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Part 1.1 Disk organization.

Question 1.1.1 Disk Access

1. How many records fit onto a block?

Block size = 4096 bytes

each record byte = 100 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:

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

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

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$$\text{Blocks per track} = \frac{\text{no. of sector per track}}{\text{no. of blocks per sector}} = \frac{50}{1} = 50 \text{ blocks}$$

$$= 50 \times 5 \times 2 = 500 \text{ blocks}$$

$$\text{no. of cylinder for entire file} = \frac{3750}{500} = 7.5 \text{ cylinder}$$

$$= 8 \text{ cylinder.}$$

Ans: 8 cylinders are needed.

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

$$\text{no. of records per block} = 40$$

$$\text{no. of sectors} = 50$$

$$\text{platters} = 5 \times 2 = 10$$

$$\text{tracks} = 1000$$

$$= 40 \times 50 \times 10 \times 1000$$

$$= 20,000,000 \text{ records}$$

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?

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

$$\text{Seek time} = 8 \text{ ms}$$

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

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

$$\text{Rotational delay} = 4.15 \text{ msec}$$

$$\text{Total records} = 100,000$$

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

$$\text{Each cylinder} = 500 \text{ blocks}$$

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

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

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

$$\underline{\text{Ans:}} \text{ Access Time is } 0.42715 \text{ Sec.} = 0.42715 \text{ Sec}$$

