Indian Statistical Institute

Semester Examination: 2025 – 2026

Bachelor of Mathematics, Semester VI

Elective (E8): Data Structures and Algorithms: Back Paper Exam

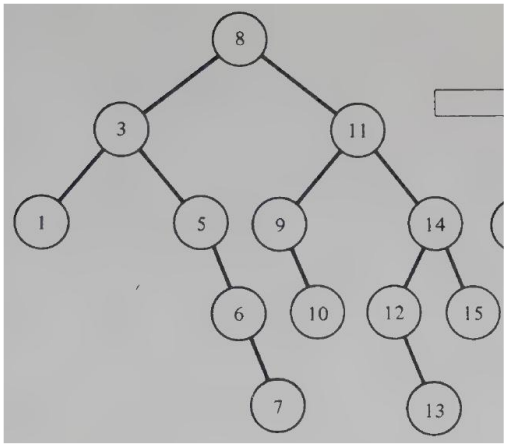
Date: 05 June 2026 Maximum Marks: 100 Duration: 3 hours

Attempt all the questions. Credit will be given for precise and brief answers. Provide diagram wherever appropriate.

1. Write bubble-sort algorithm. Determine its best case, worst case and average case time complexity. 4 + 2 + 2 + 2 = 10

2. Define Turing machine. What is Von-Neumann architecture? 6 + 4 = 10

3. Draw the following binary tree after deleting the key 11.



10

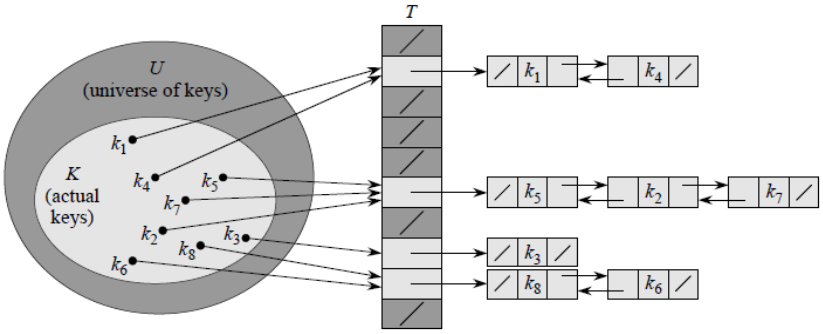
4. Construct the inorder traversal tree of the expression (A + B * C) $ ((A + B) * C). Operators are to be evaluated in usual order with $ having the highest precedence. 10

5. Write a note on array data structure within 250 words. 10

6. Convert the infix A - B/(C * D $ E) to postfix and prefix. 5 + 5 = 10

7. Describe a doubly liked list. Define a node of a doubly linked list in C or any other language. 5 + 5 = 10

8. Observe the following diagram of the data keys carefully. Describe a 'suitable' data structure to accommodate the keys so that (1) no two keys occupy the same position, (2) addition of a new key and deletion of any existing key can always be accomplished in a fixed number of operations. 10



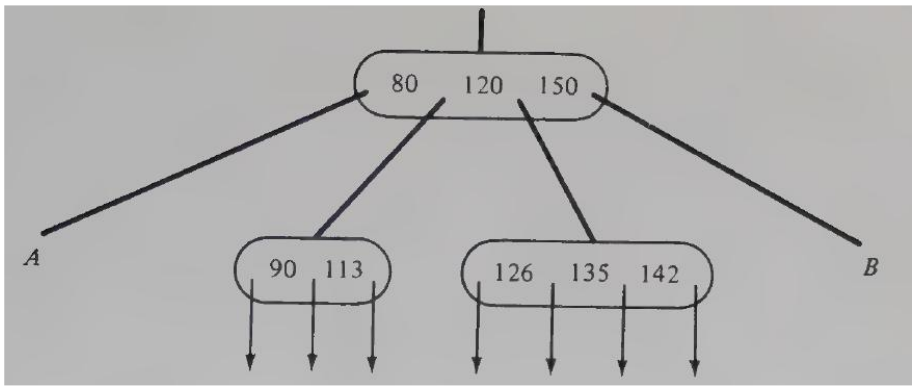
9. Which stack operation does the following C program signify? Explain.

```
#define  STACKSIZE  100
struct  stack  {
                int   top;
                int   items[STACKSIZE];
               };

 struct  stack  *s;
 int  x;
{
 s -> items[++(s -> top)] = x;
 return;
}
```

10

10. From the following B-tree diagram draw the resulting B-tree diagram after deleting the key 113. Only drawing the diagram will be enough.



10