**53 (CS 304) DTST**

**2018**

# DATA STRUCTURE

Paper : CS 304

*Full Marks : 100*

Time : Three hours

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

*Answer **any five** questions.*

1. *(A)* Define abstract data type. Explain it briefly. 5

   *(B)* Explain about asymptotic notation. 7

   *(C)* Consider the $A = 20 \times 5$, $2D$ array. Base address of $A = 1000$ and word per cell, $W = 4$.

   Find the address of $A[10, 3]$ and $A[15, 4]$, when we represent it in column major order. 8

2. *(A)* Suppose a 10 element array, $M$ contains the values $a_1, a_2 \cdots a_{10}$.

Find the values in $M$ after each loop. 5

*(i)* Repeat for $K = 1$ to 9

Set $M[K+1] = M[K]$

*(ii)* $K = 9$ to 1 by $-1$

Set $M[K+1] = M[9]$

*(B)* Discuss the advantages, if any of a two-way list over a one-way list. 3

*(C)* Define header linked list. What is its advantages? 4

*(D)* Consider following infix arithmetic expression : 8

$Q : A + (B * C - (D / E \uparrow F) * G) * H$

convert into post fix expression.

3. (A) Write a function/pseudocode for the following operation in a single linked list : 16

*(i)* Delete a node whose key information is given.



*(ii)* Insert an element at last position.

*(iii)* Count the number of elements.

*(iv)* Insert at first position.

*(B)* Let, $a$ and $b$ denote positive integers suppose a function $Q$ is defined recursively as follows : 4

$$Q(a, b) = \begin{cases} 0 \quad , & \text{if } a < b ; \\ Q(a - b, b) + 1 & \text{if } b \Leftarrow a \end{cases}$$

Find the value of $Q(2, 3)$ and $Q(6, 3)$.

4. *(A)* Write a function/pseudocode for PUSH and POP operation, when we represent a STACK using linked list. 8

*(B)* A binary tree has 9 nodes. Inorder and preorder traversal of tree yield the following sequences of nodes : 8

Preorder – DCABIEFGH

Inorder – ACIBDGHFE

Draw the Tree.

(C) Suppose a QUEUE is maintained by a circular array QUEUE with $N=12$ memory cell. Find the number of elements in QUEUE if 4

(i) Front = 10, Rear = 3 and

(ii) Front = 5, Rear = 6 and then two elements are deleted.

5. (A) Define following term for the binary tree : 8

(i) Level

(ii) Height

(iii) Complete binary tree

(iv) Full binary tree

(v) Path

(B) Suppose the following eight numbers are inserted in order into an empty Binary Search Tree (BST) T.

70, 60, 50, 80, 90, 100, 150, 95

Draw the Tree. 4



(C) Write a function/pseudocode for Binary Search. What is its complexity? 8

6. (A) What is Spanning tree ? What is minimum spanning tree ? Find the minimum spanning tree of the following graph, G. 8

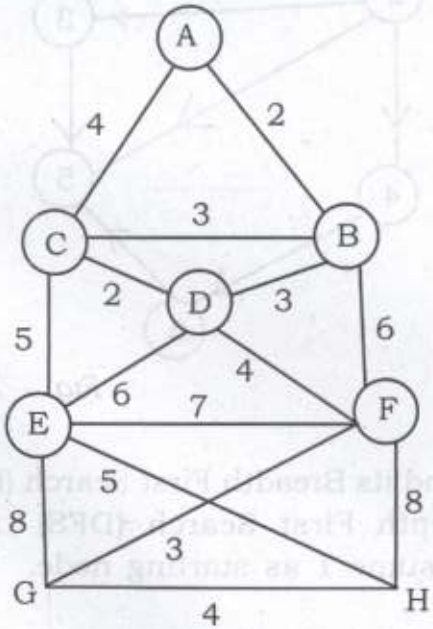


*Fig.* - 1

(B) Write a function/pseudocode for Quick sort technique. What is its complexity ? 7

(C) Consider the following graph, G. 5

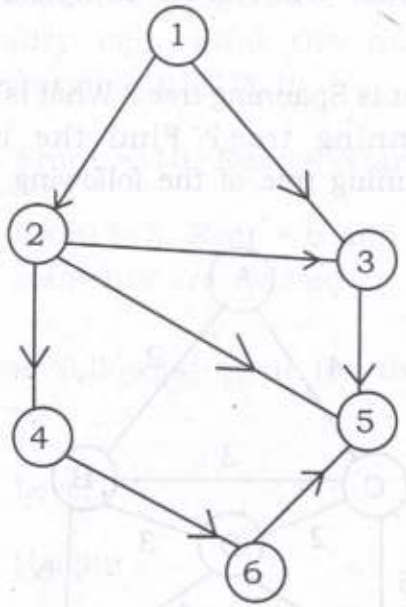


*Fig. - 2*

Find its Breadth First Search (BFS) and Depth First Search (DFS) traversal. Assume 1 as starting node.

7. (A) Define AVL Search tree. Insert the following elements in order into an initially empty AVL search tree. 8

70, 80, 90, 85, 82, 75, 78, 100, 95, 150, 140.



(B) Sort the following elements using insertion sort: 8

65, 70, 60, 80, 85, 78, 90, 55, 50

What is its complexity in average case?

(C) What is Hashing? What you mean by collision? 4