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Part 1.2 Index Structures

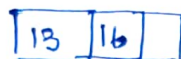
Question 1.2.1 B⁺ tree Construction

$$\underline{n = 3}$$

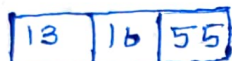
Insert 13



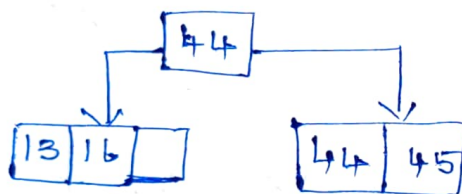
Insert 16



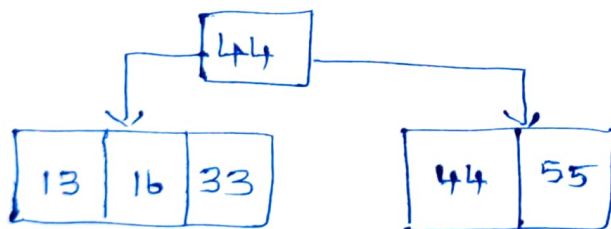
Insert 55



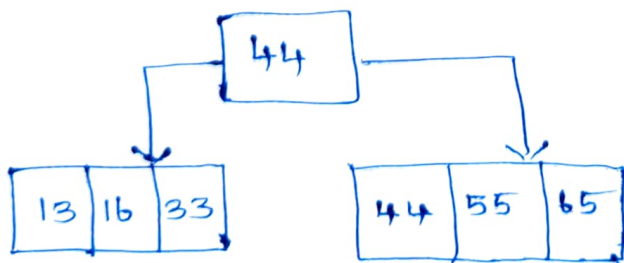
Insert 44



Insert 33

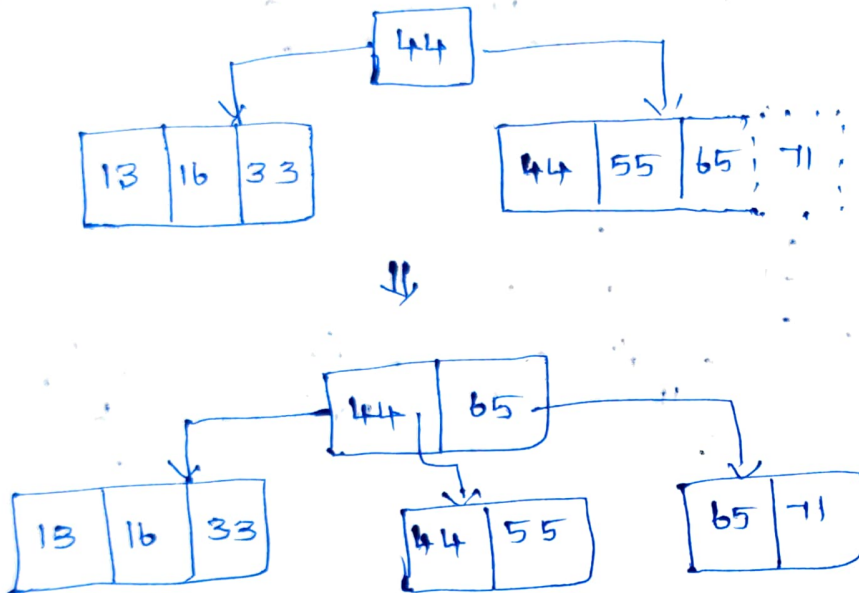


Insert 65

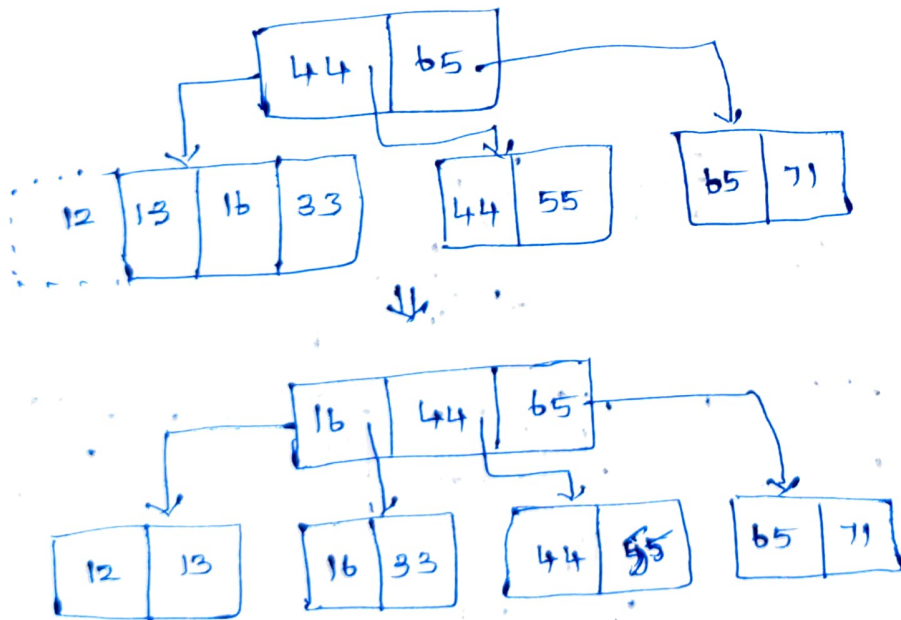




Insert 71

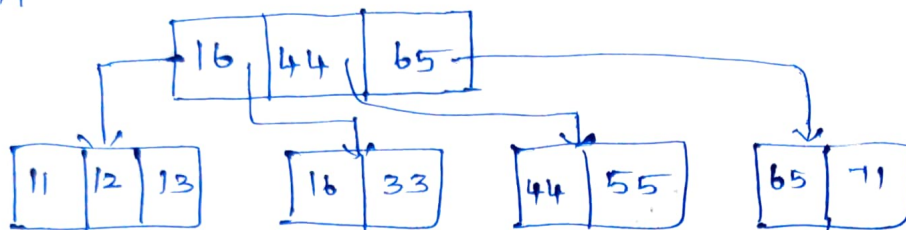


Insert 12

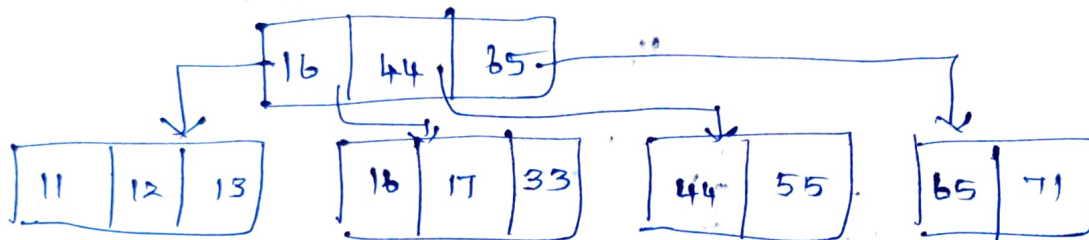


6

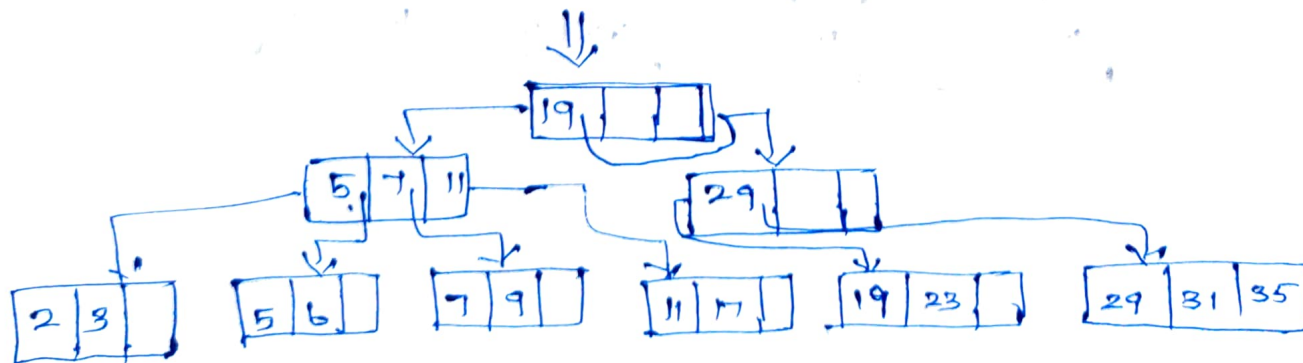
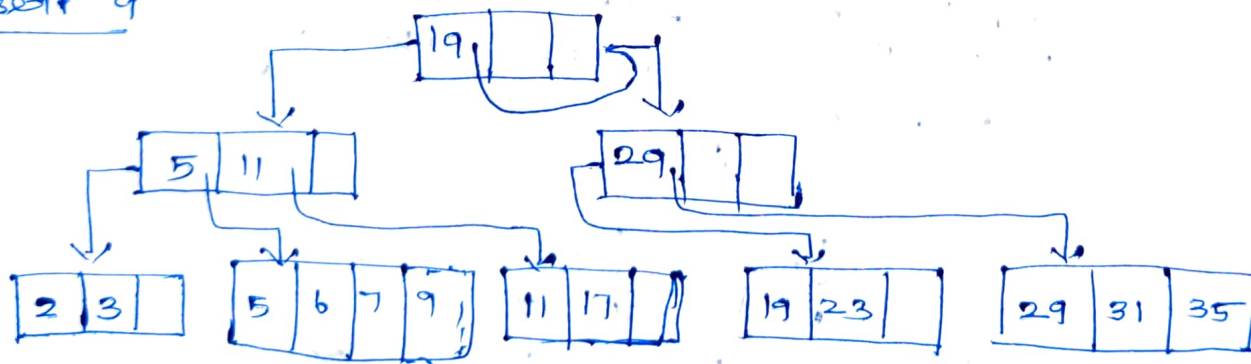
Insert 11



