**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)* What is a data structure? Give examples. 2+2=4

   *(b)* How will you measure efficiency of an algorithm? 3

   *(c)* Discuss various asymptotic notations for complexity of an algorithm. 8

   *(d)* Write row-major order and column-major order representation of a three dimensional array, say $\beta(2, 3, 2)$. 5

2. *(a)* Write pseudocodes/algorithms for insert and delete operations of a queue. 6

*(b)* Explain the structures of stack and queue. Differentiate them. 5+2=7

*(c)* Write the algorithm for binary search. What is its complexity? 6+1=7

3. *(a)* Insert the following numbers in the order shown to construct an AVL search tree.

50, 60, 70, 80, 90

Delete 90 and then 60. 5+3=8

*(b)* Suppose the following numbers are inserted in order into an empty binary search tree.

50, 33, 44, 22, 77, 35, 60, 40

Draw the tree. 3

*(c)* Find the inorder, preorder and postorder traversals of the tree found in *Q. No.* 3*(b)*. 6

*(d)* Explain how pointers are defined and used in *C*-language. 3

4. *(a)* Draw the binary expression tree for the following expression :

$(2 * x + y) * (5 * a - b) \uparrow 3$

Find its equivalent prefix expression and preorder traversal of the tree. 3+2+2=7

*(b)* Write an algorithm/pseudocode for PUSH and POP operations of stack. 6

*(c)* Sort the following elements using bubble sort technique.

77, 33, 44, 11, 88, 22, 66, 55

Compare the complexities of bubble sort and quicksort techniques. 5+2=7

5. *(a)* Write pseudocode/algorithm to perform the following operations on a single linked list. 3×4=12

*(i)* Delete the first node of the list.

*(ii)* Print the sum of integers contained in all nodes.

*(iii)* Insert a new node after the node pointed to by '*p*'.

*(iv)* Count the total no. of nodes.

(b) Write short notes on *(i)* recursion and *(ii)* threaded binary tree. 4×2=8

6. (a) Differentiate between a graph and a tree. What is a spanning tree? Derive *at least four* spanning trees from the following graph. 2+2+3=7

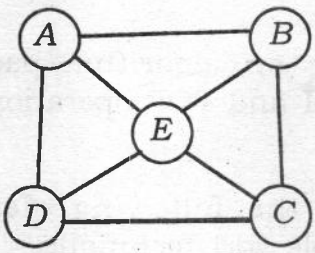


*Fig. (i) A graph*

(b) Evaluate the following infix expression using stack. 6

$$5 * 8 - ((2 \uparrow 3 + 4)/3) + 4$$

(c) Find a minimum spanning tree of the following graph using Prim's algorithm. 7

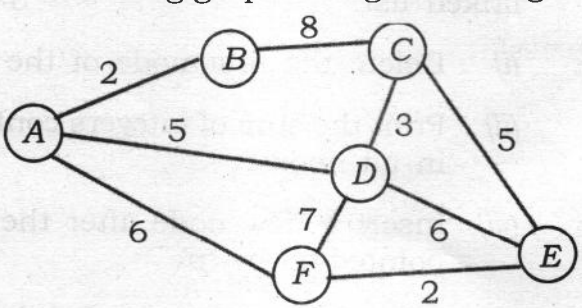


*Fig. (ii) A graph*

7. *(a)* Find the breadth-first and depth-first traversals of the following graph. 8

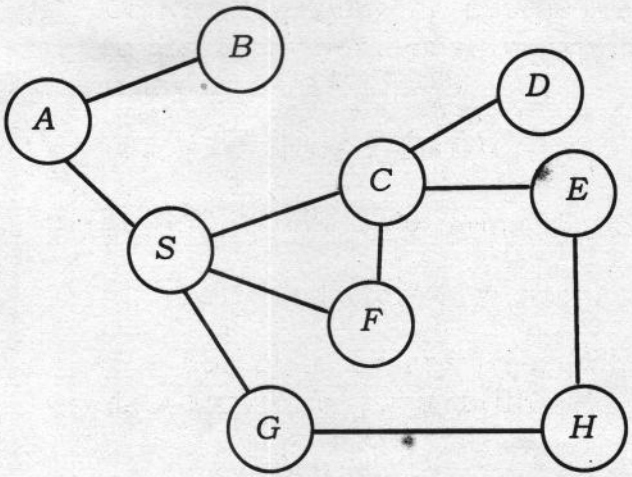


*Fig. (iii) A graph*

*(b)* Convert the following infix expression to its equivalent postfix expression using stack. 6

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

*(c)* Define the following terms : 1·5×4=6

*(i)* Balance factors of a node,

*(ii)* Complete binary tree, *(iii)* LIFO data structure, *(iv)* algorithm.

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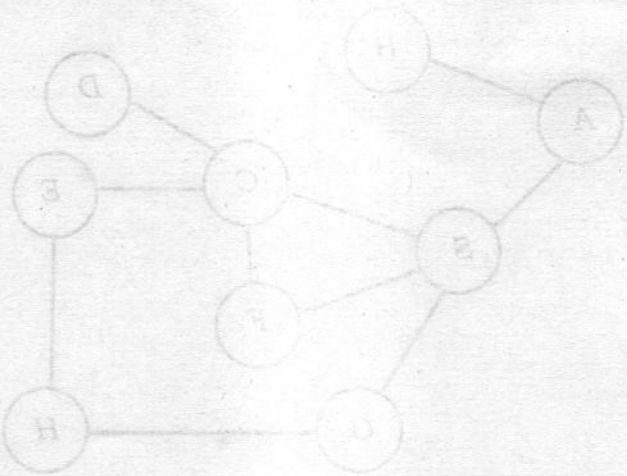
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