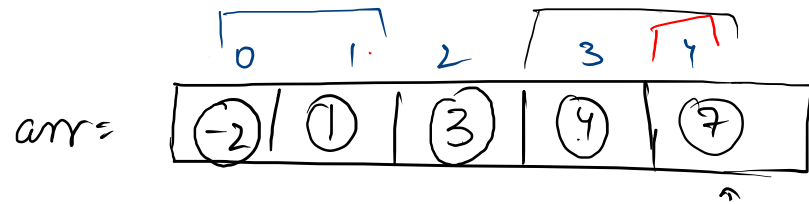
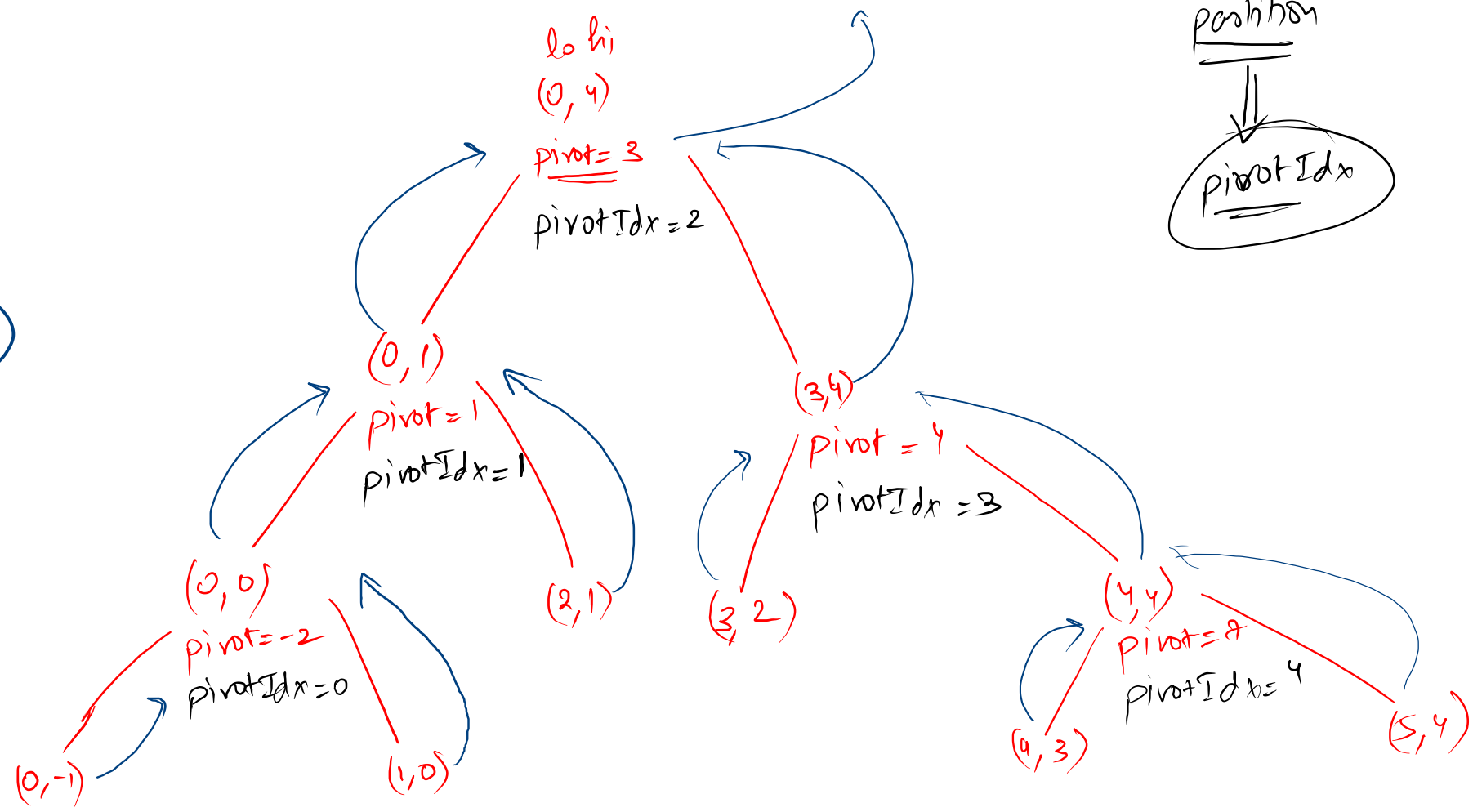
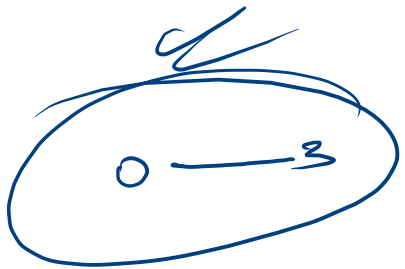


