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Roll no. : 2

Section : A

Sem : III Shift : I Branch : CSE

Course Name : Data Structures and Algorithms.

Course Code : CST252

Question Paper

Q.1) "Graph: sum of degrees of all vertices in a directed graph is two times the no. of edges." Write a program to verify the rule

Q.2) Consider the nos.

52, 88, 69, 96, 27, 100, 40, 70, 42, 14

Show all the iterations if the given nos. are sorted using quick sort.

Q.3) Use mid square method for hashing and quadratic probing as a collision resolution method. Consider $c_1 = 0$ and $c_1 = 1$ for collision resolution.

Map the following keys in hash table of size 10

68, 91, 98, 24, 36, 41, 50, 44, 51, 11, 87, 78

Q.4) Construct an AVL tree for following sequence of nos.

12, 8, 15, 16, 17, 14, 6, 7, 3

Draw separate trees whenever there is imbalance and rotation.

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AnswersQ:-> Soln:-Statement:-

Graph: sum of degrees of all vertices in a directed graph is two times the no. of edges."

#main

#include <stdio.h>

#define n 8

// suppose

int sum_degree (int graph[n][n])

{ int sum = 0 ; }

for (int i=0 ; i<n ; i++)

{ int in_degree = 0 ; }

// finding indegree

for (int j=0 ; j<n ; j++)

{ if (graph[j][i] == 1)

{ in_degree++; }

}

// finding outdegree :

for

int out_degree = 0 ;

for (int j=0 ; j<n ; j++)

{ if (graph[i][j] == 1)

{ out_degree++; }

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```

    sum = sum + in-degree + out-degree;
}

return sum;

int no-of-edges (int graph[n][n]);
int no-of-edges-graph (int graph[n][n]);
int main()
{
    // initialize as when required;
    int graph[n][n] = { { 0 } };

    int sum-of-degrees = sum-degree(graph);
    int no-of-edges = no-of-edges-graph(graph);

    if (sum-of-degrees == 2 * no-of-edges)
        printf("rule approved");
    else
        printf("failed!");
}

int no-of-edges-graph (int graph[n][n]);
{
    int no = 0;
    for (int i=0; i<n; i++)
        for (int j=0; j<n; j++)
            if (graph[i][j] == 1)
                no++;
}

return no;
}

```

Q.2)

Sol:-

quicksort algorithm - pivot is (first element)

52, 88, 69, 96, 27, 100, 40, 70, 42, 14

algorithm for partitioning is

