

## Part 1.1 Disk organization.

### Question 1.1.1 Disk Access

1. How many records fit onto a block?

$$\text{Block size} = 4096 \text{ bytes}$$

$$\text{each record byte} = 100 \text{ bytes}$$

$$\text{No. of records} = \frac{4096}{100} = 40.96$$

Ans: 40 records can fit into a block.

2. How many blocks are required to store the entire file? If the file is arranged sequentially on the disk, how many cylinders are needed?

No. of blocks for entire file:

$$\text{Total records} = 150,000$$

$$\text{No. of records per block} = \frac{150,000}{40} = 3750 \text{ blocks}$$

Ans: 3750 blocks required to store entire file

No. of cylinders:

$$\text{No. of sectors per track} = 50$$

$$\text{No. of blocks per sector} = \frac{4096}{4096} = 1$$

$$\begin{aligned}
 \text{Blocks per track} &= \frac{\text{no. of sector per track}}{\text{no. of blocks per sector}} \times \frac{50}{1} = 50 \text{ blocks} \\
 &= 50 \times 5 \times 2 \approx 500 \text{ blocks} \\
 \text{No. of cylinders for entire file} &= \frac{3750}{500} = 7.5 \text{ cylinder} \\
 &= 8 \text{ cylinder.}
 \end{aligned}$$

Ans: 8 cylinders are needed.

3. How many records of 100 bytes each can be stored using this disk?

$$\begin{aligned}
 \text{No. of records per block} &\approx 40 \\
 \text{No. of sectors} &= 50 \\
 \text{Platters} &= 5 \times 2 = 10 \\
 \text{tracks} &\approx 1000 \\
 &= 40 \times 50 \times 10 \times 1000 \\
 &= 20,000,000 \text{ records}
 \end{aligned}$$

Ans: No. of records = 20,000,000 records.

4. What time is required to read a file containing 100,000 records of 100 bytes each sequentially? You can assume that the time for moving from one cylinder to another is very small?

$$\text{Access time} = \text{Seek time} + \text{Rotational transfer time} + \text{Other delay (Waiting time)}$$

Seek time = 8 ms

Rotational delay =  $\frac{1}{2}$  Revolution

$$1 \text{ revolution} = \frac{60 \times 1000}{7200} = 8.3 \text{ msec}$$

Rotational delay = 4.15 msec

Total records = 100,000

$$\text{No. of blocks} = \frac{100,000}{40} = 2500 \text{ blocks}$$

each cylinder = 500 blocks

$$= \frac{2500}{500} = 5 \text{ cylinders}$$

$$\text{Transfer time} = 5 \times 8.3 \times 10 = 415 \text{ msec}$$

$$\text{Access time} = 415 + 8 + 4.15 = 427.15 \text{ msec}$$

Ans: Access time is 0.42715 sec.

## Part 1.8 Index Structures

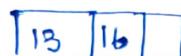
### Question 1.8.1 B<sup>+</sup> tree Construction

D = 3

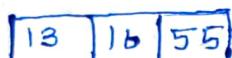
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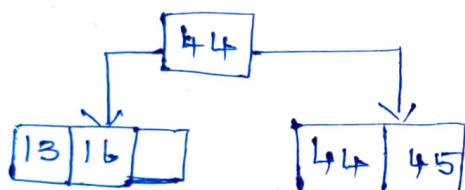
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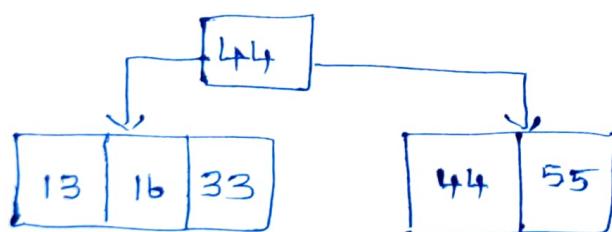
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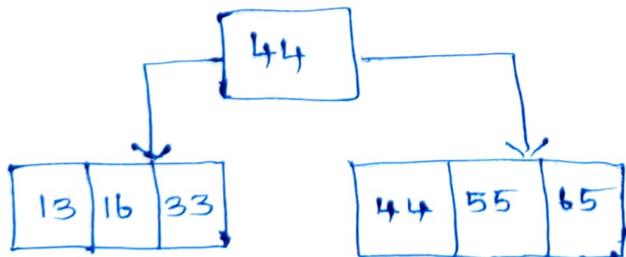
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Insert 33



