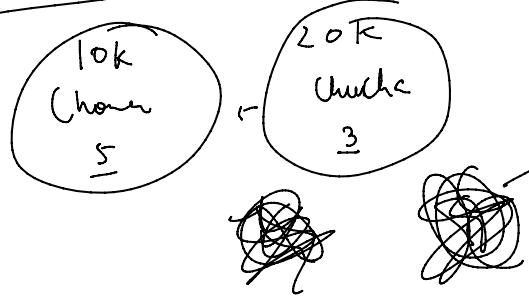


Generic

A. Compare  $T_o(B) > 0 \{$   
 $\downarrow \quad \downarrow$   
 $A - B$   
 this



A.compareTo(B) & 0

$A.gk - B.gk$

$f^n \{ 10 \}$

$f^n ( i + a )^{10}$

n-1) (Object obj)

n-2)  $\langle \text{UI} \rangle \leftarrow f^n ( \text{UI} [ \text{arr} ] )$   
 $\underbrace{\text{start}}_{\text{limits}} \quad \underbrace{\text{end}}_{\text{limits}}$

$\langle \text{UI} \rangle \rightarrow \text{sort} ( \text{Object} [ \text{arr} ] ) X$   
 $\text{sort} (\text{Comparable} < \text{UI})$

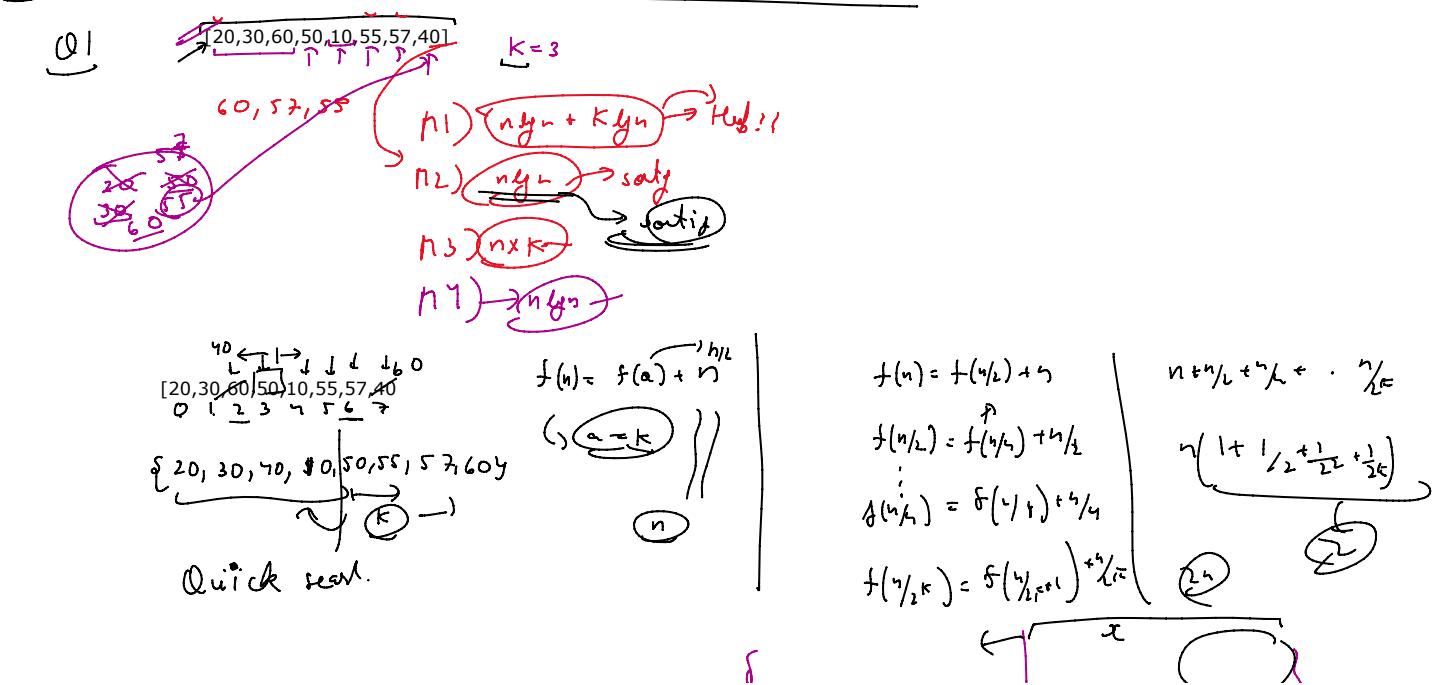
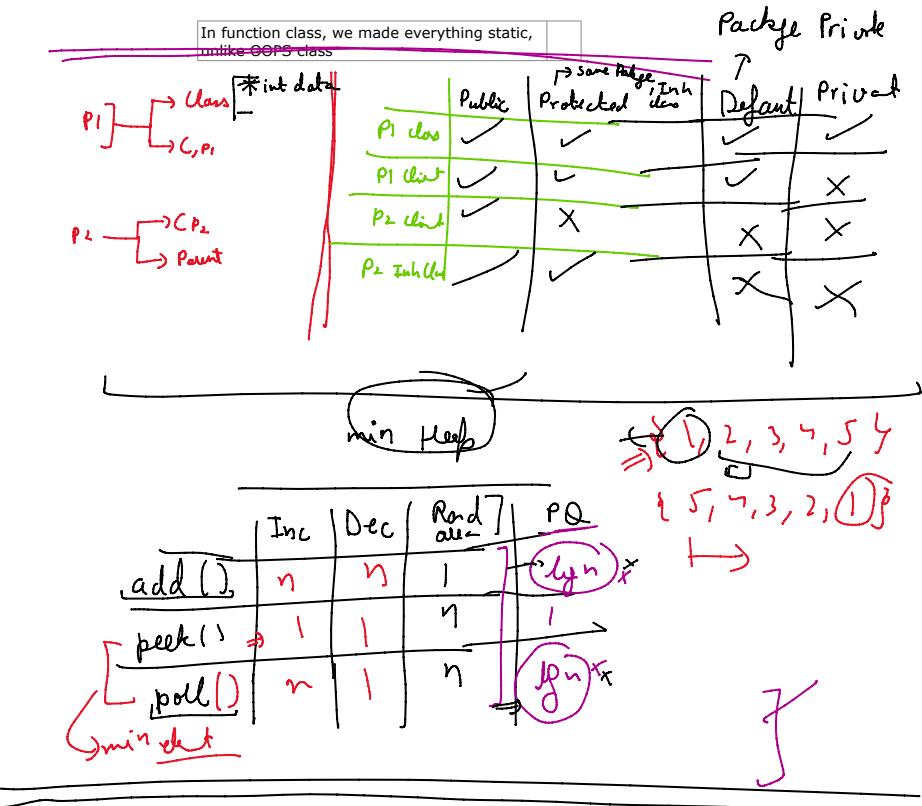
$\boxed{\text{sort} ( T \text{ arr, } \text{comparable} \rightarrow \text{obj} ) }$   
 $\text{obj. compare} ( \text{obj}_1, \text{obj}_2 )$