```

partition (arr, low, high)
{
    start ← low;
    end ← high;
    pivot ← arr[low];
    while (start < end) {
        while (arr[start] <= pivot)
            start++;
        while (arr[end] > pivot)
            end--;
        if (start < end)
            swap (arr[start], arr[end]);
    }
    swap (arr[low], pivot);
    int temp = arr[low];
    arr[low] = pivot;
    arr [low] = temp;
}
  
```

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partition

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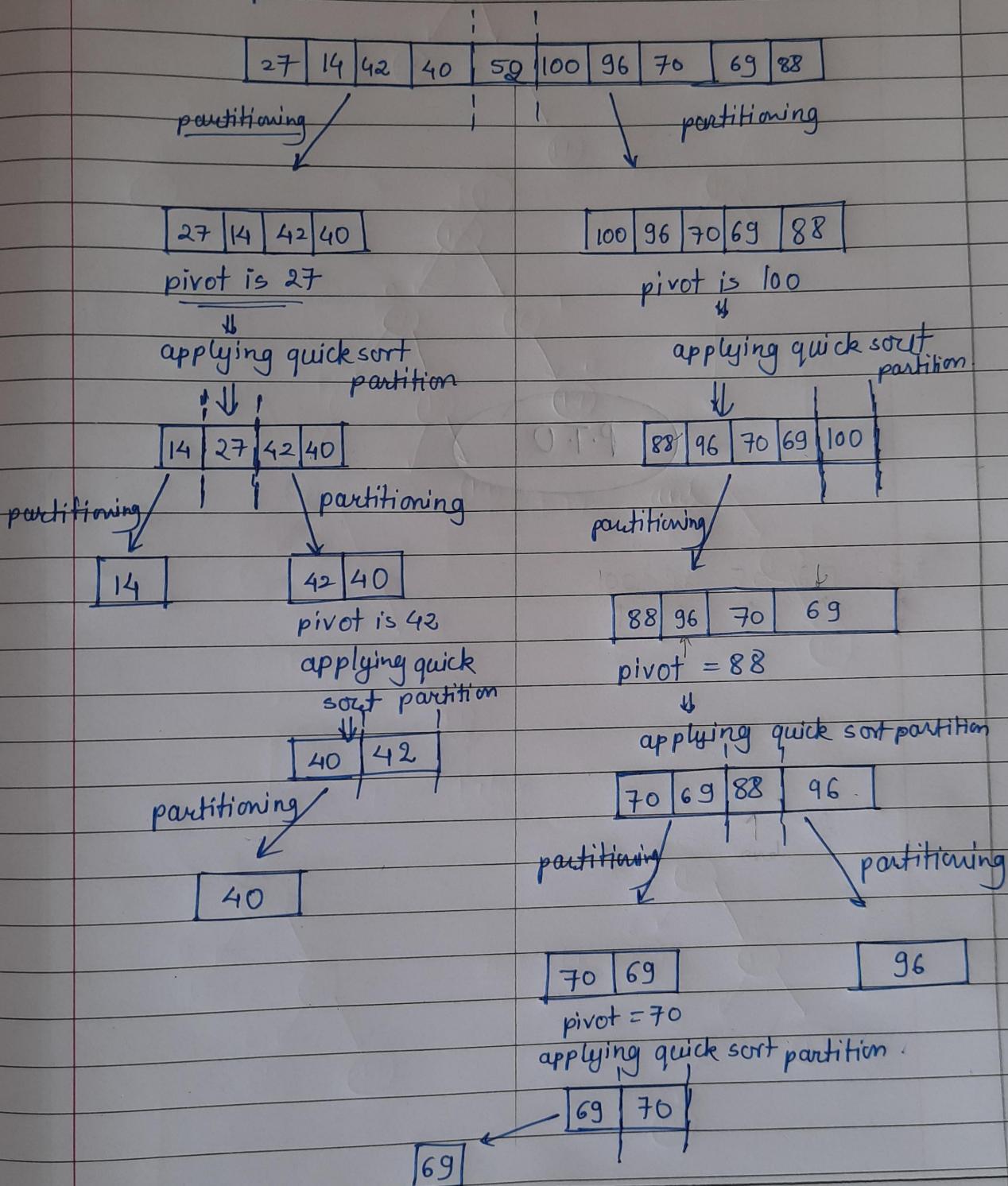
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it is a recursive function.

Steps:-

pivot = 52



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Q.3)

Soln:- mid square methodmid square method

$$\text{location} = (h(k) + c_1 i + c_2 i^2) \% m$$

68, 91, 98, 24, 36, 41, 50, 44, 51, 11, 87, 78

$$c_1 = 0$$

$$c_2 = 1$$

$$m = 10 \quad i = 1 \quad \text{as } 0-9$$

keep decreasing