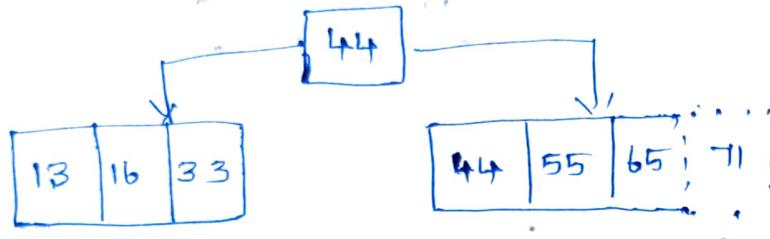
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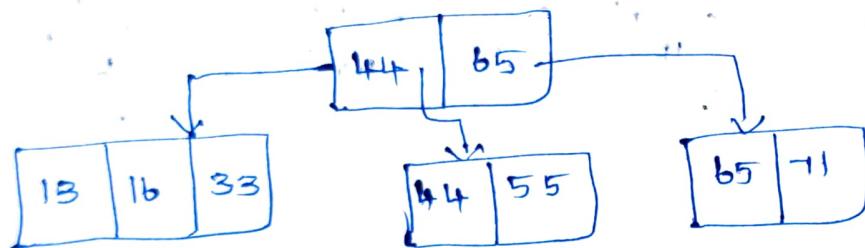


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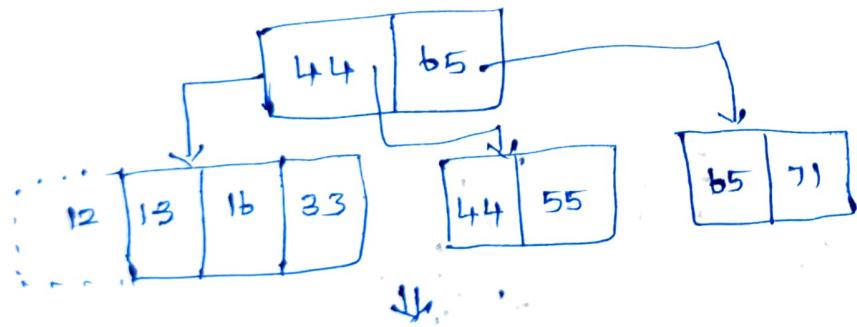
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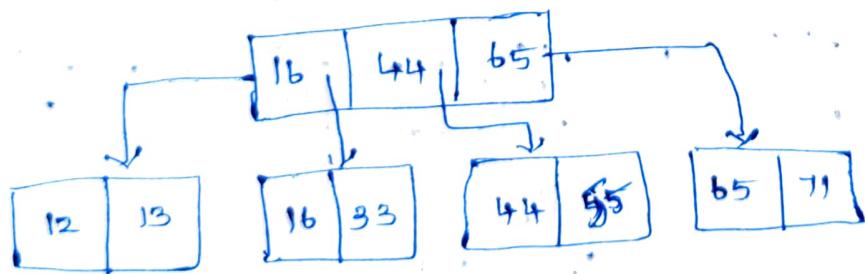
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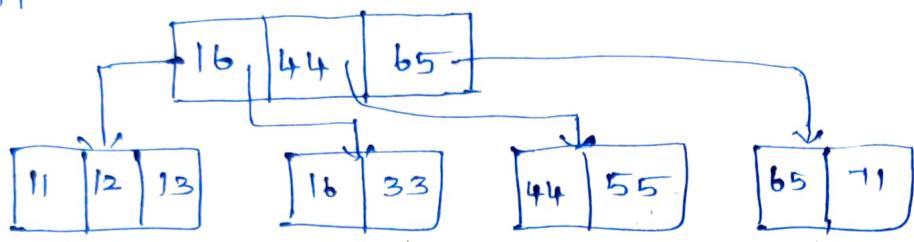
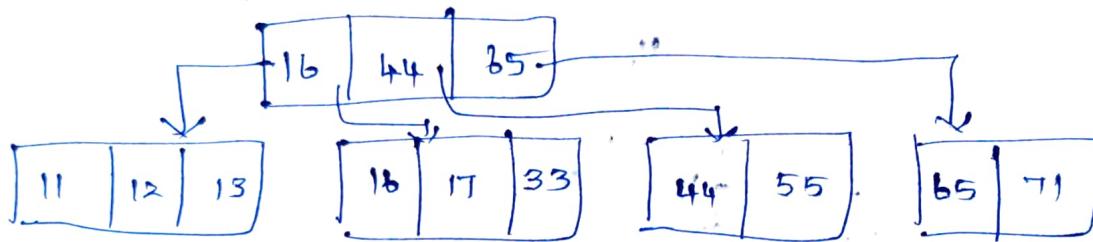
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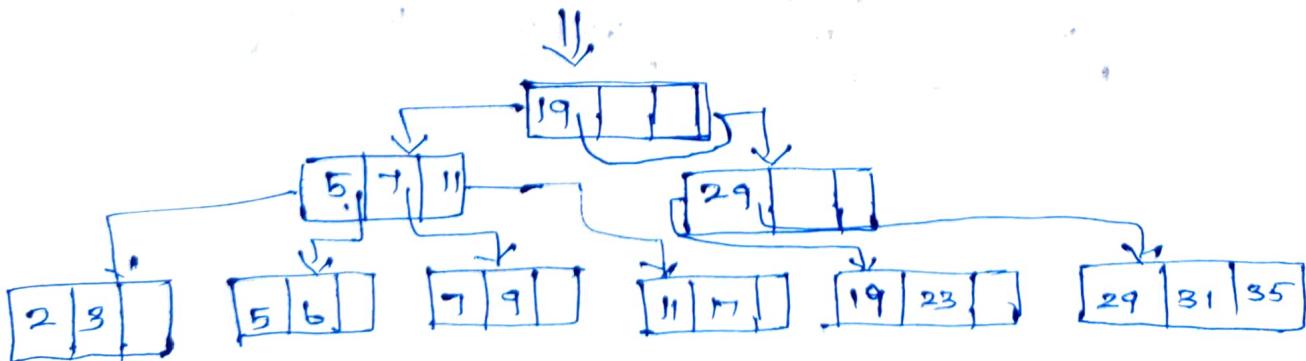
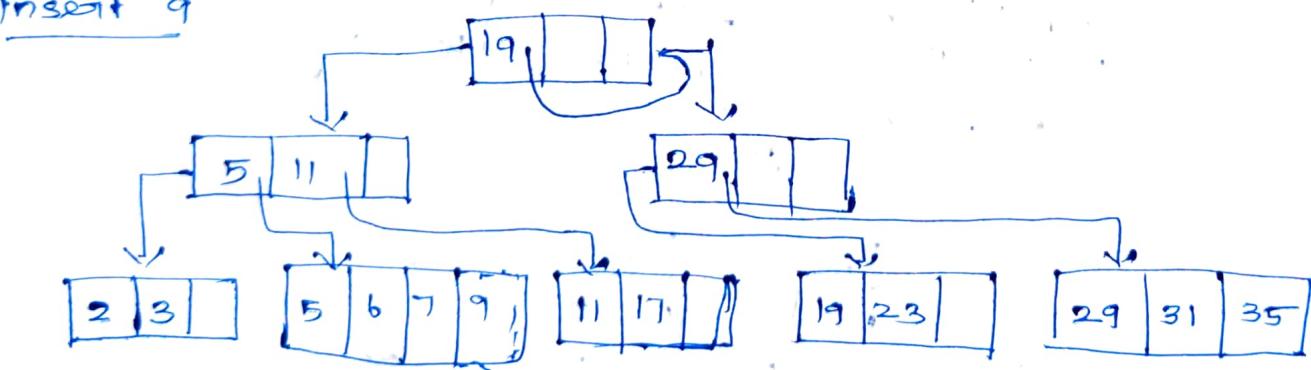


