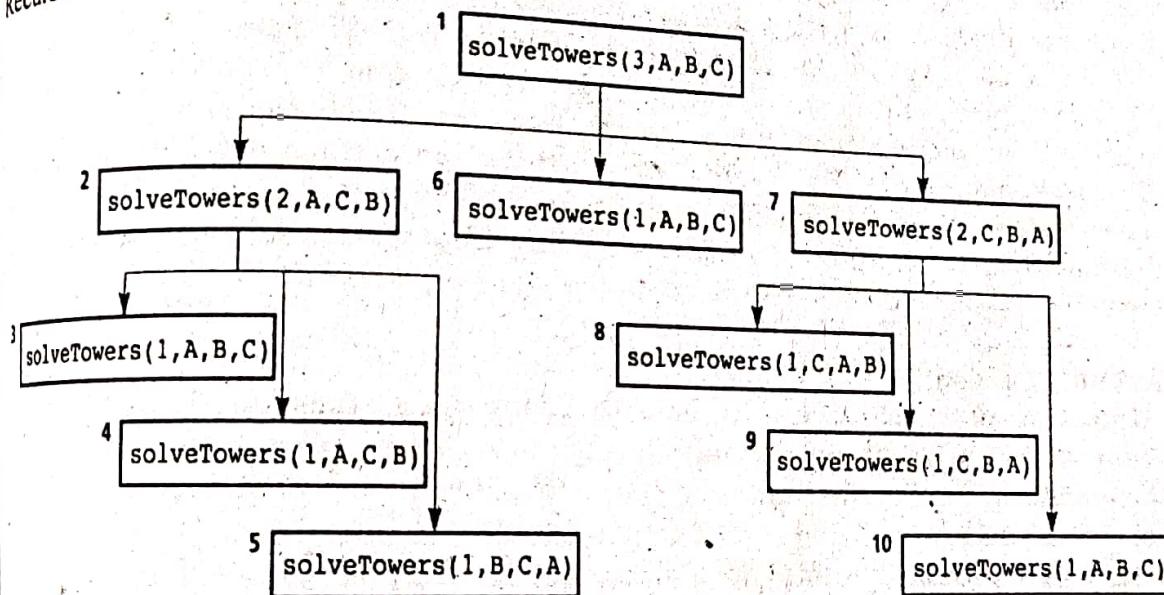
ascending key sequence

```

Answer:
/* c function */
void solveTowers(int count, char source,
                 char destination, char spare) {
    if (count == 1) {
        printf("Move top disk from pole" + source +
               "to pole" + destination);
    } else {
        solveTowers(count-1, source, spare, destination); // X
        solveTowers(1, source, spare, destination); // Y
        solveTowers(count-1, spare, destination, source); // Z
    } // end if
} // end solveTowers

```

Recursive tree with n = 3.



2 Write short notes on the following:

- a) Index sequential file ordering
- b) Tail recursion

[WBUT 2010, 2014]  
[WBUT 2018]

**Answer:**

**a) Building Indexed-Sequential Files:**

The additional entries required on the File specification for an output Indexed-Sequential File (as compared to an ordinary sequential output file) are:

Length of Key Field (columns 29-30)

Record Address Type (column 31) should contain K to specify that records are accessed with record keys.

Type of File Organization (column 32)-should contain I, to specify Indexed-Sequential organization.

The records written to the Indexed-Sequential file being built must be written in ascending key sequence. If an attempt is made to write a record with a key equal to or

## POPULAR PUBLICATIONS

less than the key of the record previously written to the file, H0 will be set on and the program will terminate abnormally.

### **Processing Indexed-Sequential Files Sequentially**

There are no additional entries required beyond those listed above (for building Indexed-Sequential files) in order to process an Indexed-Sequential file in its entirety. A sequentially processed file may be used as input (I in column 15 on the File specification) or update (U in column 15). If processed as an update file, records from the file may be updated at either detail or total time. The record available for updating is the record read on the previous input cycle.

### **Processing Indexed-Sequential Files by Chaining**

From one to nine Indexed-Sequential files may be processed by the use of record key fields specified as chaining fields. A data field in an input record is designated as a chaining field by placing the chaining field identifier (C1, C2, C3, ... C9 in columns 61-62 of the Input specification). Each chaining field must also be included on an Extension specification which functions to link the chaining file to the chained file. During the input cycle, the record key(s) contained in one or more chaining fields are used to retrieve the corresponding record(s) from the Indexed-Sequential file specified on the Extension specification. Chaining is the only circumstance in which more than one record identifying indicator may be on during a single cycle.

#### **b) Tail recursion:**

A function call is said to be tail recursion if there is nothing to do after the function returns except return its value. Since the current recursive instance is done executing at that point, saving its stack frame is a waste. Specifically, creating a new stack frame on top of the current, finished, frame is a waste. A compiler is said to implement Tail recursion if it recognizes this case and replaces the caller in place with the callee, so instead of nesting the stack deeper, the current stack frame is reused. This is equivalent in effect to a "GOTO", and lets a programmer write recursive definitions without worrying about space inefficiency during execution. Tail recursion is as efficient as iteration.

