

B.E./B.TECH. Degree Examination, December 2020

Third Semester

IT18304-Data structures and Algorithms

(Regulation 2018)

Time: Three hours

Maximum : 80 Marks

Answer **ALL** questions**PART A - (8 X 2 = 16 marks)**

1. Consider the following code snippet

```

struct item
{
    int data;
    struct item * next;
};

int f(struct item *p)
{
    return (
        (p == NULL) ||
        (p->next == NULL) ||
        (( P->data <= p->next->data) && f(p->next))
    );
}

```

For a given linked list p, the function f returns 1 if and only if

- the list is empty or has exactly one element
 - the elements in the list are sorted in non-decreasing order of data value
 - the elements in the list are sorted in non-increasing order of data value
 - not all elements in the list have the same data value.
2. The following postfix expression with single digit operands is evaluated using a stack:

$$8\ 2\ 3\ ^\ / \ 2\ 3\ * \ + \ 5\ 1\ * \ -$$

Note that ^ is the exponentiation operator. The top two elements of the stack after the first * is evaluated are:

- 6, 1
- 5, 7
- 3, 2
- 1, 5

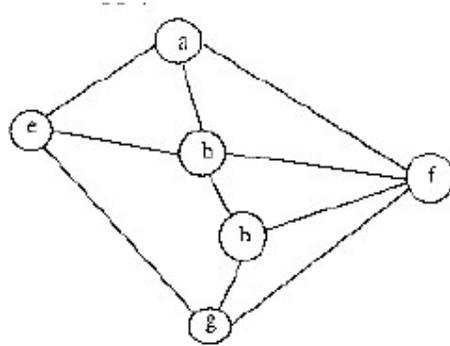
3. Consider the following graph among the following sequences

I. a b e g h f

II. a b f e h g

III. a b f h g e

IV. a f g h b e



Which are depth first traversals of the above graph?

a) I, II and IV only

b) I and IV only

c) II, III and IV only

d) I, III and IV only

4. Given the following input (4322, 1334, 1471, 9679, 1989, 6171, 6173, 4199) and the hash function $x \bmod 10$, which of the following statements are true?

i. 9679, 1989, 4199 hash to the same value

ii. 1471, 6171 has to the same value

iii. All elements hash to the same value

iv. Each element hashes to a different value

a) i only

b) ii only

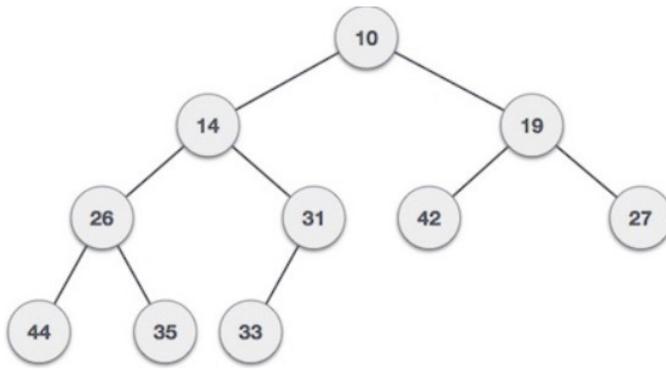
c) i and ii only

d) iii or iv

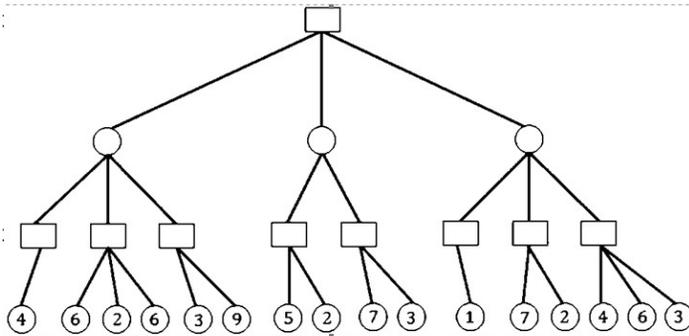
5. Represent the insertion of new node into a doubly linked list diagrammatically showing the sequence of changing pointers.

6. A circular queue of capacity $(n - 1)$ elements is implemented with an array of n elements. Assume that the insertion and deletion operations are carried out using REAR and FRONT as array index variables, respectively. Initially, $\text{REAR} = \text{FRONT} = 0$. Write the conditions to detect queue full and queue empty.

7. Is the following tree a Binary Search Tree? Justify your answer.



8. Complete the following max heap using the keys given in leaf nodes.



PART B - (4 X16 = 64 marks)

09. (a) Use appropriate ADT and give pseudo code for the following: (16)
 i. To insert set of elements in an ordered form.
 ii. To count the number of elements.
 iii. To copy the elements from A to B.

(OR)

(b) Use appropriate ADT to store polynomials, Write pseudo code for the following: (16)
 i. Read a Polynomial and store it in the ADT.
 ii. Perform polynomial addition
 iii. Display the result in appropriate form.

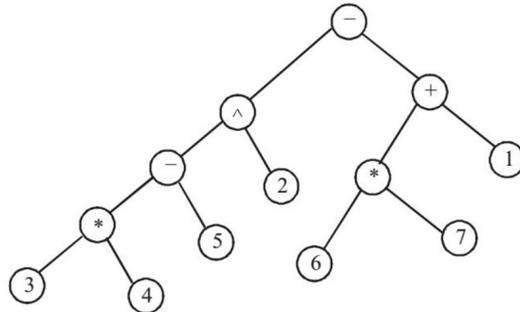
10. (a) A programmer wants to check unbalanced braces in a C source file. Use appropriate ADT and develop an application which takes C source file as input and checks whether all the braces are balanced. (16)

(OR)

(b) Consider the following queue of characters where Q is circular queue with 6 memory locations. Assume Rear=4, Front=2 and Q={A,C,D} initially. (16)
 Describe the queue as the following operations takes place.

- i. Three letters are deleted.
- ii. K,L and M are added.
- iii. Three letters are deleted.
- iv. R is added.
- v. Three letters are deleted.

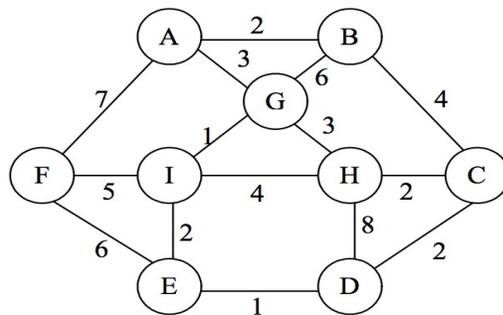
11. (a) Devise an algorithm to generate infix, prefix and postfix expression from an expression tree. Using your algorithm, find the infix, prefix and postfix expression of the following expression tree. **(16)**



(OR)

- (b) Devise an algorithm to perform different kind of rotation in AVL tree. Using your algorithm, construct the AVL tree for the given set of numbers {63, 9, 19, 27, 18, 108, 99, 81, 25, 46} **(16)**

12. (a) Devise an algorithm to generate the minimum spanning tree from a graph. Apply your algorithm on the following graph. **(16)**



(OR)

- (b) Devise two different kind of algorithms to arrange the list of words in alphabetical order. Trace your algorithms to arrange the following cities in alphabetical order. CITIES={Delhi, Mumbai, Chennai, Hyderabad, Cochin, Kolkata, Bangalore, Lucknow, Pune, Agra}. **(16)**