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Insert 11Insert 17

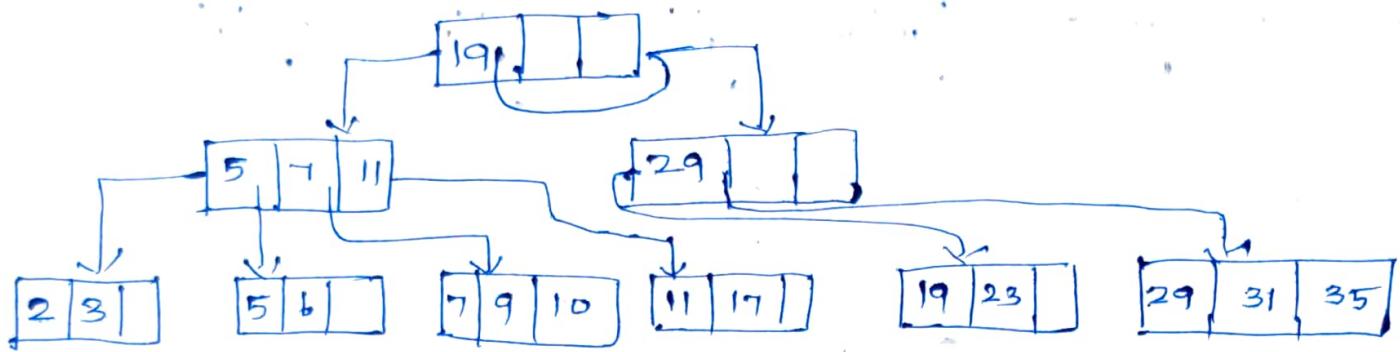
Question 1. 2. 3 operations :-

$$\underline{n=3}$$

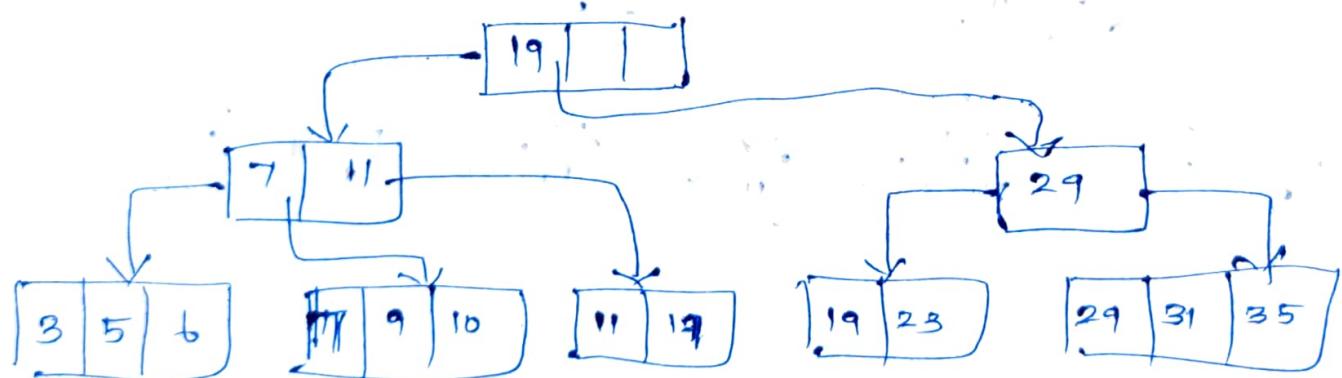
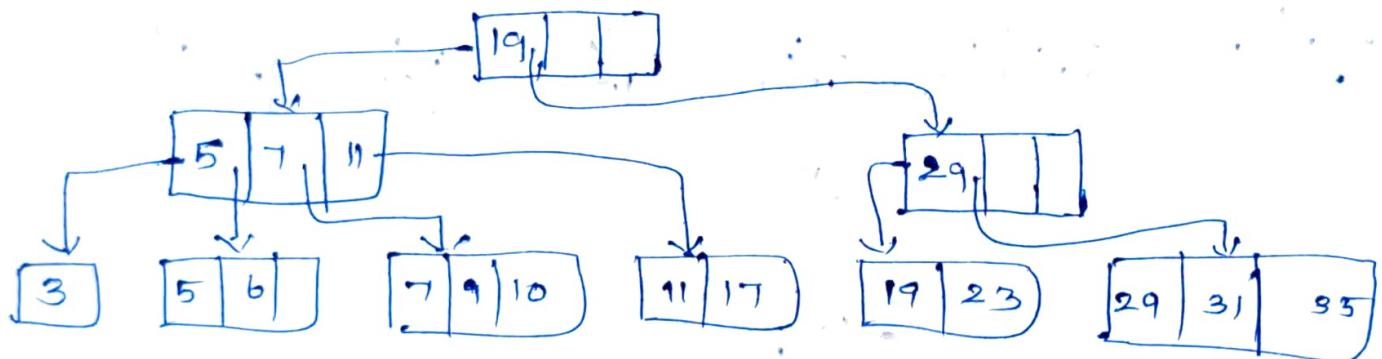
Insert 9