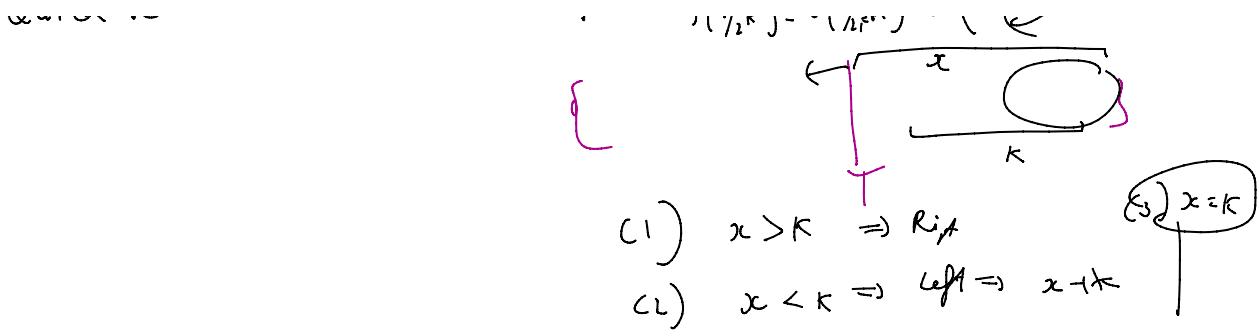
final  
 variable X initialise X update  
 $f^n$  Override X X  
 class; inherit  
 static

- Can you access non static variables in a static function!!!?!

- . Can you access non static function in static function?
- . Can you access static variables in a static fn ?!
- . Can you access static fn in a static fn ?!

- . Can you access non static variables in non static fn!!!?!
- . Can you access non static function in non static fn?!
- . Can you access static variables in non static fn ?!
- . Can you access static fn in non static fn ?!

