103

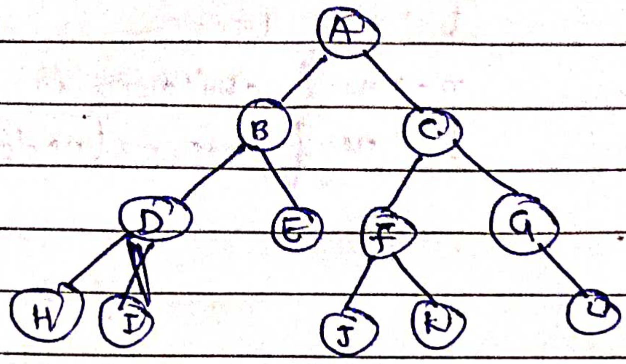
Suraj Kumar

Date.....................

DS-Assignment-2

Section-I

Ans 1:



Array representation:

Array[0] = A, Array[1] = B, Array[2] = C, Array[3] = D, Array[4] = E
Array[5] = F, Array[6] = G, Array[7] = H, Array[8] = I, Array[9] = J.
Array[10] = K, Array[11] = L.

Linked List representation:

Head: A.

A → left: B
A → right: C.
B → left: D
B → Right: E
C → left: F
C → right: G.
D → left: H
D → right: I.
E → left: null
E → right: Null.
F → left: J.
F → right: K.
G → left: Null
G → right: ~~Null~~ L.

H → left: Null.
H → right: null.
I → left: null.
I → right: null.
J → left: null
J → right: null
K → left: null
K → right: null.
L → left: null.
L → right: null.

Spiral

Date..................

Ans2: No. of leaves in a complete n-ary tree.

$L = (n-1)I + 1$

$41 = (n-1)10 + 1$

$41 = 10n - 9$

$50 = 10n$

$\boxed{n = 5}$

$L \to$ no. of leaves.

$n \to$ no. of children in each node.

$I \to$ no. of internal nodes.

Ans3 (i) Degree of no. of neighbours of a node.

total nodes $= n = n_1 + n_2 + n_3$.

Sum of degrees $= 2$(no. of edges).

$1 \times n_1 + 2n_2 + 3n_3 = 2(n-1)$.

$n_1 + 2n_2 + 3n_3 = 2(n_1 + n_2 + n_3 - 1)$.

$\boxed{n_3 = n_1 - 2}$

(ii) Now we have removed all 2 degree nodes,

so no. of edges is $n_1 + n_3 - 1$.

also, $n_3 = n_1 - 2$.

So, no. of edges $\Rightarrow 2n_1 - 3$.

Date....................

Section - II

Ans 1 Post Order:

1. EEJFCGKLHDBA.
2. ABC - EDF * $ * +
3. ABC + + AB + C * $

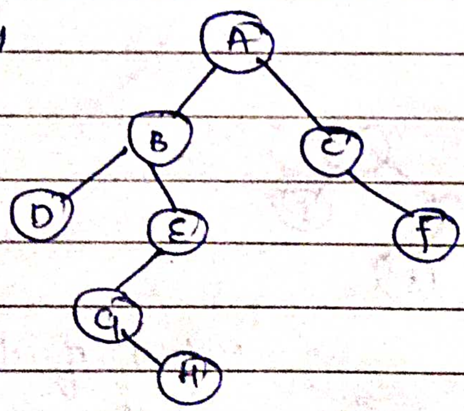
In Order.

1. EICJFBGDKHLA.
2. A+B-C*ED$*F.
3. A+B+C $ A+B*C

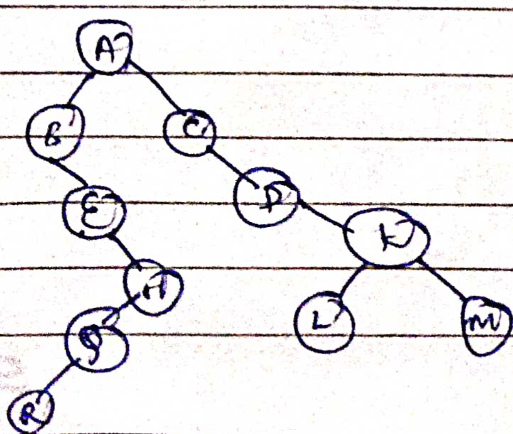
Preorder.