5 7 -2 4 1 3

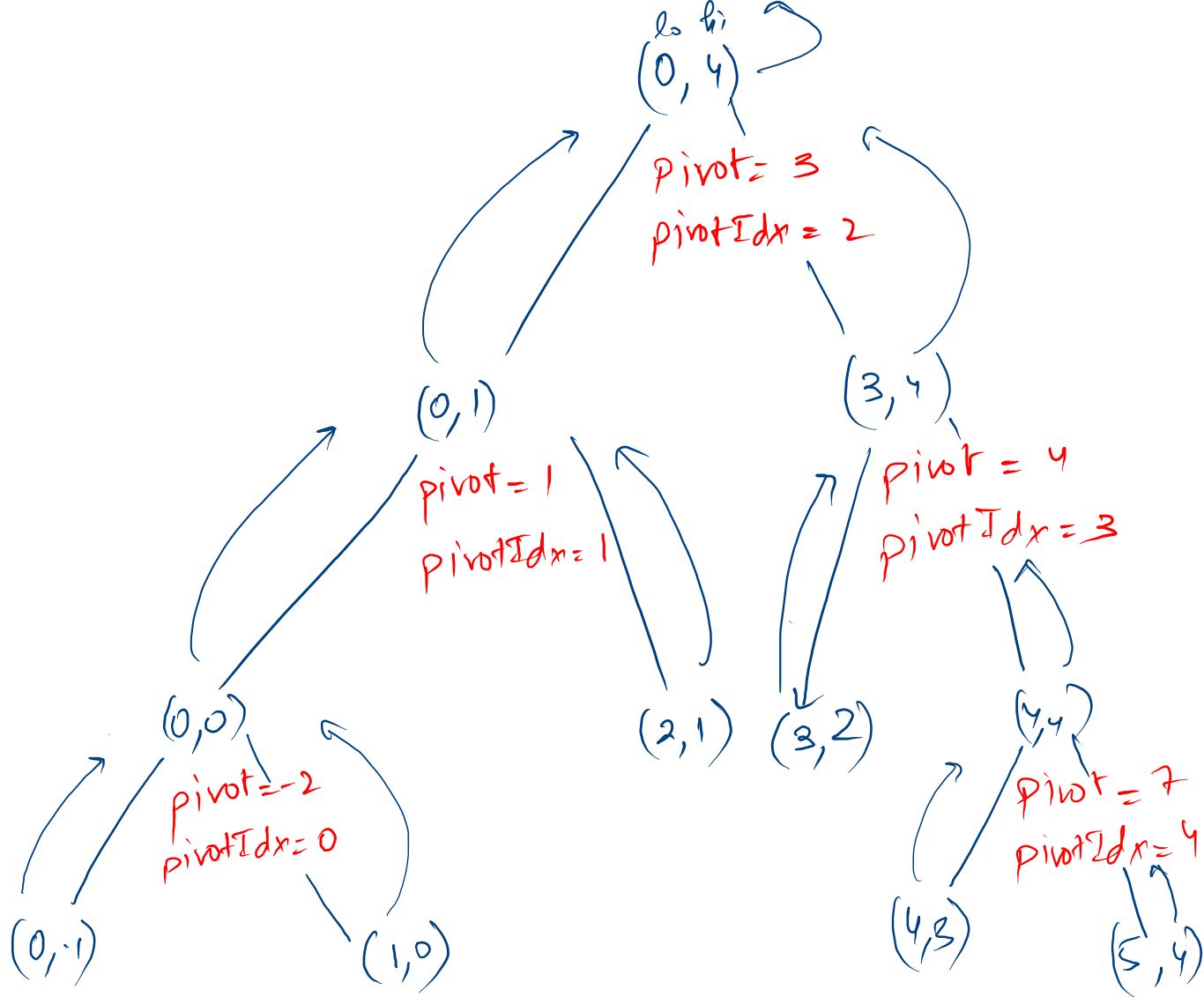
inplace



pivot  
⇓  
position  
⇓  
pivotIdx



0	1	2	3	4
-2	1	3	4	7



(0, 8)

pivot = 17

pivotIdx = 4



(5, 8)

pivot = 18

pivotIdx = 5



(6, 8)

pivot = 19

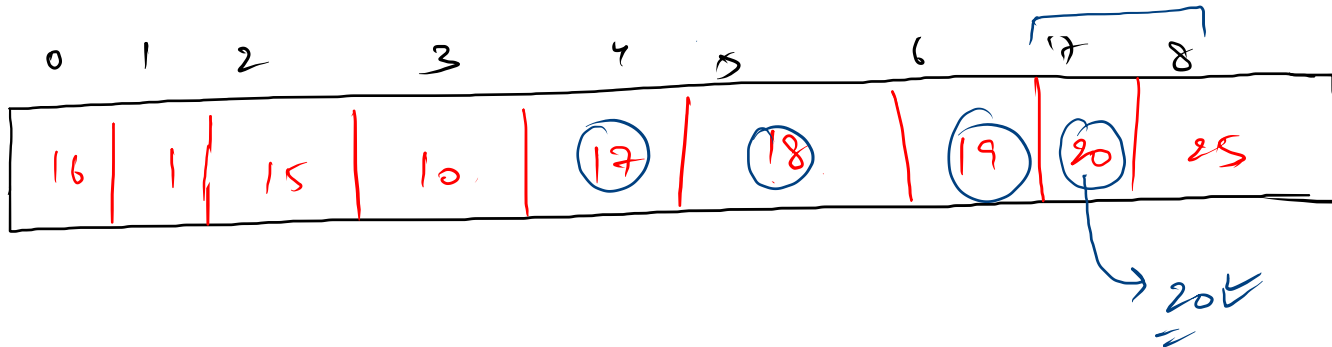
pivotIdx = 6



(7, 8)

pivot = 20

pivotIdx = 7



idx = 7 ✓

$\downarrow \quad \downarrow \quad \downarrow \quad \downarrow \quad \downarrow \quad \downarrow \quad \downarrow$   
 0 1 2 3 4 5 6

arr =

7	-2	4'	1'	3	4''	1''
---	----	----	----	---	-----	-----

max = 7  
min = -2

①

freq =

0	1	2	3	4	5	6	7	8	9
1	0	0	2	0	1	2	0	0	1

range  $\Rightarrow$  max - min + 1

-2	-1	0	1	2	3	4	5	6	7
$\downarrow$	$\downarrow$	$\downarrow$	$\downarrow$	$\downarrow$	$\downarrow$	$\downarrow$	$\downarrow$	$\downarrow$	$\downarrow$
0	1	2	<u>3</u>	4	5	6	7	8	9

②

psa =

0	1	2	3	4	5	6	7	8	9
<del>1</del>	1	1	<del>3</del>	3	<del>1</del>	<del>6</del>	6	6	<del>7</del>
0			2		3	4			6

③

0	1	2	3	4	5	6
-2	1'	1''	3	4'	4''	7

4''    4' x

- ① val
- ② pos
- ③ place
- ④ idx

$\begin{pmatrix} 1 & 2 & 4' \end{pmatrix}$   
 $\begin{pmatrix} & 4 & 4'' \end{pmatrix}$   
 $\left. \begin{matrix} 1 & 2 & 4' \\ & 4 & 4'' \end{matrix} \right\}$   
 $\left. \begin{matrix} 4 & 4'' \\ 1 & 2 & 4' \end{matrix} \right\}$

