53 (IT 304) DTST

2017

DATA STRUCTURES

Paper : IT 304

Full Marks : 100

Time : Three hours

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

*Answer **any five** questions.*

1. *(a)* Write the differences between stack and queue. 2

(b) Consider the following queue of characters where queue Q is a circular array which is allocated 5 memory cells :

Front = 2, Rear = 3, Q : ———, *a*, *b*, ———, ———.

Describe the following operations on queue Q : 4

(i) C is added to the queue.

(ii) Two letters are deleted from the queue Q.

Contd.

(iii) d, e, f are added to Q.

Give the value of Front and Rear after each operations.

(c) Write an algorithm to convert an infix expression to its postfix form using stack. 6

(d) Convert $A+(B*C-(D/E\hat{}F)*G)*H$ into its postfix form using stack. 8

2. (a) Define Big-O Ω and θ(Theta) notation. 6

(b) The following recursive function in C is a solution to the Towers of Hanoi problem : 6

```
Void move (int n, char A, char B, char C)
{
    if ( - - - - - - - - - - - - - - - - - - - -)
        printf ("Move disk%d from %c
                to %c" n, A, C);
    else
    {
        move ( - - - - - - - - - - - - -);
        printf ("Move disk %d from
                %c to %c", n, A, C);
        move ( - - - - - - - - - - - - -) ;
    }
}
```

Fill in the dotted parts of the solution.

(c) Draw the recursive tree of Towers of Hanoi. 8

3. (a) Represent the following polynomial by a linked data structure (show only the diagram) : $5x^6 + 4x^4 - 25x^3 + 10$ 5

(b) Write an algorithm (or *C* function) for reversing the elements of a single linked list. 10

(c) Is hashing a search technique ? If yes, then compare with binary search. 5

4. (a) Construct a binary tree from the given pre-order and in-order sequence :

Pre-order : A, B, D, I, E, J, C, F, G, K

In-order : D, I, B, E, J, A, F, C, K, G

10

(b) Show how the following integers can be inserted in an empty binary search tree in the order they are given :

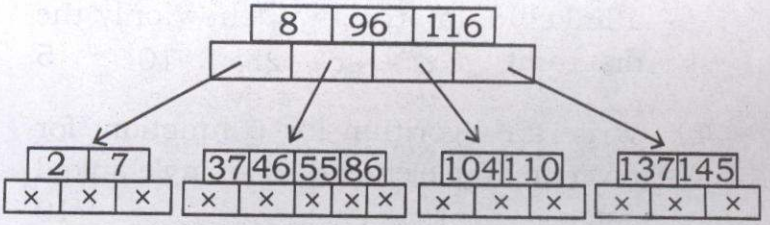
50, 30, 10, 90, 100, 40, 60, 20, 110, 80

10

5. (a) Insert the following keys in order given to build them into an AVL tree : 10

a, z, b, y, c, x, d, w, e, v

(b) Consider a *B*-Tree of order 5 as shown below. Insert the elements 4, 5, 58, 6 in this order in the *B*-Tree. 10



6. (a) Consider an array containing the following 8 integers : 8

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

Suppose we want to sort the array using selection sort. Show the contents of the array after every pass (step).

(b) Give the complexity of insertion sort in best, worst and average case. 2

(c) Consider a partition P containing the following members in the context of quicksort algorithm :

P = (50 20 90 10 80 70 60 40)

Assume that the last element (i.e 40) is chosen as the pivot element, show the steps involved in one pass of the partitioning process that places the pivot element in its final position in the sorted list. 10

7. *(a)* Write an algorithm for Merge sort. 10

(b) Consider the graph given below :
Find the adjacency list and bfs traversal of the following graph. 10