keyhash table

of size 10

$$68 \quad 68^2 = 4624$$

selected element $\Rightarrow 6$

$$(6+0+0)\%10 \Rightarrow 6$$

$$91 \quad 91^2 = 8281$$

location $\Rightarrow 2$

$$(2+0+0)\%10 \Rightarrow 2$$

$$98 \quad 98^2 = 9604$$

location 6

$$(6+0+0)\%10 \Rightarrow 6$$

$$(6+0+1)\%10 \Rightarrow 7$$

$$24 \quad 24^2 = 576$$

location = 5

$$(5+0+0)\%10 = 5$$

$$36 \quad 36^2 = 1296$$

location 2

$$(2+0+0)\%10 = 2$$

$$(2+0+1)\%10 = 3$$

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$$41 \quad 41^2 = 1681$$

location = 6

$$(6+0+0) \% 10 = 6$$

$$(6+0+1) \% 10 = 6$$

$$(6+0+4) \% 10 = 0$$

$$50 \quad 2500$$

location = 5

$$(5+0+0) \% 10 = 5$$

$$(5+0+1) \% 10 = 6$$

$$(5+0+4) \% 10 = 9$$

$$44 \quad 44^2 = 1936$$

location = 9

$$(9+0+0) \% 10 = 9$$

$$(9+0+1) \% 10 = 0$$

$$(9+0+4) \% 10 = 3$$

$$(9+0+9) \% 10 = 8$$

$$51 \quad 51^2 = 2601$$

location = 6

$$(6+0+0) \% 10 = 6$$

$$(6+0+1) \% 10 = 7$$

$$(6+0+4) \% 10 = 0$$