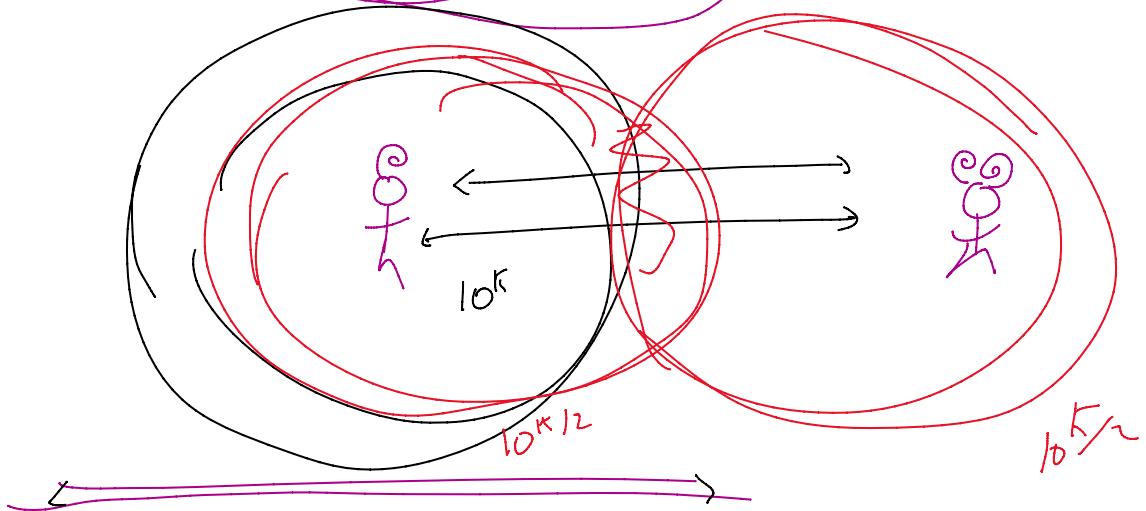
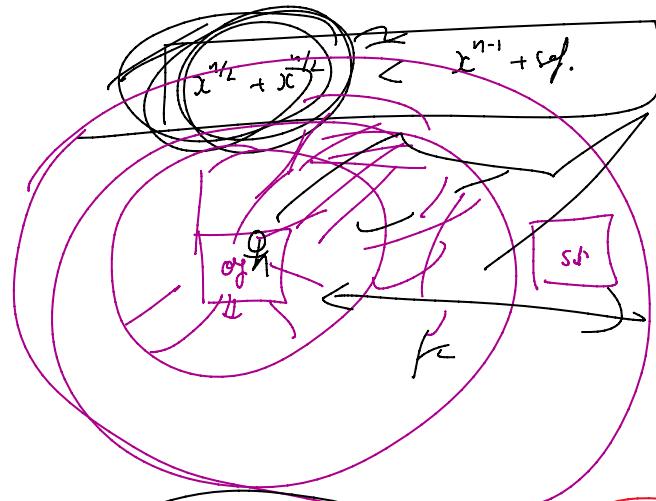




Given K sorted lists : Merge them

```
int[][] arr = {
    {10,20,30}, {15,35},
    {5,7,12,25}, {17, 22, 40}};
```

$\Rightarrow ? !$



Given K sorted lists : Merge them

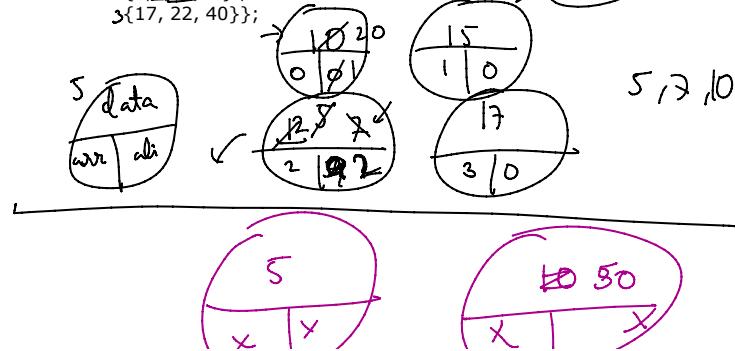
```
int[][] arr = {
    {10,20,30},
    {15,35},
    {5,7,12,25},
    {17, 22, 40}};
```

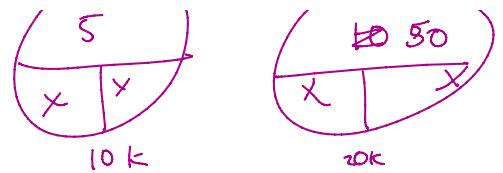
M1) merge sort

M2)