①

Insert 10

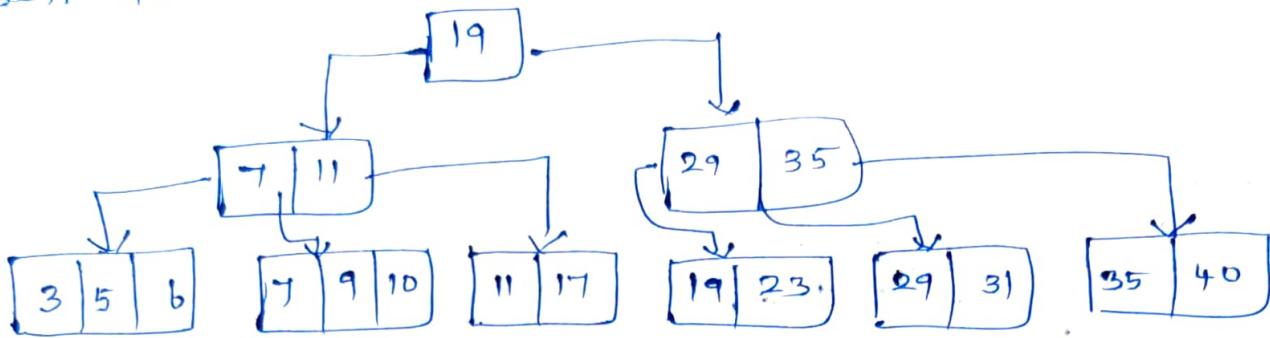


delete 2

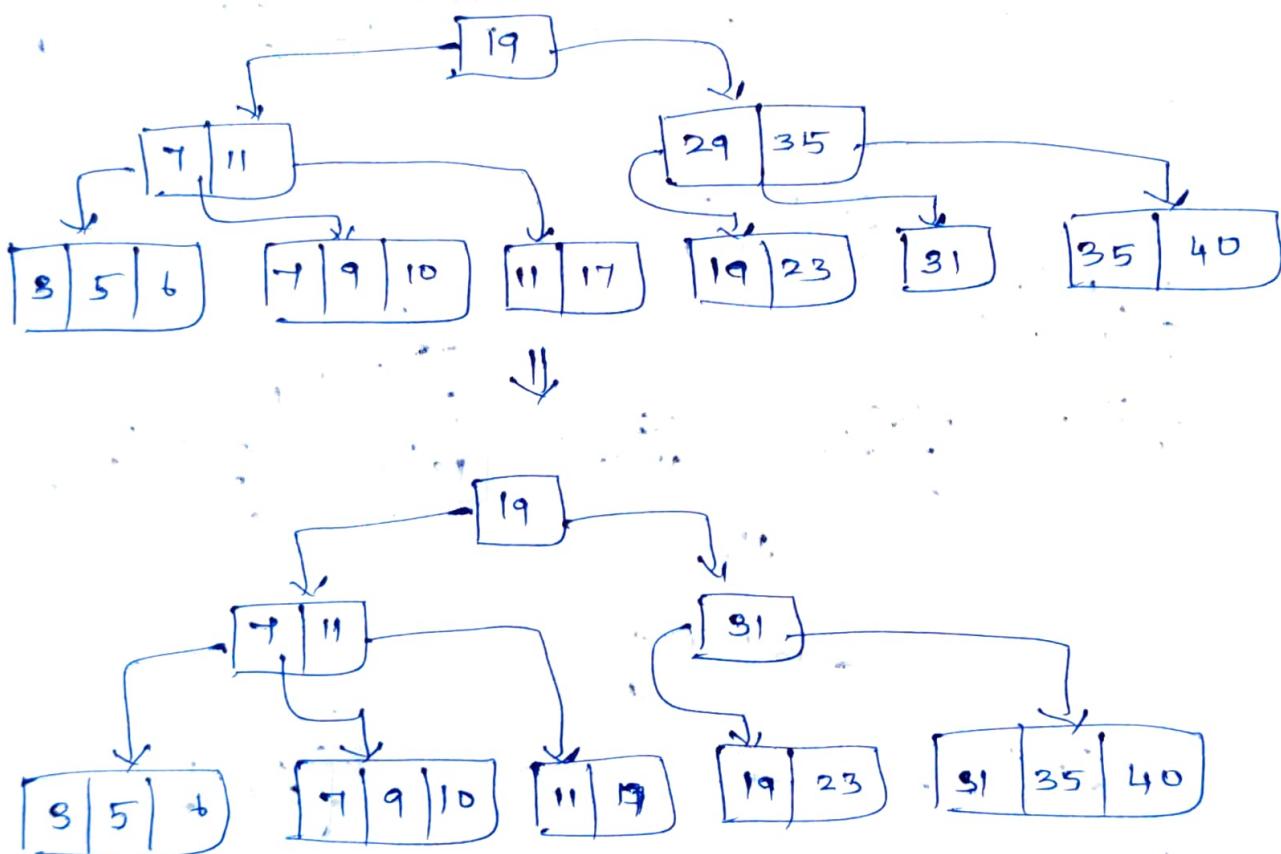