Insert 17

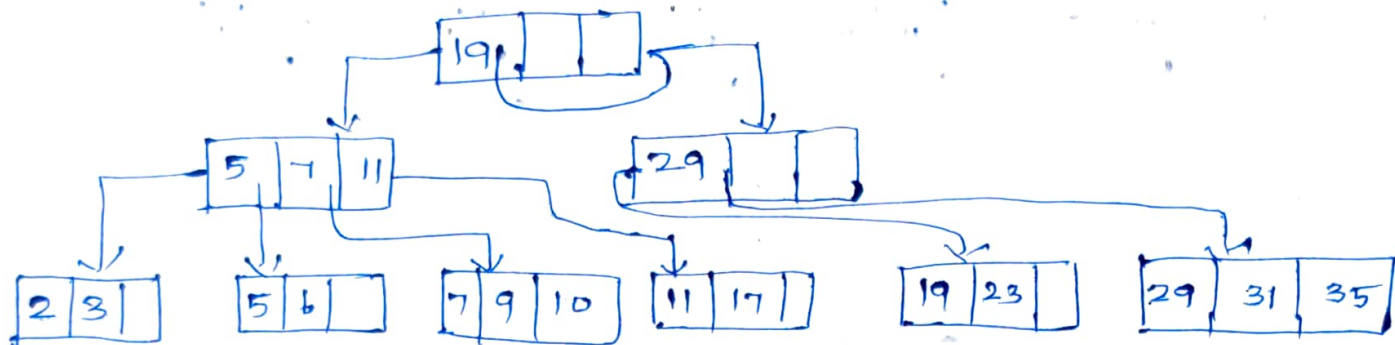


Question 1.2.2 Operations :-

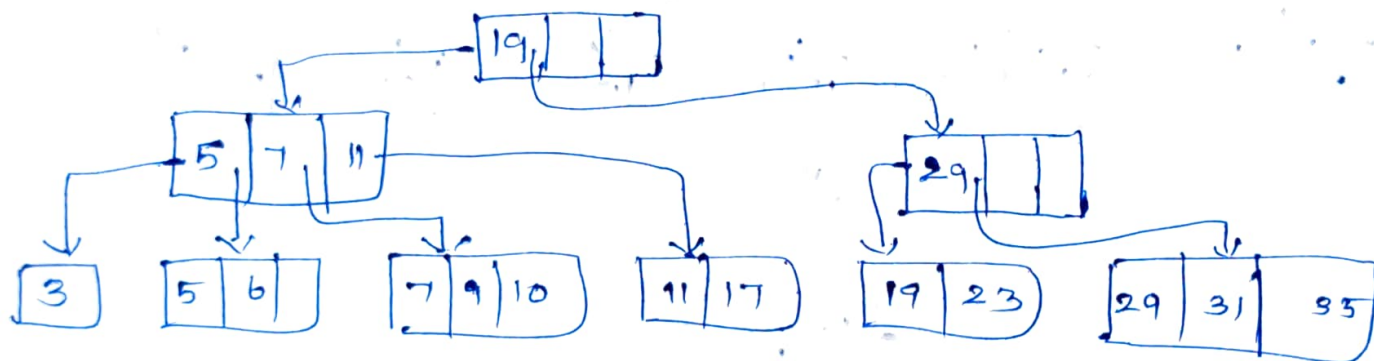
 $n = 3$ Insert 9

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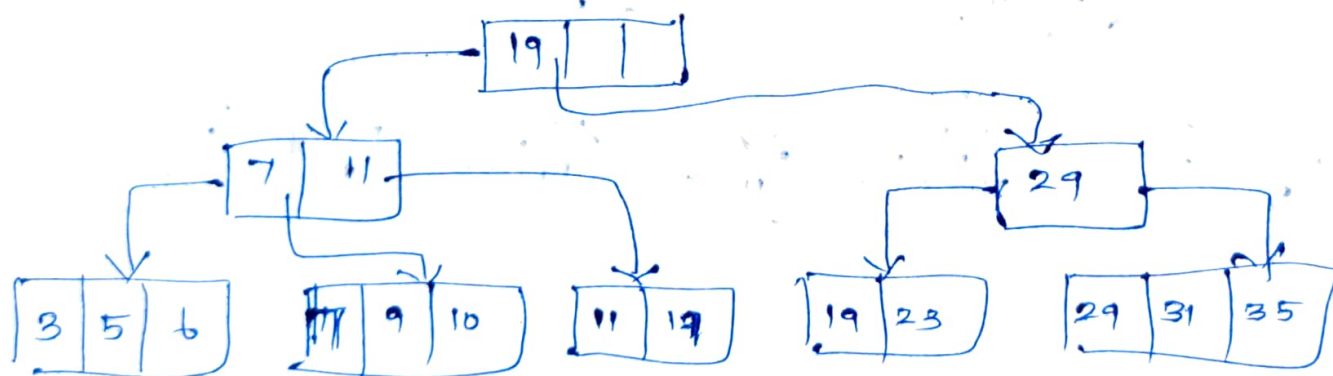
Insert 10