$n - K$

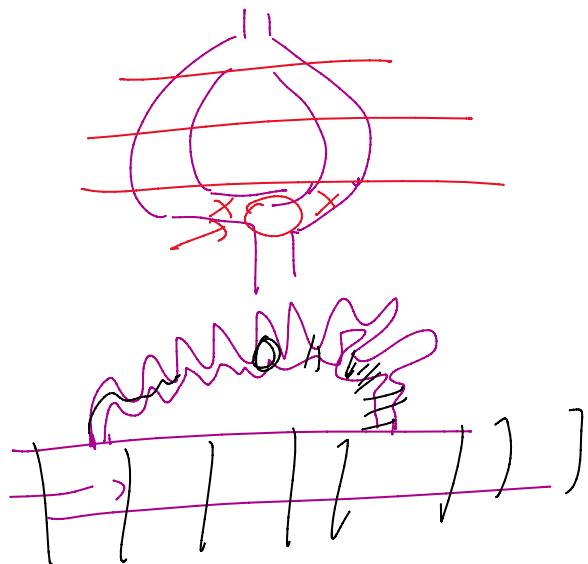
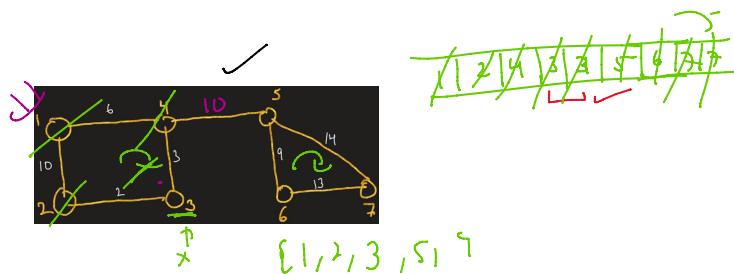
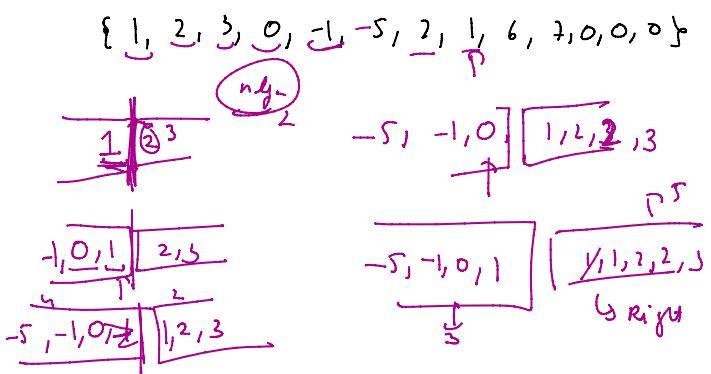
$5, 10, 12$





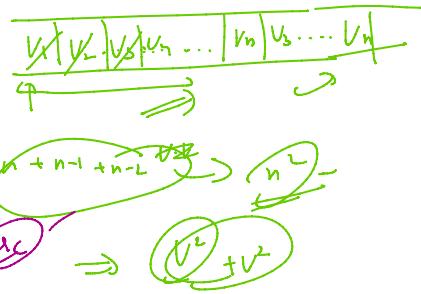
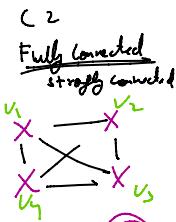
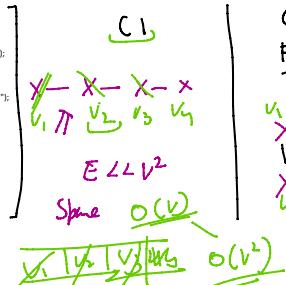
$10K$  ~~is~~  $\rightarrow$   $(20K)$  {  
 this }  
 when  $10K \cdot \text{dot} < \frac{0}{20K \cdot \text{dot}}$   
 this dot =  $0 \cdot \text{dot}$

$\underline{1, 2, 3, 0, -1, 5, 2, 1, 6, 7, 0, 0, 0}$	$\rightarrow P^1$
$1 \rightarrow 1$	$-1, 0, 1, 2, 3, 5 \rightarrow 1+1$
$1, 2 \rightarrow 1+2$	$-1, 0, 1(2) ?, 3, 5 \rightarrow 2$
$1, 2, 3 \rightarrow 2$	$-1, 0, 1, 1, 2, 3, 5 \rightarrow$
$0, 1, 2, 3 \rightarrow 1+2$	
$-1, 0, 1, 2, 3 \rightarrow 1$	