1. Answer any  
i) The number  
using bubble s  
a) 11

ii) Binary search  
a) divide a  
c) heuristic

iii) The following  
push(2), pop, p  
✓ a) 2, 2, 1

iv) The postfix e  
✓ a) ab + c

v) Adjacency ma  
a) unit matr  
c) asymmetri

vi) Which of the  
✓ a) Quadra  
c) open add

vii) Linked list is  
a) insertion  
✓ c) binary s

viii) Number of a  
a) 13

ix) If the inorder a  
G, H, C respectiv  
a) D, F, G, A  
c) C, G, H, F

x) The heap (repr  
17 is –

a) 60, 80, 55,  
c) 80, 60, 30,

## QUESTION 2014

### GROUP - A (Multiple Choice Type Questions)

1. Answer any ten questions:

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

a) 11

b) 12

c) 13

✓ d) 14

ii) Binary search uses

- a) divide and reduce strategy
- c) heuristic search

- ✓ b) divide and conquer strategy
- d) both (a) and (b)

iii) The following sequence of operations is performed on a stack: push(1), push(2), pop, push(1), push(2), pop, pop, pop, push(2), pop. The sequence of popped out values are

✓ a) 2, 2, 1, 1, 2

b) 2, 2, 1, 2, 2

c) 2, 1, 2, 2, 1

d) 2, 1, 2, 2, 2

iv) The postfix expression for \* + a b - c d is

✓ a) ab + cd - \*

b) ab cd + - \*

c) ab + cd \* -

d) ab + - cd \*

v) Adjacency matrix for a digraph is –

a) unit matrix

✓ b) symmetric matrix

c) asymmetric matrix

d) none of these

vi) Which of the following is a hash function?

✓ a) Quadratic probing

b) chaining

c) open addressing

d) folding

vii) Linked list is not suitable data structure for which one of the following problems?

a) insertion sort

b) radix sort

✓ c) binary search

d) polynomial addition

viii) Number of all possible binary trees with 4 nodes is –

a) 13

b) 12

✓ c) 14

d) 15

ix) If the inorder and preorder traversal of a binary tree are D, B, F, E, G, H, A, C and A, B, D, E, F, G, H, C respectively then, the postorder traversal of that tree is –

a) D, F, G, A, B, C, H, E

b) F, H, D, G, E, B, C, A

c) C, G, H, F, E, D, B, A

✓ d) D, F, H, G, E, B, C, A

x) The heap (represented by an array) constructed from the list of numbers 30, 10, 80, 60, 15, 55, 17 is –

a) 60, 80, 55, 30, 10, 17, 15

✓ b) 80, 55, 60, 15, 10, 30, 17

c) 80, 60, 30, 17, 55, 15, 10

d) none of these

## POPULAR PUBLICATIONS

- xi) In array representation of Binary tree, if the index number of a child node is 6 then the index number of its parent node is:
- a) 2
  - b) 3
  - c) 4
  - ✓ d) 5

xii) BFS constructs

- ✓ a) a minimal cost spanning tree of a graph
- b) a depth first spanning tree of a graph
- c) a breadth first spanning tree of a graph
- d) none of these

### GROUP - B

#### (Short Answer Type Questions)

2. Differentiate between Linear and Non Linear data structures? Give two examples of each.  
See Topic: INTRODUCTION, Short Answer Type Question No. 10.

3. Write an algorithm to find the largest and smallest element in a single linear list.

See Topic: LINKED LIST, Short Answer Type Question No. 9.

4. a) Suppose one 2-D array is initialized as int a [5][7]; Base address is 4000. Find the location of element a [2][4] in row major form and column major form.

b) Define Sparse Matrix.

See Topic: INTRODUCTION, Short Answer Type Question No. 12.

5. a) Prove that the maximum no. of nodes in a binary tree of depth k is  $2^k - 1$ .

b) What are the characteristics of algorithm?

a) See Topic: TREES, Short Answer Type Question No. 12.

b) See Topic: INTRODUCTION, Short Answer Type Question No. 11.

6. Draw a minimum heap tree from the list below:

12, 11, 7, 3, 10, -5, 0, 9, 2

Now do the heap sort operation over the heap tree.

See Topic: SORTING & HASHING, Short Answer Type Question No. 6.

### GROUP - C

#### (Long Answer Type Questions)

7. a) Represent the given polynomial using a link list.

$$3x^4 + x^2 - 5x + 2$$

b) Write the pseudo code / C code for adding two polynomials (already given by user, no need to take input). Also comment on the complexity of your algorithm.

c) Write the Pseudocode or C code to implement Tower of Hanoi problem. Also find the complexity of your procedure.

a) & b) See Topic: LINKED LIST, Long Answer Type Question No. 3(a) & (b).

c) See Topic: MISCELLANEOUS, Long Answer Type Question No. 1(a).