delete 2

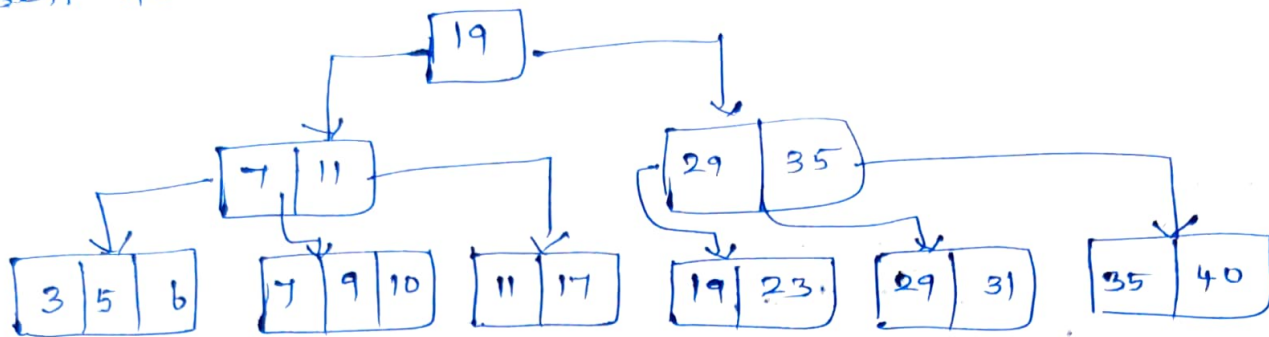


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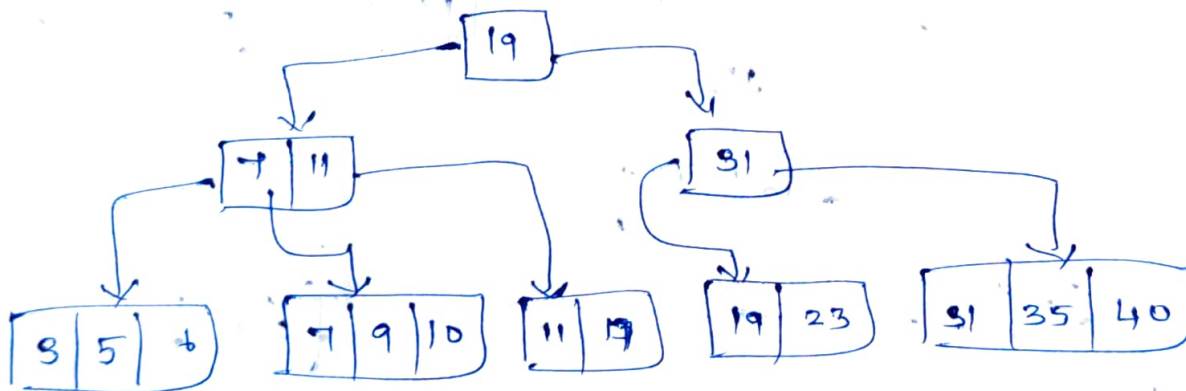
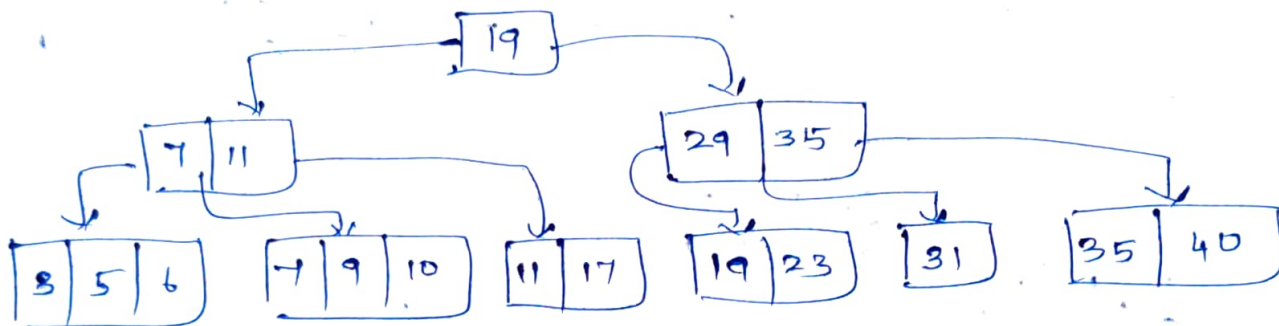