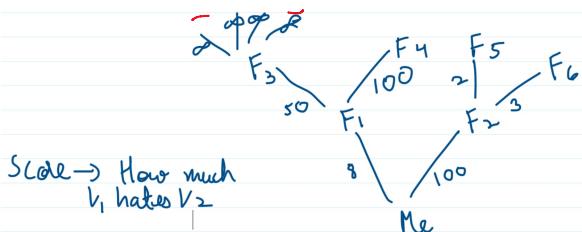
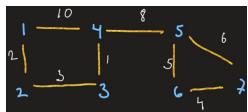
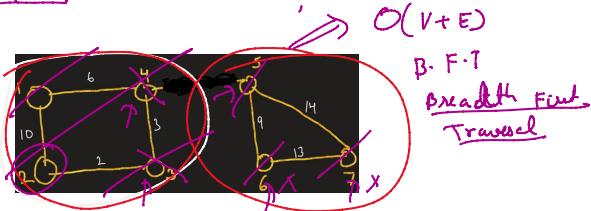


$O(V+E)$

```
public void BFS(int src) {
    Queue<Integer> Q = new LinkedList<>();
    Q.add(src);
    HashSet<Integer> Visited = new HashSet<>();
    while(Q.size() != 0) {
        int curr = Q.poll();
        if(Visited.contains(curr)) {
            System.out.println("cycle hein!!!");
        }
        Visited.add(curr);
        for(int nbr : G.get(curr).keySet()) {
            if(!Visited.contains(nbr)) {
                Q.add(nbr);
            }
        }
    }
}
```

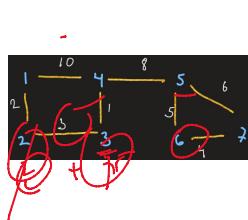


1 component

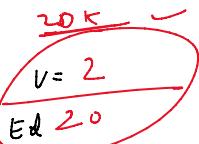
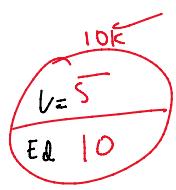


Dijkstra

single source shortest Path algo



$1 \rightarrow 0$   
 $2 \rightarrow 2$   
 $3 \rightarrow 5$   
 $4 \rightarrow 6$   
 $5 \rightarrow 14$



$10K - 20K$

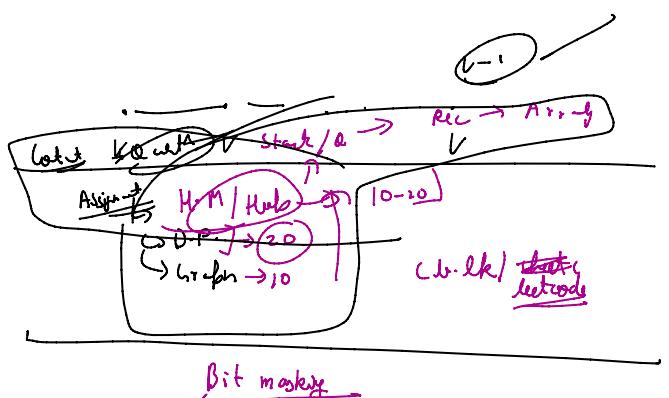
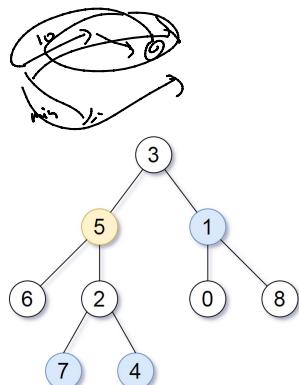
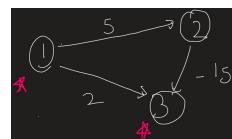
$10K - 0K$

$10K \cdot \text{cableTo}(20K) < 0$

$$\begin{array}{c} \text{Edy E} \\ \text{10K - 20K} \\ \text{10K - } \cancel{0} \\ \text{10K} \cdot \text{exponeTo}(20K) \\ \text{P} \end{array}$$

$$E_{\text{dy}}(V^2) = 2(E_{\text{dy}}V)$$

$E_{\text{dy}}V$



2	3	1	1
1	1	1	1
5	1	1	1
2	0	1	1
1	1	1	1

$$\begin{array}{ccccccc} & 4 & 8 & 4 & 2 & 1 & \\ & \downarrow & \downarrow & \downarrow & \downarrow & \downarrow & \\ 1 & 0 & 1 & 0 & 1 & 1 & \\ & \downarrow & \downarrow & \downarrow & \downarrow & \downarrow & \\ & 2 & 2 & 2 & 2 & 2 & \end{array} = 23$$

$$\begin{array}{r} 10111 \rightarrow 23 \\ 06101 \\ \hline \end{array}$$

$$\begin{array}{r} 10111 \rightarrow 23 \\ 06101 \\ \hline 10111 \\ \hline 23 \end{array}$$