8. a) Insert the following number into a binary search tree in the order that they are given and draw the resulting tree.

87; 36; 22; 15; 56; 85; 48; 91; 72; 6

Delete 48 and draw the resulting tree. Delete 15 and draw the resulting tree.

## DATA STRUCTURE & ALGORITHM

- b) Write an algorithm to insert an element into binary search tree.  
i) See Topic: TREES, Long Answer Type Question No. 10.  
ii) See Topic: TREES, Long Answer Type Question No. 1.
- g) a) Define sorting.  
b) What is a stable sorting? What is In-Place sorting?  
c) Write the Pseudocode for Merge sort implementation. What is its time complexity?  
d) If the existing array is sorted and you want to insert a new element in the list without disrupting the sortedness then which sorting technique you should use? Why?  
e) What is Hashing?  
f) b, c) & d) See Topic: SORTING & HASHING, Long Answer Type Question No. 10.  
g) See Topic: SORTING & HASHING, Short Answer Type Question No. 2.

10. a) Show the stages in growth of an order -4B- Tree when the following keys are inserted in the order given:

84 82 29 97 61 10 45 28 49 70 86 68 19 55 22 11 55 77 16

b) How does an AVL tree differ from a binary search tree? Insert the following keys in the order given below to build them into an AVL tree:

8 12 9 11 7 6 66 2 1 44

Clearly mention different rotation used and balance factor of each node.

c) Write the Prim's algorithm for finding MST from a graph.

d) See Topic: TREES, Long Answer Type Question No. 11.

e) See Topic: GRAPHS, Short Answer Type Question No. 4.

11. Write short notes on any three of the following:

- a) Radix Sort
- b) Index sequential File Organization
- c) DFS in graph
- d) Interpolation search
- e) Threaded binary tree

i) See Topic: SORTING & HASHING, Long Answer Type Question No. 15(a).

ii) See Topic: MISCELLANEOUS, Long Answer Type Question No. 2(a).

iii) See Topic: GRAPHS, Long Answer Type Question No. 3(d).

iv) See Topic: SORTING & HASHING, Long Answer Type Question No. 15(c).

v) See Topic: TREES, Long Answer Type Question No. 16(b).

## QUESTION 2015

### GROUP - A

#### (Multiple Choice Type Questions)

Answer any ten questions:  
Which of the following traversal techniques lists the nodes of a binary search tree in ascending order?

a) Post-order

✓ b) In-order

c) Pre-order

d) None of these

## POPULAR PUBLICATIONS

- ii) The number of possible distinct binary trees with 12 nodes is  
 ✓ b) 4084. c) 3082 d) 3084  
 a) 4082
- iii) Which of the following expressions access the  $(i, j)$ th entry of a  $(m \times n)$  matrix stored in column major order?  
 a)  $n \times (i - 1) + j$  ✓ b)  $m \times (j - 1) + i$  c)  $m \times (n - j) + j$  d)  $n \times (m - i) + j$
- iv) Stack cannot be used to  
 a) evaluate an arithmetic expression in postfix form  
 b) implement recursion  
 ✓ c) allocate resources (like CPU) by the operating system  
 d) convert infix expression to its equivalent postfix expression
- v) The postfix equivalent of the prefix  $* + ab - cd$  is  
 ✓ a)  $ab + cd - *$  b)  $abcd + - *$  c)  $ab + cd^* -$  d)  $ab + - cd^*$
- vi) Merge sort uses  
 ✓ a) divide and conquer strategy b) backtracking approach  
 c) heuristic search d) greedy approach
- vii) The following sequence of operations is performed on a stack  
 push(1), push(2), pop(), push(1), push(2), pop(), pop(), push(2), pop().  
 the sequence of popped out values are  
 a) 2, 2, 1, 2, 1 ✓ b) 2, 2, 1, 1, 2 c) 2, 1, 2, 2, 2 d) 2, 1, 2, 2, 1
- viii) Which of the following is not a requirement of good hashing function?  
 a) Avoid collision ✓ b) Reduce the storage space  
 c) Make faster retrieval d) None of these
- ix) Self-referential pointer is used in defining  
 a) an array ✓ b) a node of linked-list  
 c) a queue d) all of these
- x) A binary tree has  $n$  leaf nodes. The number of nodes of degree 2 in this tree is  
 a)  $\log n$  b)  $n - 1$  c)  $n$  ✓ d) cannot be said

## GROUP – B

(Short Answer Type Questions)

2. What is the difference between array and linked-list? What is the primary criterion of performing binary search technique on a list of data?

1<sup>st</sup> Part: See Topic: LINKED LIST, Short Answer Type Question No. 12.

2<sup>nd</sup> Part: See Topic: SORTING & HASHING, Short Answer Type Question No. 9.

3. Write a recursive algorithm to solve tower of Hanoi problem.

See Topic: MISCELLANEOUS, Long Answer Type Question No. 1(b).