$$(6+0+9) \% 10 = 5$$

$$(6+0+16) \% 10 = 2$$

$$(6+0+25) \% 10 = 1$$

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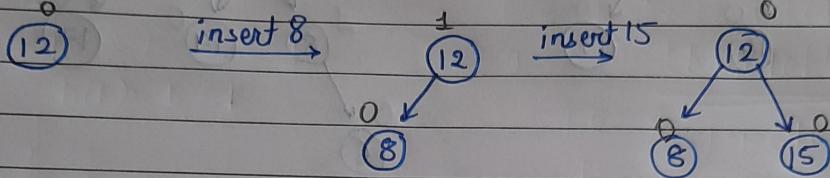
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(Q4) Soln:-

12, 8, 15, 16, 17, 14, 6, 7, 3

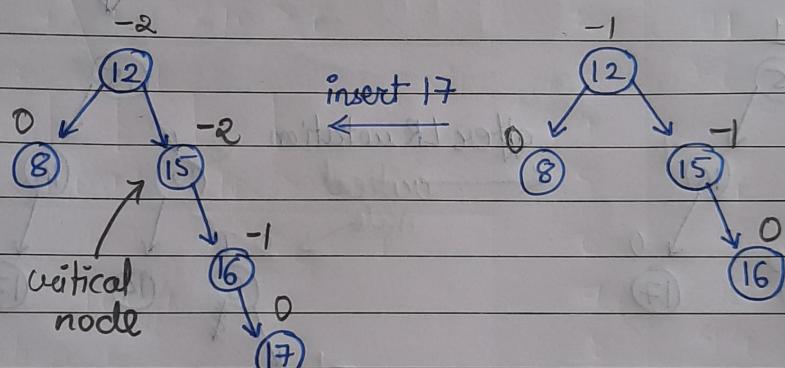
insert 12



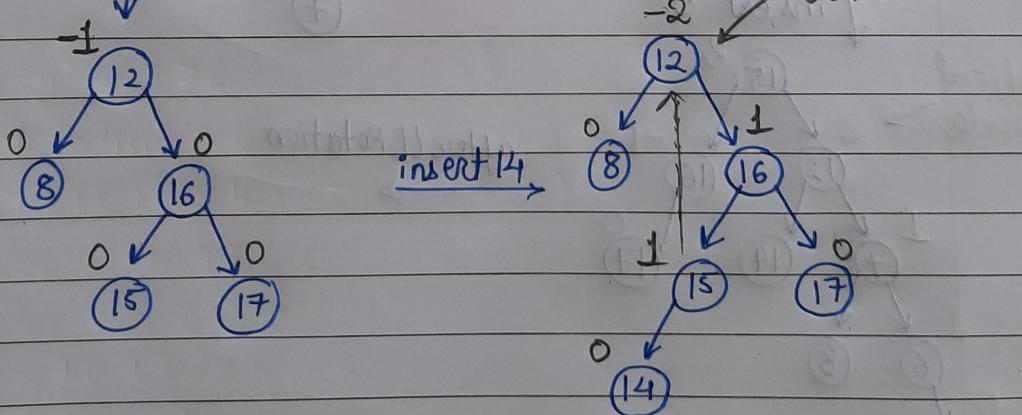
insert 8

insert 15

insert 16



after RR rotation.



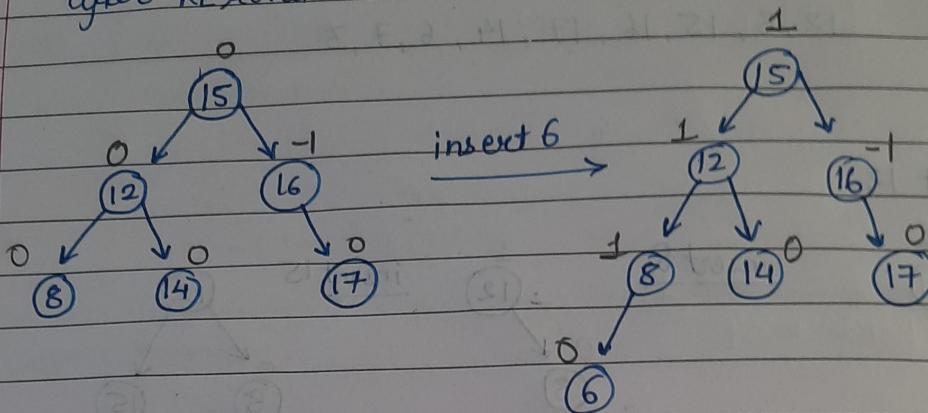
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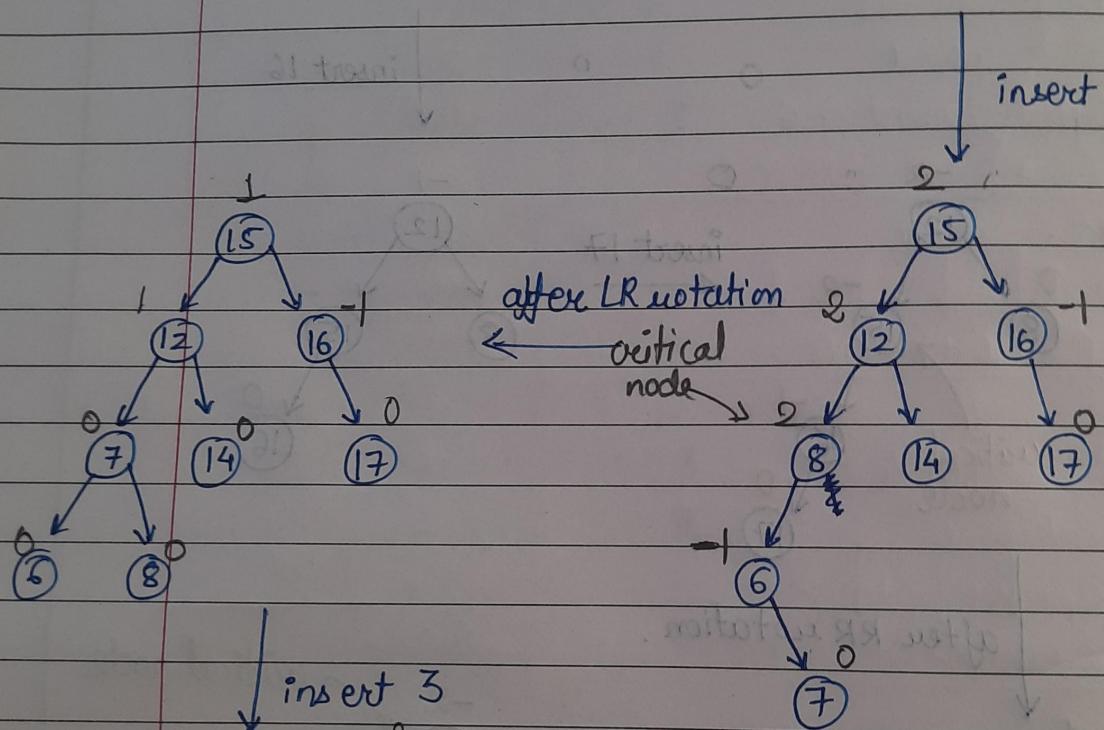
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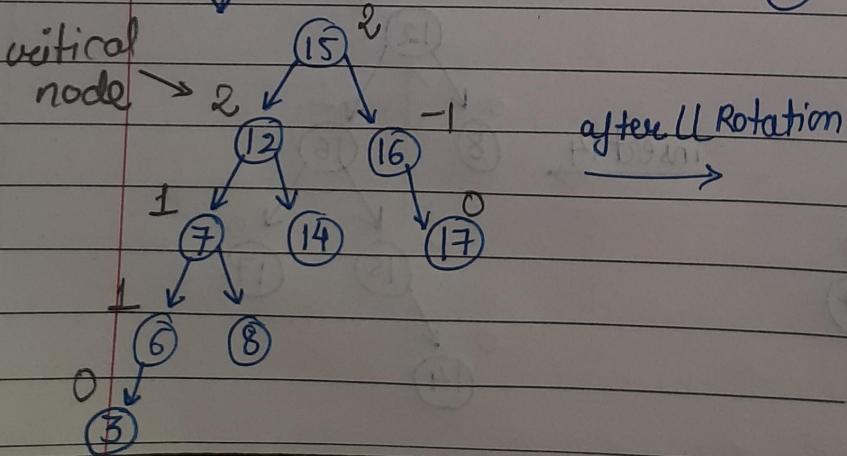
after RL rotation



insert 7



insert 3



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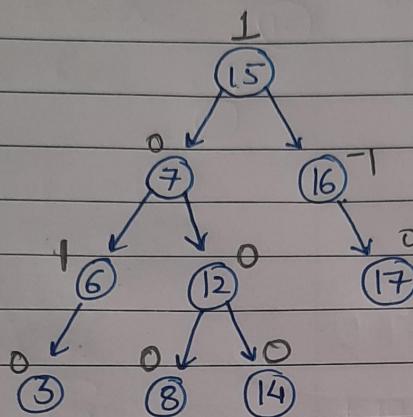
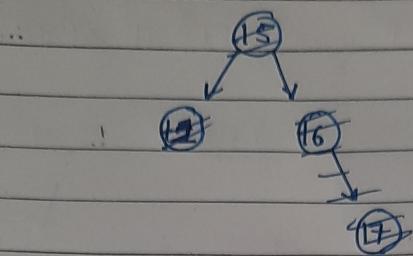
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$C_1 = 0$, $C_2 = 1$

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