XOR

$$x \wedge x = 0$$

~~x~~

different  $\rightarrow 1$

$$x \wedge 1$$

$[0, \dots, n]$

$$(x \wedge 0 = x)$$

$$\begin{array}{l} (A \wedge B) \wedge C \\ ((\neg A) \wedge A) \end{array}$$

$$15 \wedge 15 = 0$$

$$15 \wedge 0 = 15$$

$$\frac{\cancel{x}}{(0 \wedge 1 \wedge 2 \wedge 3 \wedge 4 \wedge 5 \wedge 6 \wedge 7 \wedge 8 \wedge 9 \wedge 10 \wedge 11 \wedge 12 \wedge 13 \wedge 14 \wedge 15)} \wedge 15 = 15$$

$$\begin{array}{ccccccc} 2 & \rightarrow & 16 & \rightarrow & 37 & \rightarrow & 58 \\ F_s & \swarrow & F_s & & & & \downarrow \\ 20 & & 42 & & 145 & & +16 \\ & & & & & & \end{array}$$

$$\begin{array}{ccccccc} 3 & \rightarrow & 8 & \rightarrow & 81 & \rightarrow & 65 \\ & & 9 & & 1 & & 5 \\ & & 16 & \rightarrow & 37 & \rightarrow & 58 \\ 10 & \leftarrow & 4 & \leftarrow & 145 & \leftarrow & 61 \end{array}$$

l  $\rightarrow$  const.

$$\begin{array}{c} 10 \\ \overbrace{999999999} \rightarrow 810 \\ 999 \rightarrow 81 \times 3 \end{array}$$

$$81 \times 3 -$$

Times

CEO

Distr.

AD

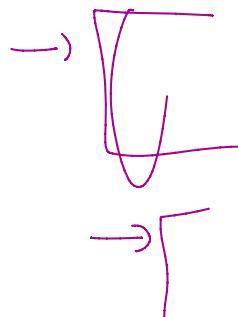
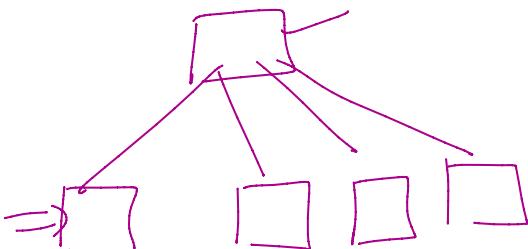
Mayer

Leadr.

