Total No. of printed pages = 5

2015

COMPUTER SCIENCE

(Major)

Paper : 3.1

(Data Structure and Algorithm)

Full Marks – 60

Time – Three hours

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

1.  Answer the following questions :          1×5=5

    (a)  What is the number of comparisons performed
        by insertion sort algorithm when the imput
        is a sorted array of size n ?

    (b)  On an empty stack the following operations
        have been performed in the order in which
        it is shown below :

    push (a), push (b), push (a), pop ( ), push (a),
    pop ( ), push (c), push (b).

    After the completion of the operations, draw
    the stack showing its content.

(c) What is the worst case running time of quick-sort using θ-notation ?

(d) Which of the following statement is/are correct ?

    (i) Stack is a Last-in-First-out data structure.

    (ii) Stack is a First-in-First-out data structure.

    (iii) Queue is a Last-in-First-out data structure.

    (iv) Queue is a First-in-Last-out data structure.

(e) Convert the following infix expression to prefix expression.

$$a * b + 2 * d - c.$$

2. Answer the following questions :      2×5=10

(a) What is the minimum and maximum height of a binary search tree having 7 elements ? Draw two binary search trees to demonstrate each case separately. Take any data values of your choice.
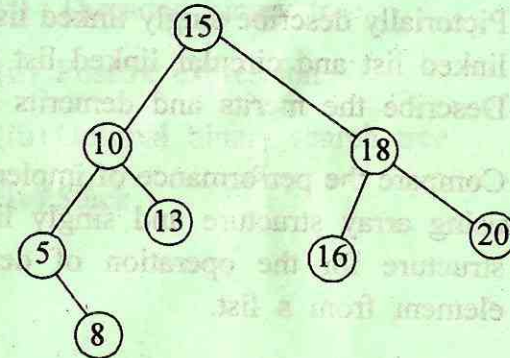
(b) Draw a max-heap and a min-heap for the following data :

        25    30    10    15    20    5

(c) Describe how the elements in a two dimensional array stored in memory if the C programming language is used.

(d) Consider the following binary search tree. How many comparisons will have to be performed while searching for the element 2 ? Describe the sequence in which the comparisons are performed.



(e) How many comparisons will have to be performed while searching for the element 15 in the following array using binary search ? Describe the sequence in which the comparisons are performed.

    5   7   15   16   18   20   30   40

3. Answer any *three* questions from the following : 3×5=15

(a) Sort the following list using Bubble sort.

$$-1 \quad 15 \quad 2 \quad 10 \quad 25 \quad 11$$

Show all intermediate steps.

(b) Write a function for traversing a binary tree in postorder. Use a suitable data structure.

(c) Write a short note on packed words.

(d) Pictorially describe singly linked list, doubly linked list and circular linked list structure. Describe the merits and demerits of each.

(e) Compare the performance of implementation using array structure and singly linked list structure for the operation of deleting an element from a list.

4. Answer any *three* questions from the following : 3×10=30

(a) Write a C program to implement a queue using linked list structure. Write functions for adding and removing elements from a queue.

(b) Write an algorithm or a computer program for implementing mergesort algorithm.

(c) Write a computer program for inserting an element into a binary search tree. Use a suitable data structure and describe it.

(d) (i) Compute the worst case time complexity of insertion sort algorithm. 6

(ii) Formally define the $\theta$ and $0$ asymptotic notations. 4

(e) Write short notes on : 2½×4=10

(i) Threaded binary tree

(ii) Postfix expression

(iii) Optimal binary search tree

(iv) Stack.