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Insert 40

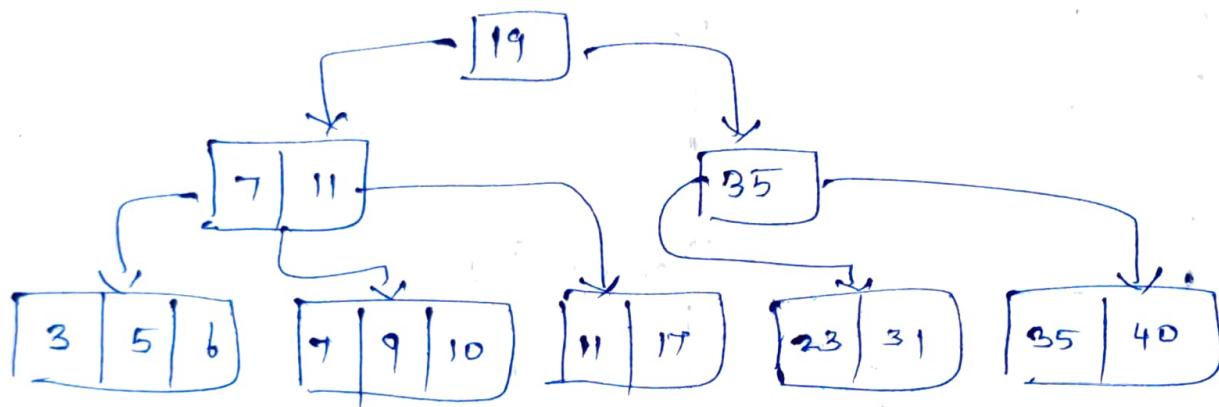
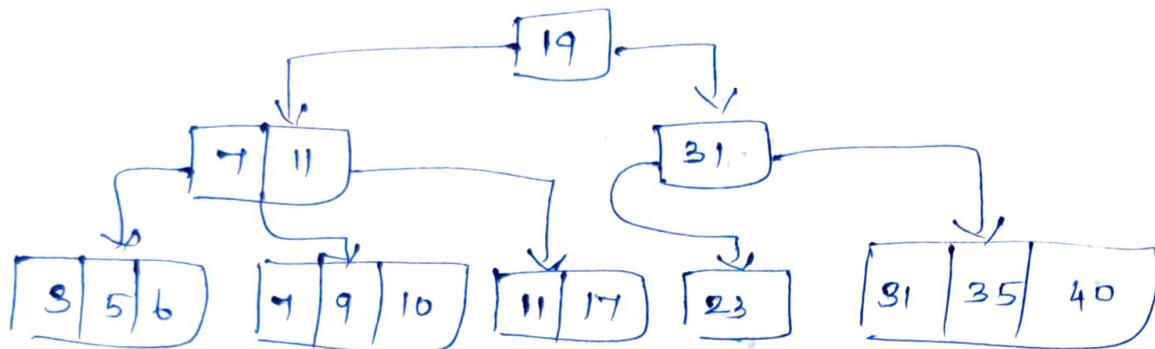