**DSA-150**

4. Deduce the  
See Topic: SE
5. Suppose a  
kth position of  
See Topic: ST
6. Write an alg  
See Topic: LIN
7. a) The in-or  
Pos  
In-o  
Construct the t
- b) Define Hash
- c) Describe a S
- d) Write an alg
- a) & d) See Top
- b) See Topic: SE
- c) See Topic: M

8. a) Convert th  
(A + B)  
b) What is deque  
c) How can a pa  
d) For the follow  
 $a + b$   
e) Write an algo
- a) See Topic: ST  
b) See Topic: ST  
c) See Topic: LIN  
d) See Topic: TR  
e) See Topic: LIN

9. a) For the follo

## DATA STRUCTURE & ALGORITHM

4. Deduce the average time complexity of Quicksort algorithm.  
 See Topic: **SEARCHING & SORTING**, Short Answer Type Question No. 8.

5. Suppose a queue is implemented by an array. Write an algorithm to insert a new element at the  $k^{th}$  position of the array.

See Topic: **STACKS & QUEUES**, Short Answer Type Question No. 8.

6. Write an algorithm to delete the last node of a linked-list.

See Topic: **LINKED LIST**, Short Answer Type Question No. 10.

### GROUP - C

#### (Long Answer Type Questions)

7. a) The in-order and pre-order traversal sequence of nodes in a binary tree are given below:

Post-order:	I	E	J	F	C	G	K	L	H	D	B	A
In-order:	E	I	C	F	J	B	G	D	K	H	L	A

Construct the tree.

b) Define Hashing.

c) Describe a String reversal Algorithm.

d) Write an algorithm for inserting an element into a Binary tree with example.

a) & d) See Topic: **TREES**, Long Answer Type Question No. 12(a) & (b).

b) See Topic: **SORTING & HASHING**, Short Answer Type Question No. 2.

c) See Topic: **MISCELLANEOUS**, Short Answer Type Question No. 1(a).

8. a) Convert the following infix expression into equivalent postfix expression using stack.

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

b) What is dequeue?

c) How can a polynomial such as  $6x^6 + 3x^3 - 2x + 10$  be represented by a linked list?

d) For the following expression draw the corresponding expression tree:

$$a + b * c - d / e$$

e) Write an algorithm to insert an element in the middle of a linked list.

a) See Topic: **STACKS & QUEUES**, Short Answer Type Question No. 1(a).

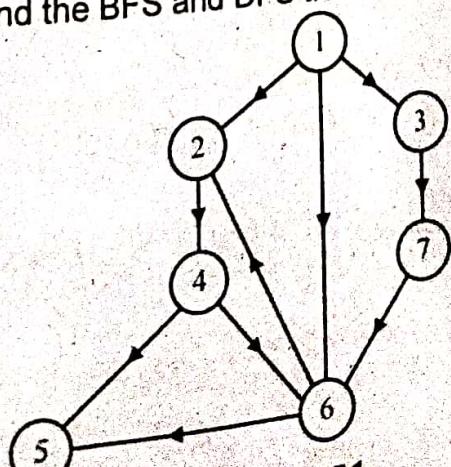
b) See Topic: **STACKS & QUEUES**, Short Answer Type Question No. 3.

c) See Topic: **LINKED LIST**, Short Answer Type Question No. 4.

d) See Topic: **TREES**, Short Answer Type Question No. 13.

e) See Topic: **LINKED LIST**, Short Answer Type Question No. 11.

f) a) For the following graph find the BFS and DFS traversal with proper algorithm.



## POPULAR PUBLICATIONS

- b) Insert the following keys in the order given below to build them into an AVL-tree, 12, 11, 13, 10, 09, 15, 14, 18, 7, 6, 5, 4. Clearly mention different rotations used and balance factor of each node.
- a) See Topic: GRAPHS, Short Answer Type Question No. 5.
- b) See Topic: TREES, Short Answer Type Question No. 11.

10. a) What is hashing? Describe any three methods of defining a hash function.

- b) Discuss different collision resolution techniques.
- a) See Topic: SORTING & HASHING, Long Answer Type Question No. 11.
- b) See Topic: SORTING & HASHING, Long Answer Type Question No. 3(c).

11. Write short notes on any three of the following:

- a) ADT
- b) AVL Tree
- c) Circular link list
- d) Threaded binary trees
- e) Heap

- a) See Topic: INTRODUCTION, Long Answer Type Question No. 1.
- b) See Topic: TREES, Long Answer Type Question No. 16(a).
- c) See Topic: LINKED LIST, Long Answer Type Question No. 6(b)
- d) See Topic: TREES, Long Answer Type Question No. 16(b).
- e) See Topic: SORTING & HASHING, Long Answer Type Question No. 15(d).