✓ min = -2

max = 7

range ⇒ 10

arr =

0	1	2	3	4	5	6
7	-2	4	1	3	4	1

freq =

0	1	2	3	4	5	6	7	8	9
<del>0</del>	1	1	<del>2</del>	3	<del>4</del>	<del>6</del>	6	6	<del>7</del>
0			2	3	3	4			6

res =

0	1	2	3	4	5	6
-2	1	1	3	4	4	7

-2 - (-2)

✓ int range = max - min + 1;

✓ int freq[] = new int[range];

```
for(int v1 : arr){  
    int pos = v1 - min;  
    freq[pos]++;  
}
```

```
for(int i = 1 ; i < range ; i++){  
    freq[i] += freq[i-1];  
}
```

✓ int res[] = new int[arr.length];

```
for(int i = arr.length-1; i >= 0; i--){  
    int v1 = arr[i]; // 7  
    int pos = v1 - min; // 9  
    int place = freq[pos]; // 4  
    res[place-1] = v1;  
    freq[pos]--;  
}
```

Radix  
(Least Sig → Most Sig)

$$d \leftarrow \left( \text{num} / \text{exp} \right) \cdot 10 \rightarrow \underline{8}$$

$$10(2)/100 \rightarrow 10 \cdot 10 \rightarrow 10$$

✓1	✓10
9 0 8 5 ✓	✓ 0 7 0 0 ✓
1 0 5 8 ✓	✓ 1 1 1 1 ✓
0 0 0 9 ✓	✓ 1 0 2 1 ✓
0 0 1 9	✓ 1 0 0 1 ✓
1 1 1 1 ✓	✓ 0 0 9 9 ✓
1 0 2 1 ✓	✓ 9 0 8 5 ✓
1 0 0 1 ✓	✓ 0 0 0 5 ✓
0 7 0 0 ✓	✓ 0 0 0 7 ✓
0 0 0 7 ✓	✓ 1 0 5 8 ✓
0 0 0 5 ✓	✓ 0 0 0 9 ✓
0 0 4 4 ✓	✓ 0 0 1 9 ✓
9 9 9 9 ✓	✓ 9 9 9 9 ✓

0	1	2	3	4	5	6	7	8	9
8	7	8	8	9	10	10	10	11	12
4	8	7	0	8	9				
3	5								
2									
1									
0									

```
public static void countSort(int[] arr, int exp) {
    int freq[] = new int[10];
    for(int vl : arr){
        freq[(vl/exp)%10]++;
    }

    for(int i = 1; i < 10; i++){
        freq[i] += freq[i-1];
    }

    int res[] = new int[arr.length];
    for(int i = arr.length-1; i >= 0; i--){
        int vl = arr[i];
        int pos = (vl/exp)%10;
        int place = freq[pos];
        res[place-1] = vl;
        freq[pos]--;
    }

    for(int i = 0; i < arr.length; i++){
        arr[i] = res[i];
    }
    System.out.print("After sorting on " + exp + " place -> ");
    print(arr);
}
```

0	1	2	3	4	5	6	7	8	9	10	11
0200	1001	0005	0007	0009	1111	1019	1021	0044	1058	9085	9999

1  
✓✓

10  
✓✓

9  
✓✓

19  
✓✓

18  
✓✓

17  
✓✓

~~max  $\Rightarrow$  - $\infty$  1 10 19~~

~~max = + $\infty$~~

DDMMYY

5

✓ 12041996

✓ 20101996

05061997

✓ 12041989

11081987

H.W.

I

✓ Day [32]

Sum

✓ 05 06 1997

✓ 11 08 1987

✓ 12 04 1996

✓ 12 04 1989

✓ 20 10 1996

✓ day → (date / 1000000)

Count Dates

It → 3

(12 / 100) / 100 → (2) =

✓ Month [12] II

✓ 12 04 1996

✓ 12 04 1989

✓ 05 06 1997

✓ 11 08 1987

✓ 20 10 1996

✓ Month = (date / 10000) % 100

✓ Year [2501] III

11 08 (1987)

12 04 1989

12 04 1996

20 10 1996

05 06 1997

✓ Year ← date % 10000

[ ] =





14	✓ 10	✓ 2000	06	11	2000
06	11	2000	14	10	1998