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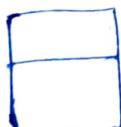


⑨

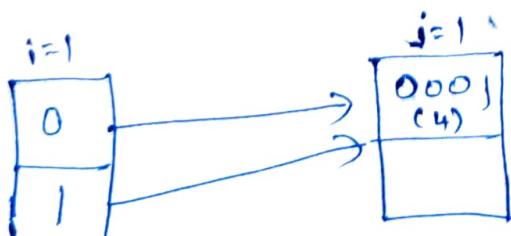
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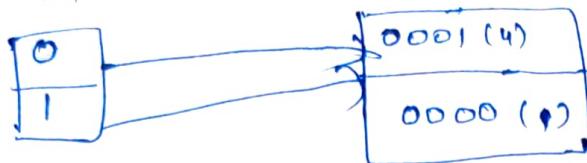
Questions 1, 2, 3 Extensible Hash construction

 $i=1$  $j=1$ 

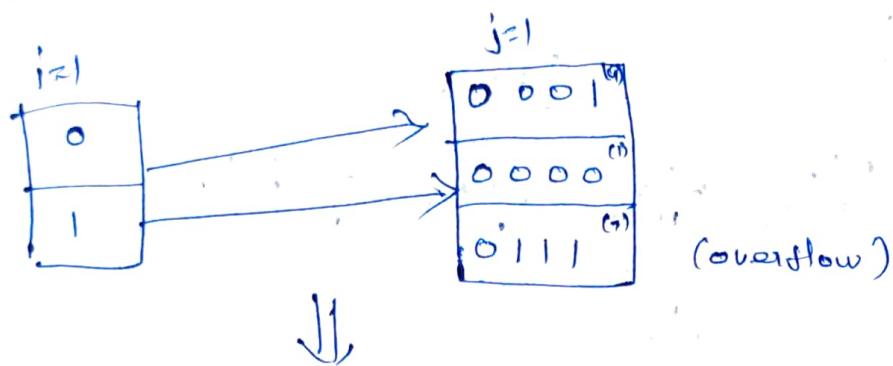
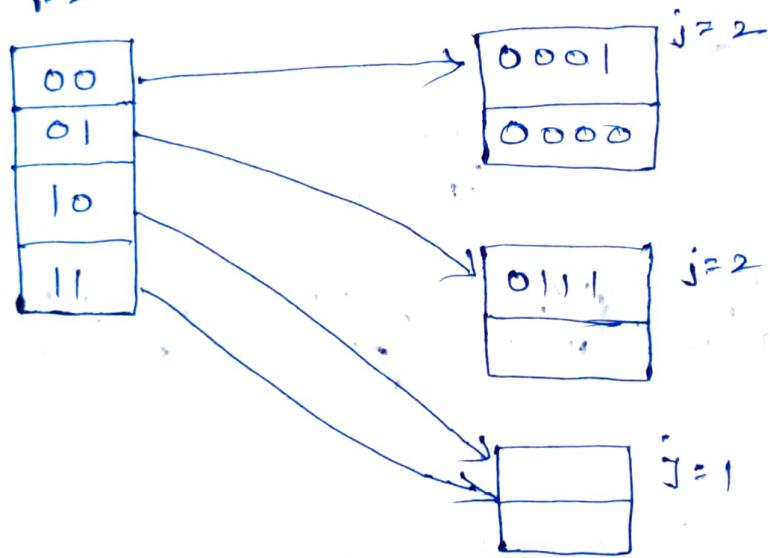
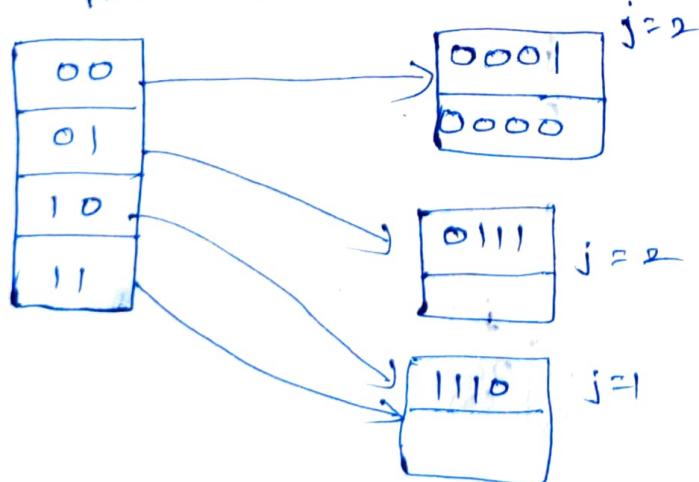
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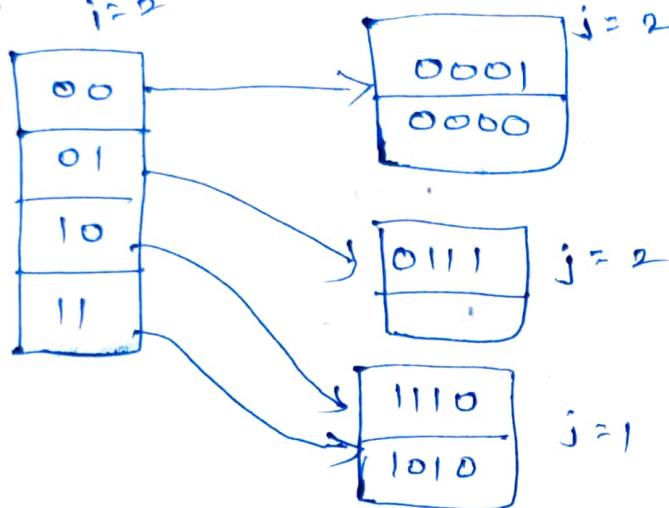
10