## QUESTION 2016

### GROUP - A

(Multiple Choice Type Questions)

1. Answer any ten questions:

- i) The postfix equivalent of the prefix  $* + ab - cd$  is
- ✓ a)  $ab + cd - *$
  - b)  $abcd + - *$
  - c)  $ab + cd * -$
  - d)  $ab + - cd *$
- ii) If a binary tree is threaded for inorder traversal a right NULL link of any node it is replaced by the address of its
- ✓ a) successor
  - b) predecessor
  - c) root
  - d) own
- iii) Adjacency matrix of a digraph is
- a) Identity matrix
  - ✓ b) Symmetric matrix
  - c) Asymmetric matrix
  - d) None of these
- iv) Linked lists are not suitable for
- a) Stack
  - b) Dequeue
  - c) AVL tree
  - ✓ d) Binary Search
- v) The ratio of items present in a hash table of the total size is called
- a) balance factor
  - ✓ b) load factor
  - c) item factor
  - d) weight factor
- vi) Maximum possible height of an AVL tree with 7 nodes is
- ✓ a) 3
  - b) 4
  - c) 5
  - d) 6

- vii) The deque can be used  
 a) as a stack  
 ✓c) both as a stack and as a queue  
 b) as a queue  
 d) none of these
- viii) Inserting a node after a given node in a doubly linked list requires  
 a) four pointer exchanges  
 ✓b) two pointer exchanges  
 c) one pointer exchange  
 d) no pointer exchange
- ix) The minimum height of a binary tree of  $n$  nodes is  
 a)  $n$   
 b)  $n/2$   
 c)  $n/2 - 2$   
 ✓d)  $\log_2(n+1)$
- x) What will be the time complexity for selection sort to sort an array of  $n$  elements?  
 a)  $O(\log n)$   
 b)  $O(n \log n)$   
 c)  $O(n)$   
 ✓d)  $O(n^2)$

**GROUP - B**  
**(Short Answer Type Questions)**

1 Show that the function  $f(n)$  defined by

$$f(n) = 1; \quad n = 1$$

$$f(n) = f(n-1) + 1/n, \quad n > 1$$

has complexity  $O(\ln n)$ .

See Topic: INTRODUCTION, Short Answer Type Question No. 2.

- 3 a) Does a B tree grow at its leave or at its root? Why?  
 b) In deleting a key from a B tree, when it is necessary to combine nodes?  
 c) For what purposes are B trees especially appropriate?  
 d) See Topic: TREE, Short Answer Type Question No. 14.  
 e) See Topic: TREE, Long Answer Type Question No. 5(b).

4 The post-order and in-order traversal sequences of codes in a binary tree are given below:

Post-order: D G E B H I F C A

In-order: D B G E A C H F I

Construct the binary tree.

See Topic: TREES, Short Answer Type Question No. 15.

5 Construct one B-Tree of order 4 with the following data. 34, 67, 89, 90, 100, 2, 36, 76, 53, 51, 12, 19, 77, 69.

See Topic: TREES, Short Answer Type Question No. 16.

6 What is the default return type of malloc( )? Why do we need to typecast it? Write an algorithm to insert a node after a specified node in single linked list.

Part: See Topic: INTRODUCTION, Short Answer Type Question No. 13.

Part: See Topic: LINKED LIST, Short Answer Type Question No. 3(2<sup>nd</sup> Part).

## POPULAR PUBLICATIONS

### GROUP - C

#### (Long Answer Type Questions)

7. a) Why circular queue is better than simple queue?  
b) Evaluate the postfix expression using stack:  
    3, 16, 2, +, \*, 12, 6, /, -  
c) Convert the infix expression into its equivalent prefix expression using stack:

$$a + b * c + (d * e + f) * g.$$

- a) See Topic: STACKS & QUEUES, Short Answer Type Question No. 5(b).  
b) & c) See Topic: STACKS & QUEUES, Short Answer Type Question No. 8.

8. a) Write a non-recursive algorithm to traverse a binary tree in its inorder traversal.  
b) Write a C function to find out the maximum and the minimum elements in a binary search tree.  
c) Given the pre-order sequence and the post-order sequence, why cannot you reconstruct the tree?  
a) See Topic: TREES, Long Answer Type Question No. 2(d).  
b) & c) See Topic: TREES, Long Answer Type Question No. 13.

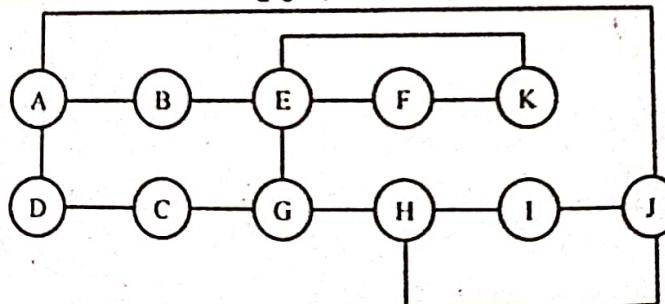
9. a) Construct a tree from the given postfix expression  $abc * + de * f + g * +$   
b) Write a C function to sort positive integers that does not compose the array elements.  
c) Show how linked list can be used to add the following polynomials:

$$5x^4 + 5x^3 + 10x^2 + 8x + 3$$

$$3x^3 + 2x^2 + 7x + 8.$$

- a) See Topic: TREES, Short Answer Type Question No. 17.  
b) See Topic: SORTING & HASHING, Long Answer Type Question No. 12.  
c) See Topic: LINKED LIST, Short Answer Type Question No. 13.