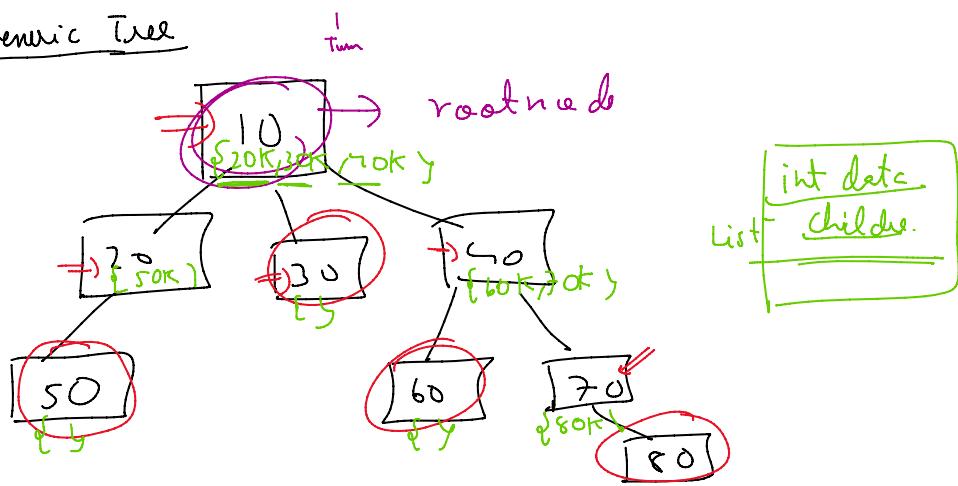
SD3

SD2

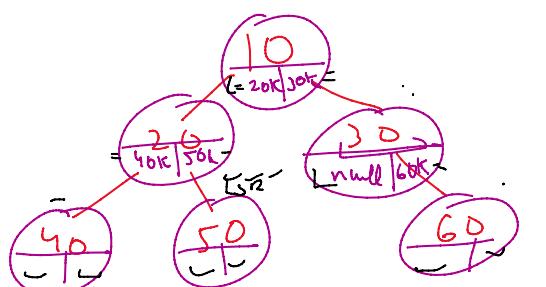
SD1



## Generic Tree



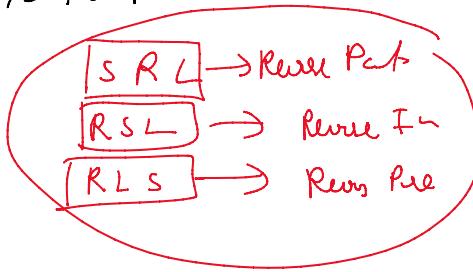
## Binary Tree

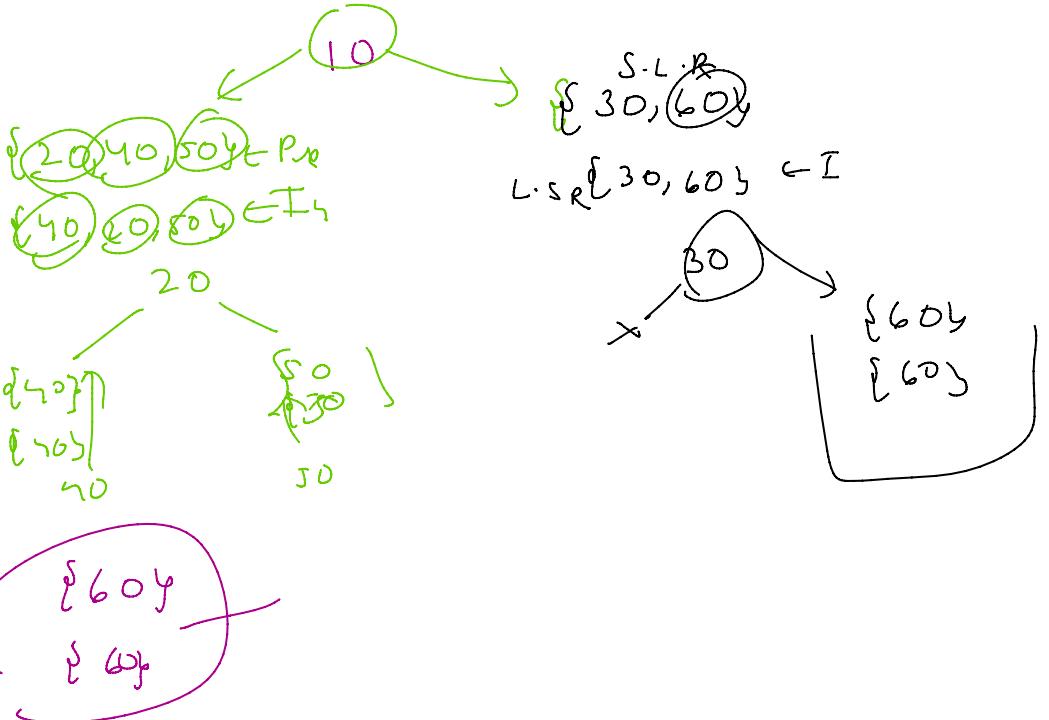
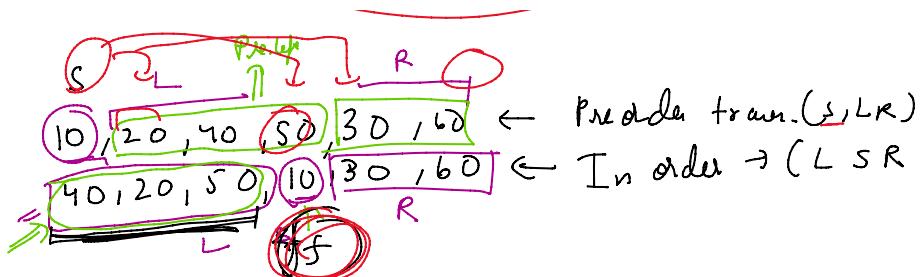


```
public void print() {
    print(root);
}
private void print(Node nn) {
    if(nn==null) {
        return;
    }
    print(nn.left);
    System.out.println(nn.data);
    print(nn.right);
}
```

