This question paper contains 8 printed pages]

Your Roll No. : .....

Sl. No. of Q. Paper : 167 I

Unique Paper Code : 42347902

Name of the Course : B.Sc.(Prog.) /B.Sc. Math. Sciences : DSE - 2A

Name of the Paper : Analysis of Algorithms and Data structures

Semester : V

Time : 3 Hours Maximum Marks : 75

Instructions for Candidates :

(a) Write your Roll No. on the top immediately on receipt of this question paper.

(b) Question **NO.1** is compulsory.

(c) Attempt any **five** of question nos. **2** to **8**.

(d) **Parts** of a question must be answered together.

(a) Consider an array of numbers {4, 6, 3, 7, 8} : 2

(i) Can linear search be applied to find 5 ?

(ii) Can binary search be applied to find 8 ?

P.T.O.

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(b) Arrange the following running times increasing order.

$O(n^2)$, $O(n\log n)$, $O(2^n)$, $O(\log n^2)$

(c) Consider an integer array A of dimens m × n, at what memory location will element A[i][j] be located, consider column major address mapping ?

(d) Consider the 0-1 knapsack problem; greedy strategy always give the optir solution ? If yes, prove; if no, give a coun example.

(e) Perform selection sort on the ar {3, 5, 1, 8, 7}, show the steps after e iteration. Report the number of comparis

(f) Write a recursive algorithm to compute product of two integers a and b.

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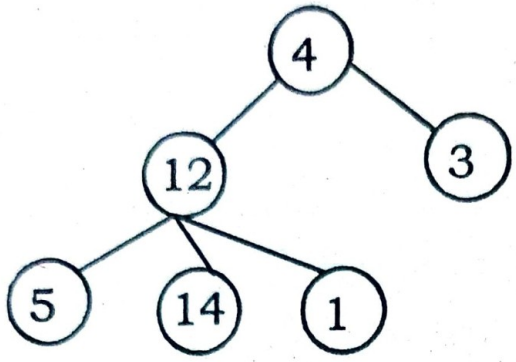
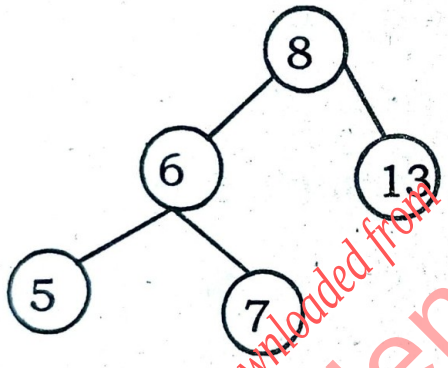
(g) For each of the following trees, specify whether it is a binary search tree or not. Give reasons for your answers. 6

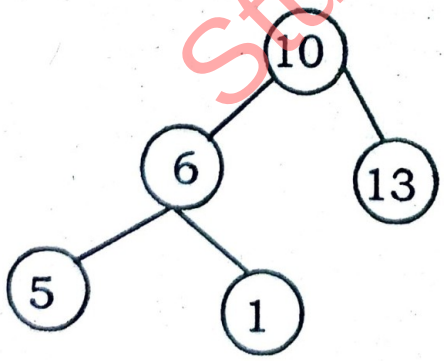
(i)



(ii)



(iii)



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2. (a) Write an algorithm for push operation a
pop operation for a Stack implemented us
linked lists.

(b) Write an algorithm for finding an eleme
in an array using Binary Search.

3. (a) Consider the following sequence
operations performed on an initially em
doubly linked list :

InsertBeginning(5),

InsertBeginning(8),

InsertEnd(3),

InsertEnd(10),

DeleteBeginning(),

Deletenode(3)

Show the contents of the list, links betwe
nodes, head and tail after each operatio

(b) Consider a function f() to computer Fibona
numbers as defined below :

$$\text{Fib}(n) \quad \begin{cases} 0 \text{ if } n=0 \\ 1 \text{ if } n=1 \\ \text{Fib}(n-1) + \text{Fib}(n-2) \text{ if } >=2 \end{cases}$$

How many times will f( ) be called to
the value of Fib(6) ?

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(a) Write a recursive algorithm to compute the sum of n natural numbers. 3

(b) Do the following transformations : 4

(i) Postfix to Infix

A B C D E - + $ * E F * –

(ii) Infix to Prefix

A $ B * C – D + E / F / (G + H)

(Note : $ is the exponent operation)

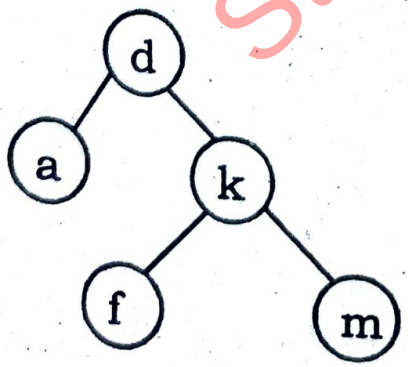
(c) Perform Merge sort on the given array of numbers {6, 5, 4, 3, 2, 1}. Show each step. 3

(a) For the given binary search tree, give the following : 6

(i) Pre-order traversal

(ii) In-order traversal

(iii) Post-order traversal



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(b) Consider the following applications a specify which data structure may be us to implement them and why ?

(i) Scheduling processes on the CPU.

(ii) Converting an infix expression to postfix expression.

6. (a) Consider an initially empty circular que of size five implemented using arra Perform the given sequence of operati and show the position of front and rear a each operation.

Enqueue(4),

Dequeue,

Enqueue(3),

Enqueue(8),

Enqueue(2),

Enqueue(6),

Enqueue(13),

Dequeue,

Enqueue(1)

(Note : Enqueue is inserting a values int queue, Dequeue is removing a value fr the queue)

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(b) Sort the following array using radix sort, show the array contents after each iteration. {245, 12, 5673, 78, 43567, 33, 25, 46, 678}

4

(a) Write an algorithm to search for an element and delete it if found, in a doubly linked list.

4

(b) Give worst case and best case running times for the following algorithms : 4

(i) Linear Search

(ii) Insertion Sort

(c) Which of the following uses divide and conquer technique for solving problems ?

2

(a) Linear search

(b) Binary Search

(c) Quick Sort

(d) Count Sort

(a) If k integer elements are to be stored :

5

(i) Determine the amount of memory used when these elements are stored using an array of size n=50 (assume $k \leq n$) and when they are stored in a singly linked list. Assume pointers require as much memory as an integer.

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(ii) How large can the ratio of two mem requirement get ?

(b) Write an algorithm to sort an array usi count sort.

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