10. a) Describe BFS algorithm.  
b) Find out the DFS traversal of the following graph starting at node A.



- c) Define Prim's algorithm for minimum cost spanning tree with example.  
a) See Topic: GRAPHS, Long Answer Type Question No. 1(a).  
b) See Topic: GRAPHS, Short Answer Type Question No. 6.  
c) See Topic: GRAPHS, Short Answer Type Question No. 4.

1. Choose the correct answer:
  - i) Which of the following is a stack?
    - a) Stacks
    - b) array
  - ii) Binary search is used in:
    - a) unsorted array
    - b) descending order
  - iii) The prerequisite for quick sort is:
    - a) unsorted array
    - b) sorted array
    - c) descending order
  - iv) Inserting an item in a stack is done by:
    - a) push, pop
    - b) insert, delete
  - v) The number of elements in a stack is:
    - a)  $2^{h+1} - 1$
    - b)  $2^h - 1$
  - vi) Minimum number of nodes in a binary tree of height h is:
    - a)  $2^h - 1$
    - b)  $2^{h+1} - 1$
  - vii) A linear link list is:
    - a) recursion
    - b) stack
  - viii) What is the sum of all even numbers from 1 to 100?
    - a) 19
    - b) 2500
    - c) 250
  - ix) The adjacency matrix of a complete graph on n vertices is:
    - a) Unit matrix
    - b) Symmetric matrix
    - c) Non-symmetric matrix
  - x) A path is:
    - a) a closed walk
    - b) an open walk
    - c) an open walk

**QUESTION 2017****GROUP - A**

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any ten of the following:

- i) Which of the following is non-linear data structure?  
 a) Stacks      b) List      c) Strings      ✓ d) Trees
- ii) Binary search is not possible for  
 a) array      ✓ b) linked list      c) stack      d) queue
- iii) The prerequisite condition of Binary search is  
 a) unsorted array      b) ascending order array  
 c) descending order array      ✓ d) sorted array
- iv) Inserting an item into the stack when stack is not full is called ..... operation and deletion of item from the stack, when stack is not empty is called ..... operation.  
 ✓ a) push, pop      b) pop, push      c) insert, delete      d) delete, insert
- v) The number of edges in a full binary tree of height  $h$  is  
 a)  $2^{h+1} - 1$       b)  $2^h - 1$       ✓ c)  $2^{h+1} - 2$       d)  $2^h - 2$
- vi) Minimum number of nodes required to make a complete binary tree of height  $h$  is  
 a)  $2^h - 1$       ✓ b)  $2^h$       c)  $2^h + 1$       d)  $2^{h-1}$
- vii) A linear link list can be traversed using  
 ✓ a) recursion      b) both (a) and (c) are correct  
 c) stack      d) both (a) and (c) are wrong
- viii) What is the sum of the degrees of all the vertices in the following graph?  
 ✓ a) 19      b) 20      c) 5      d) none of these
- 
- ix) The adjacency matrix of an undirected graph is  
 a) Unit matrix      b) Asymmetric matrix  
 ✓ c) Symmetric matrix      d) none of these
- x) A path is  
 a) a closed walk with no vertex repetition  
 ✓ c) an open walk with no edge repetition      b) an open walk with no vertex repetition  
 d) a closed walk with no edge repetition

## POPULAR PUBLICATIONS

- xi) The data structure used to solve recursive problem is  
 a) Linked list      b) Queue      ✓ c) Stack      d) none of these
- xii) Which one is required to reconstruct a binary tree?  
 a) Only inorder sequence  
 ✓ c) Both inorder and postorder sequences      b) Both preorder and postorder sequences  
 d) Only postorder sequence

### Group - B

#### (Short Answer Type Questions)

2. How a polynomial such as  $8x^5 + 4x^3 - 9x^2 + 2x - 17$  can be represented using a linked list?

What are the advantages and disadvantages of linked list over an array?

See Topic: LINKED LIST, Short Answer Type Question No. 14.

3. If  $T(n) = a_0 + a_1x + a_2x^2 + a_3x^3 + \dots + a_nx^n$ , then prove  $T(n) = \Theta(x^n)$ .

See Topic: INTRODUCTION, Short Answer Type Question No. 14.

4. Why circular queue is used over simple queue? Write an algorithm to insert an element into circular queue.

1<sup>st</sup> part: See Topic: STACKS & QUEUES, Short Answer Type Question No. 5(b).

2<sup>nd</sup> part: See Topic: STACKS & QUEUES, Long Answer Type Question No. 5(ii).

5. The inorder and preorder tree traversals are given. Draw the binary tree.

Inorder: ABCDEFGHI

Preorder: FBADCEGIH

Is it possible to build up a unique binary tree when its preorder and postorder traversals are given?