Insert(1)  $i=1$ 

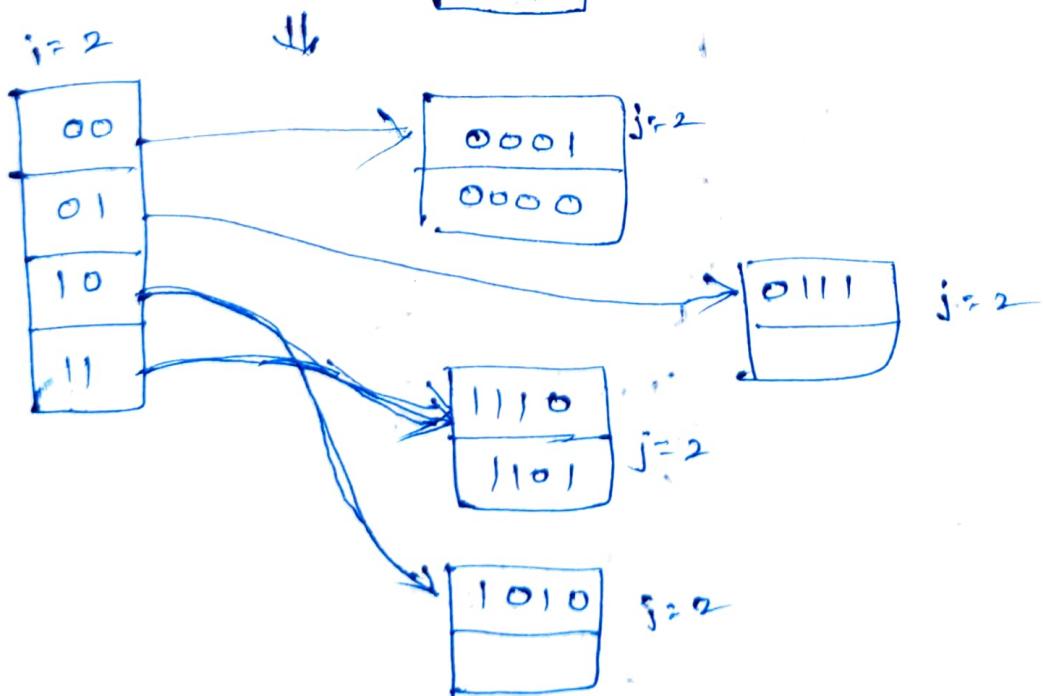
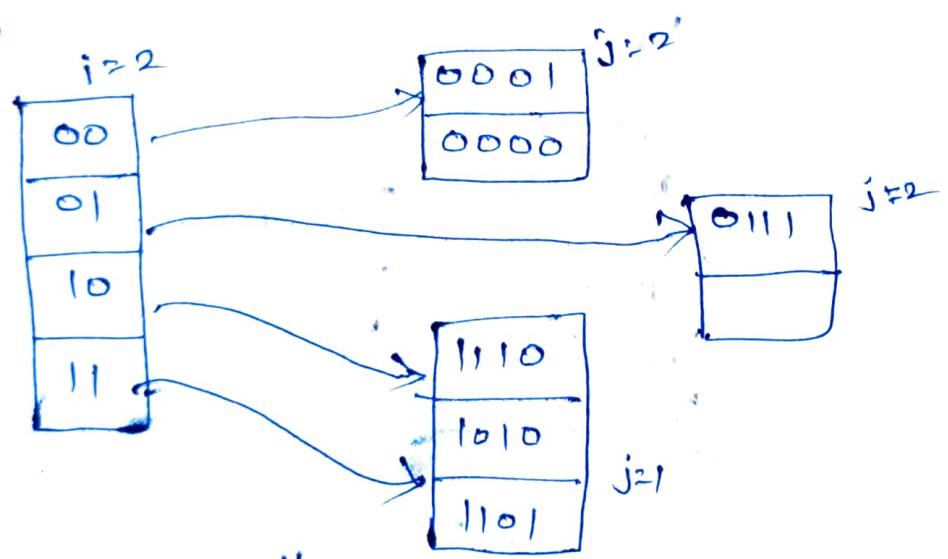
Insert(4)