1. ABCEIFJDGHKL.
2. +A* - BC$ DE *F.
3. $ +A +BC *+ ABC.

Ans 2: (a)

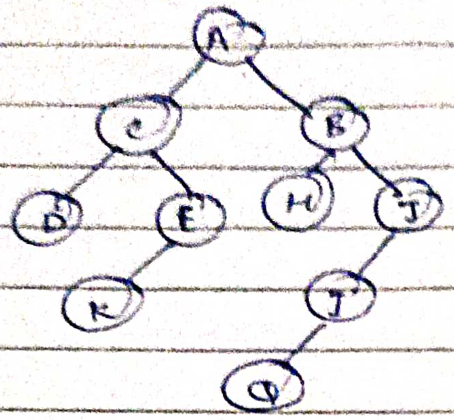


(b)



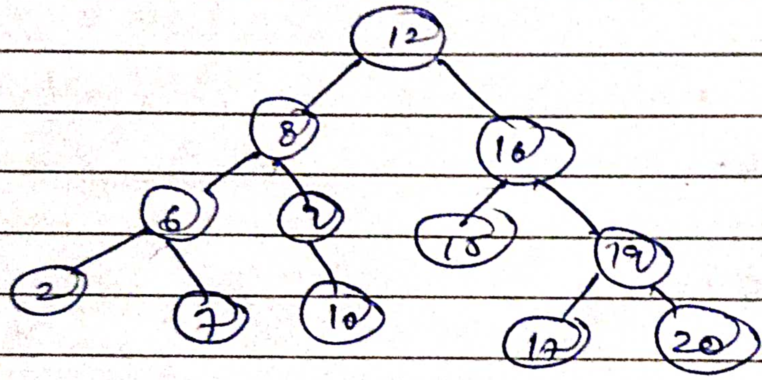
Spiral

Ans 3 : Alphabet 'D' is missing in post order so assuming that

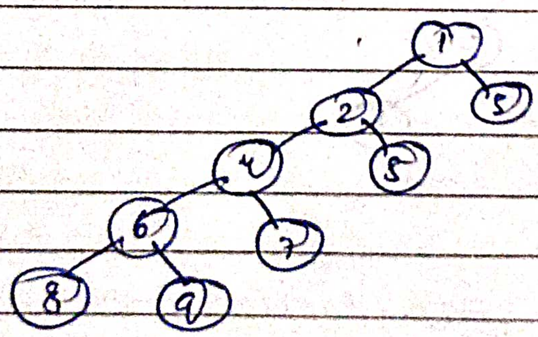


Ans 4 : ① Post order: 2, 7, 6, 10, 9, 8, 15, 17, 20, 19, 16, 12.

Tree.



② Tree



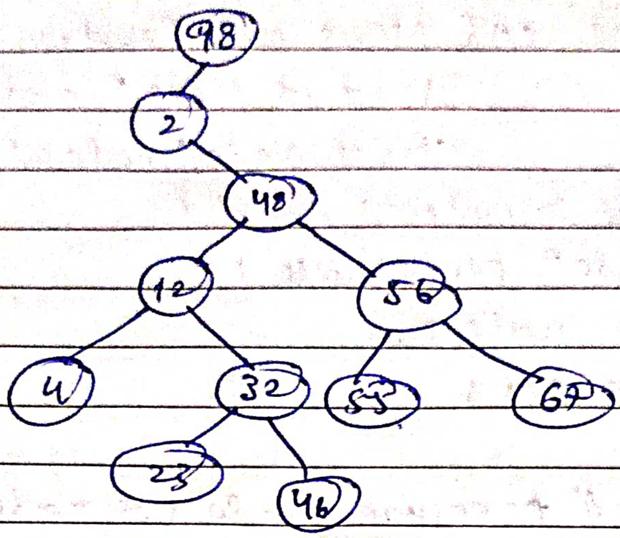
Height of this tree is 4.

⑤ In order: SQPTRWUV.