See Topic: TREES, Short Answer Type Question No. 18.

6. What is Hashing? Write two hash functions. What is collision?

See Topic: SORTING & HASHING, Short Answer Type Question No. 2.

### Group - C

#### (Long Answer Type Questions)

7. a) Write an algorithm to evaluate a postfix expression.

b) Convert the infix expression  $9 + 5 * 7 - 6^2 + 15 / 3$  into its equivalent postfix expression and evaluate that postfix expression, clearly showing the state of the stack.

a) See Topic: STACKS & QUEUES, Long Answer Type Question No. 2.

b) See Topic: STACKS & QUEUES, Long Answer Type Question No. 9.

8. a) Write an algorithm for creating a linked-list with  $n$  nodes.

b) How it can be made a circular linked-list? Write a function for that purpose.

See Topic: LINKED LIST, Long Answer Type Question No. 4.

9. a) How a linked-lists can be used to implement stack?

b) Write an algorithm for linear search.

c) Give an outline of the complexity of your algorithm.

a) See Topic: LIN  
 b) & c) See Topic

10. a) What do you

b) Write an algo

c) Find the time

of the list  $n = 2^k$

a) See Topic: SOP

b) See Topic: INT

c) See Topic: SOP

11. a) What is ha

b) Discuss differen

a) See Topic: SOP

b) See Topic: SOP

12. a) What do yo

b) Construct a bin

c) Write an algorit

d) Show that the r

a), b) & c) See Top

d) See Topic: GRA

13. a) What is an

b) Construct an AV

c) For the AVL tree

See Topic: TREES,

1. Choose the corre  
 i) Maximum possibl  
 a) 12

ii) In a circularly link  
 a). no pointer

iii) A B-tree is  
 a) always balan

a) See Topic: **LINKED LIST**, Long Answer Type Question No. 5.

b) & c) See Topic: **SORTING & HASHING**, Long Answer Type Question No. 13.

10. a) What do you mean by external sorting? How does it differ from internal sorting?  
b) Write an algorithm for sorting a list numbers in ascending order using bubble sort technique and find its time complexity.

c) Find the time complexity of merge sort technique using the recurrence relation assuming the size of the list  $n = 2^k$ .

a) See Topic: **SORTING & HASHING**, Long Answer Type Question No. 5(a).

b) See Topic: **INTRODUCTION**, Short Answer Type Question No. 3.

c) See Topic: **SORTING & HASHING**, Long Answer Type Question No. 14.

11. a) What is hashing? Describe any three methods of defining a hash function.  
b) Discuss different collision resolution techniques.

a) See Topic: **SORTING & HASHING**, Long Answer Type Question No. 11.

b) See Topic: **SORTING & HASHING**, Long Answer Type Question No. 3(c).

12. a) What do you mean by a binary search tree?

b) Construct a binary search tree by inserting the list of elements one by one:

13, 10, 3, 5, 18, 15, 14

c) Write an algorithm for pre-order traversal of a tree represented by a linked-list.

d) Show that the number of vertices of odd degree in a finite graph is even.

a), b) & c) See Topic: **TREES**, Long Answer Type Question No. 14.

d) See Topic: **GRAPHS**, Long Answer Type Question No. 1(e).

13. a) What is an AVL tree?

b) Construct an AVL search tree for the data list:

AND, BEGIN, CASE, DO, END, FOR GOTO.

c) For the AVL tree you have constructed delete the following keys in the order:

DO, FOR END.

See Topic: **TREES**, Long Answer Type Question No. 15.

## QUESTION 2018

### Group - A

#### (Multiple Choice Type Questions)

1. Choose the correct alternatives for the following:

i) Maximum possible height of an AVL Tree with 7 node is

- a) 12      b) 4

c) 5      d) 3

ii) In a circularly linked list organization, insertion of a record involves the modification of

- a) no pointer      b) 1 pointer      c) 2 pointers

d) 3 pointers

iii) A B-tree is

- a) always balanced      b) an ordered tree

c) a directed tree

d) All of these

## POPULAR PUBLICATIONS

- iv) Number of nodes in a complete binary tree of depth  $k$  is  
a)  $2^k$       b)  $2k$       c)  $2^k - 1$       d) None of these
- v) To make a queue empty, elements can be deleted till  
✓ a) front = rear + 1    b) front = rear - 1    c) front = rear    d) None of these
- vi) BFS constructs  
✓ a) a minimal cost spanning tree of a graph  
c) a breadth first spanning tree      b) a depth first spanning tree of a graph  
d) None of these
- vii) A vertex of in-degree zero in a directed graph is called  
a) Articulation point      b) Sink  
✓ c) Isolated matrix      d) Root vertex
- viii) In a height balanced tree the heights of two sub-trees of every node never differ by more than  
a) 2      b) 0      ✓ c) 1      d) -1
- ix) Inserting a new node after a specific node in a doubly linked requires  
a) four pointer exchanges      ✓ b) two pointer exchanges  
c) one pointer exchanges      d) no pointer exchanges
- x) A non-planar graph with minimum number of vertices has  
a) 9 edges, 6 vertices      b) 6 edges, 4 vertices  
✓ c) 10 edges, 5 vertices      d) 9 edges, 5 vertices

### **Group - B**

#### (Short Answer Type Questions)

2. Write an algorithm for in-order traversal of a threaded binary tree.

See Topic: TREES, Short Answer Type Question No. 6.