Pre In Post  
-> S I P  
A T D  
B I A  
O P D C

10, 20, 40, 50, 30, 60  $\leftarrow$  Preorder trans. (S, LR)  
 40, 20, 50, 10, 30, 60  $\leftarrow$  Inorder  $\rightarrow$  (L S R)  
 40, 50, 20, 60, 30, 10  $\leftarrow$  Post ord  $\rightarrow$  L R C





```

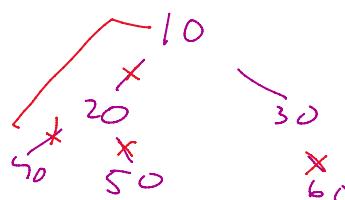
nn.left = createPreIn(pre, preS, preS+size, in, i, f-1);
nn.right = createPreIn(pre, preS+size+1, preE, in, f+1, inE);
    
```

$S > C$   
at null

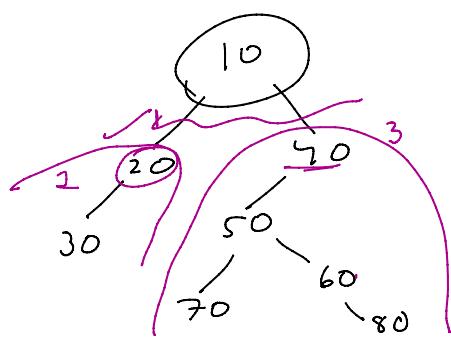


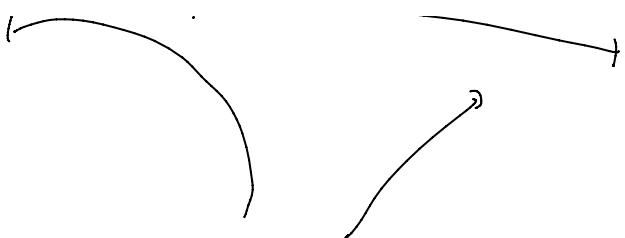
```

private int size(Node nn) {
    if(nn==null) {
        return 0;
    }
    int L = size(nn.left);
    int R = size(nn.right);
    return L+R+1;
}
    
```

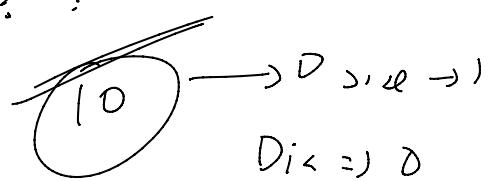
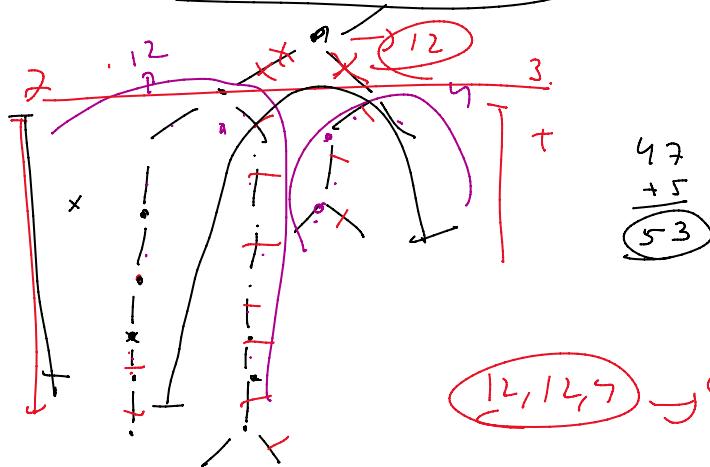
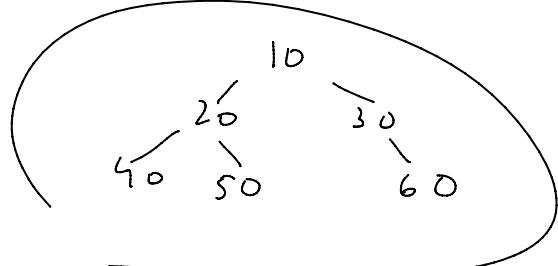
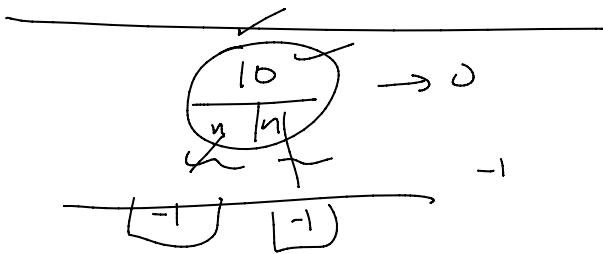


Max dist. root to leaf





80 1



$$f(n) = 2 + (n)_L + n \rightarrow \text{next step}$$

$\hookrightarrow n \log n$

$$f(n) = f(a) + f(n-a) + n$$

$n^2$        $n \log n$        $n^{\frac{1}{4}}$