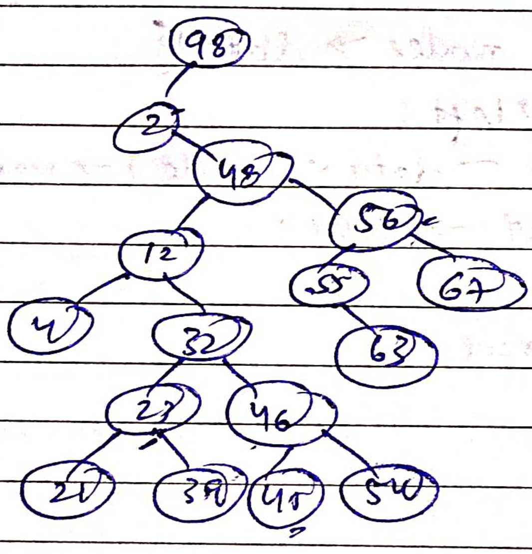
Date....................

Section III

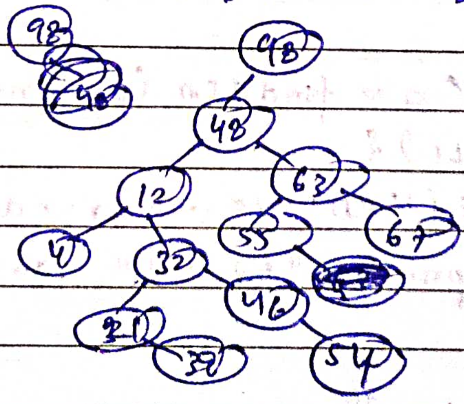
Ans 1



(a) After inserting 21, 39, 45, 54 and 63.



(b) After Deleting 23, 56, 2, and 45 from tree.



Spiral

Date..................

Ans: // finding least common Ancestor (LCA), function:-

```
Struct Node* find LCA ( Struct Node *root,
                        Struct ct Node* node1,
                        Struct Node* node2) {.
  if (node → data > node2 → data) {
      Struct Node* ptr = node 1;
      node1 = node 2,
      node = ptr;
  }.
                  // to ensure node 1 < node2.
                        in BST always.
  while (root) {.
      If (root → data > node2 → data) {.
       root = root → left;
      } else if ( root → data < node 1 → val) {
           root = root → right;
      } else {
            return root
         }
      }
      return NULL;
  }.
// Implementation.
   int main() {.
     Struct node* a = find LCA (root, node1, node2);
     if (a!= NULL) {
          printf ("LCA%d\n", a → data);
     } else {. printf ("No LCA found\n");
     }
```

Date....................

Ans 3: The no. of structurally unique BST that can be formed with key values from 1 to num (n) is given by "Catalan Numbers".

Formulae for the n^{th} Catalan No is,

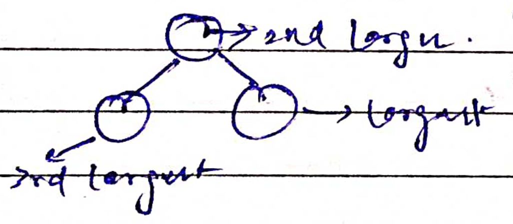
$$C_n = \frac{(2n)!}{(n+1)!\,n!}$$

Ans 4

```
int findMin (struct Node *root) {
    If (root == Null) {
        return NULL;
    }
    while (root → data != NULL) {
        root = root → left;
    }
    return root → data;
}
```

Ans 5: (a) 1000 elements → 10 levels of tree.
(10th level will be partially filled).

So total no. of nodes at 9th level = $2^9 - 1 = 511$
(2nd largest).



Index of 3rd Largest is 1 less than 511 i.e 510.

→ starting from Index 0, answer would be 509.

Spiral

Date..................

(b) Resulting tree must have height = 6,

So root must be either 1 or 7.

for node = 1 or 7;

possible permutation = $\frac{6!}{6!\,0!} = 1$

for node = 2 or 6:

Possible permutations = $\frac{6!}{5!\,1!} = 6$

→ for node 3 or 5;

possible permutation = $\frac{6!}{4!\,2!} = 15$

→ for node = 4 = $\frac{6!}{3!\,3!} = 20$

Total = 64 ways.

(c) Nodes = 15

→ Minimum height = $\lceil \log_2(n+1) \rceil - 1$

$= \lceil \log_2 16 \rceil - 1$

$= 4 - 1 = 3$

→ Maximum Height = $n - 1$

$= 15 - 1 = 14$.

Spiral