3. Compare and contrast linked list with static and dynamic array.

See Topic: LINKED LIST, Short Answer Type Question No. 15.

4. Write an algorithm to insert a data X immediately after a specific data item Y in a single linked list.

See Topic: LINKED LIST, Short Answer Type Question No. 3(2<sup>nd</sup> Part).

5. What is Load Factor? Why do we need hashing? How does a hash table allow O(1) searching?  
Why is prime number chosen for computing a hash function?

See Topic: SORTING & HASHING, Short Answer Type Question No. 10.

6. Insert the following keys into a B-Tree of given order mentioned below.  
a, f, b, k, h, m, e, s, r, c. (Order 3)

a, g, f, b, k, d, h, m, j, e, s, l, r, x, c, l, n, t, u, p. (Order 5)

See Topic: TREES, Short Answer Type Question No. 19.

1. What are sparse matrices? How such a matrix is represented in memory? What are the types of sparse matrices?  
 Show that the function  $f(n)$  defined by

$$f(1) = 1$$

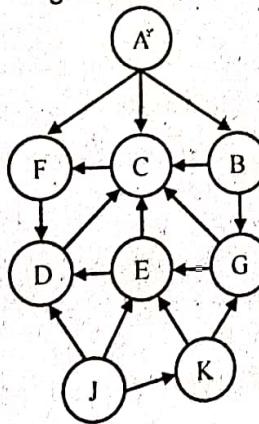
$$f(n) = f(n-1) + \frac{1}{n} \text{ for } n > 1$$

has the complexity  $O(\log n)$

Let the size of the elements stored in an  $8 \times 3$  matrix be 4 bytes each. If the base address of the matrix is 3500, then find the address of  $A[4, 2]$  for both row major and column major cases.  
 1<sup>st</sup>, 2<sup>nd</sup> & 3<sup>rd</sup> Part: See Topic: INTRODUCTION, Short Answer Type Question No. 1(2<sup>nd</sup> Part).  
 4<sup>th</sup> Part: See Topic: INTRODUCTION, Short Answer Type Question No. 2(1<sup>st</sup> Part).  
 5<sup>th</sup> Part: See Topic: INTRODUCTION, Short Answer Type Question No. 1(1<sup>st</sup> Part).

8. a) What do you mean by external sorting? How does it differ from internal sorting?  
 b) Write an algorithm for sorting a list numbers in ascending order using selection sort technique.  
 c) Describe Kruskal's minimal spanning tree algorithm.  
 d) & e) See Topic: SORTING & HASHING, Long Answer Type Question No. 5(a) & (b).  
 f) See Topic: GRAPHS, Short Answer Type Question No. 1.

9. What is expression tree? Draw the expression tree and write the In, Pre & Post-Order traversals for the given expression tree:  $E = (2x + y)(5a - b)^3$ . Prove that the number of odd degree vertices in a graph is always even. Apply BFS/DFS Algorithms and find out the path of the given graph:



- 1<sup>st</sup> & 2<sup>nd</sup> Part: See Topic: TREES, Short Answer Type Question No. 20.  
 3<sup>rd</sup> Part: See Topic: GRAPHS, Long Answer Type Question No. 1(c).  
 4<sup>th</sup> Part: See Topic: GRAPHS, Short Answer Type Question No. 7.

10. a) Define circular queue.  
 b) Write an algorithm to insert an item in circular queue.  
 c) What is input restricted dequeue?  
 d) Write an algorithm to convert an infix expression to postfix using stack.  
 e) & f) See Topic: STACKS & QUEUES, Long Answer Type Question No. 3(a), (b) & (c).  
 g) See Topic: STACKS & QUEUES, Long Answer Type Question No. 2.

## POPULAR PUBLICATIONS

11. Write short notes on *any three* of the following:

- i) AVL Tree
- ii) Heap Sort
- iii) DFS
- iv) Tail recursion
- v) Binary Search Tree

i) See Topic: TREES, Long Answer Type Question No. 16(a).

ii) See Topic: SORTING & HASHING, Long Answer Type Question No. 15(d).

iii) See Topic: GRAPHS, Long Answer Type Question No. 3(d).

iv) See Topic: MISCELLANEOUS, Long Answer Type Question No. 2(b).

v) See Topic: TREES, Long Answer Type Question No. 16(d).

Basic Pr

Probabi

Chebych

Bivariate

Basic Sta

Applied S

Small Sam

### NOTE:

MAKAUT  
Present syllabus  
with selected  
Few new topics  
are providing  
answers for  
university qu