 $i=2$ Insert 8  $i=2$ 

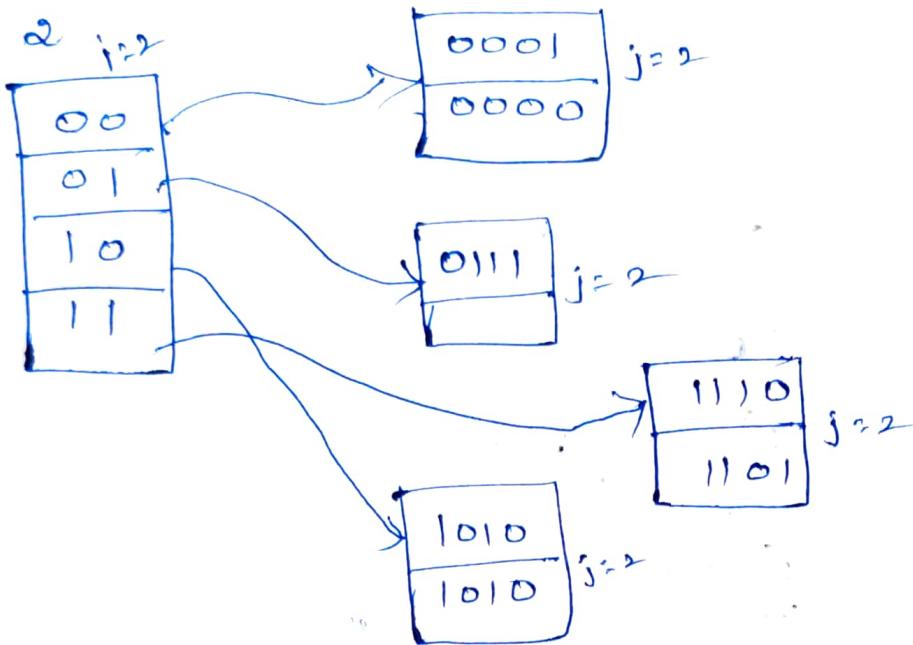
⑥ Insert 6 i=2



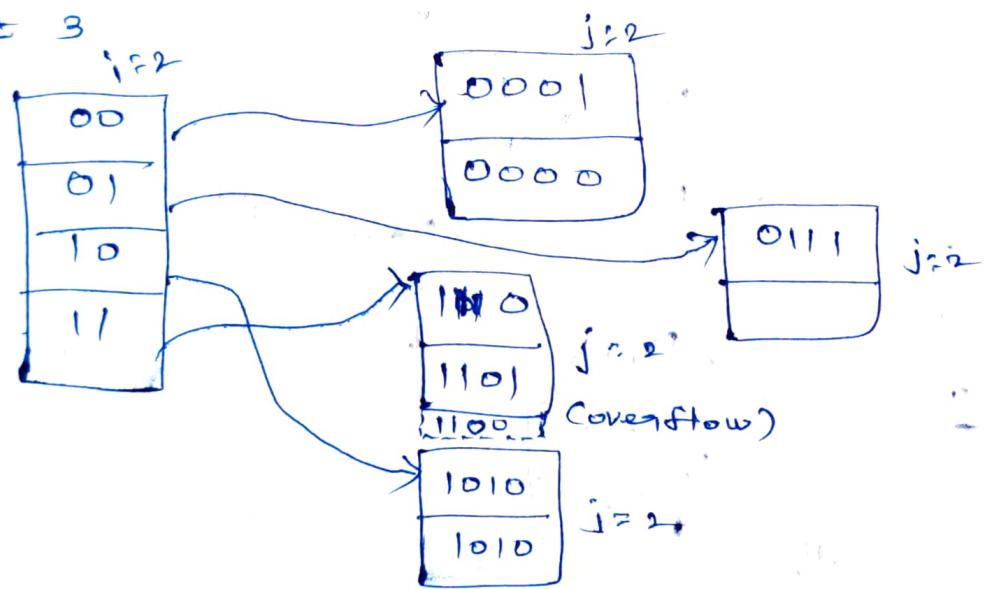
Insert 0



Insert 2  $i=2$



Insert 3  $i=2$



$i=3$