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Insert 40

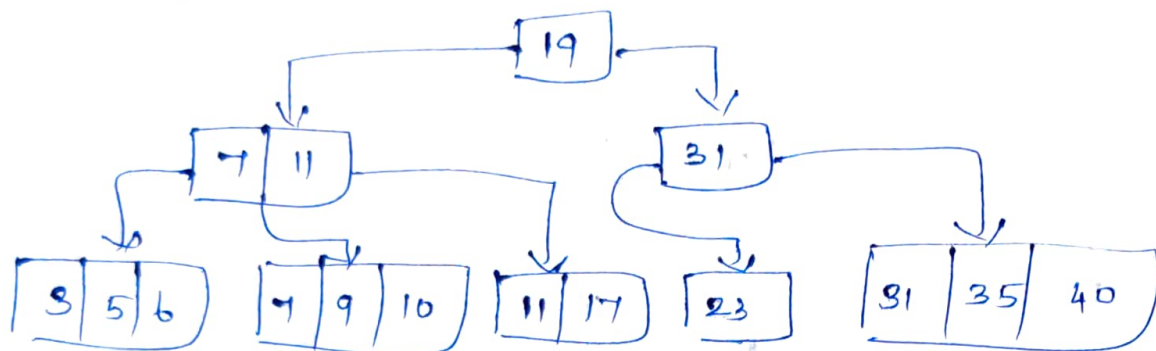


Delete 29

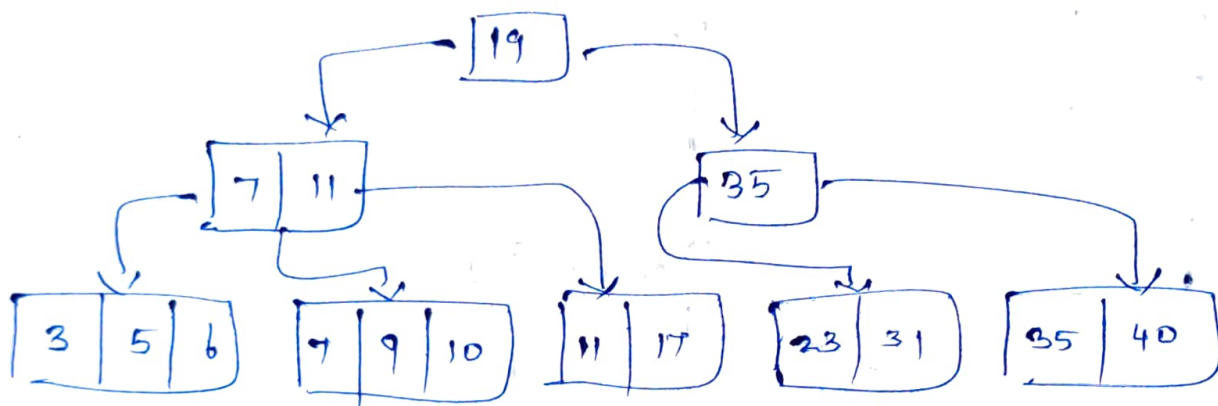


5

delete 19



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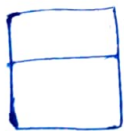


Question 1.2.3 Extensible Hash Construction

$i=1$



$j=1$

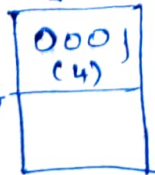


Insert (4)

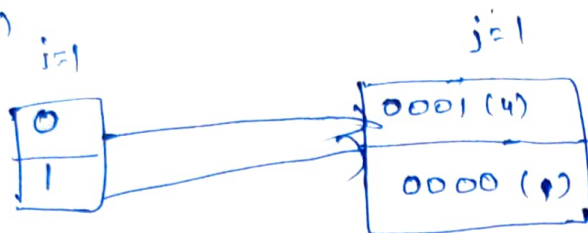
$i=1$



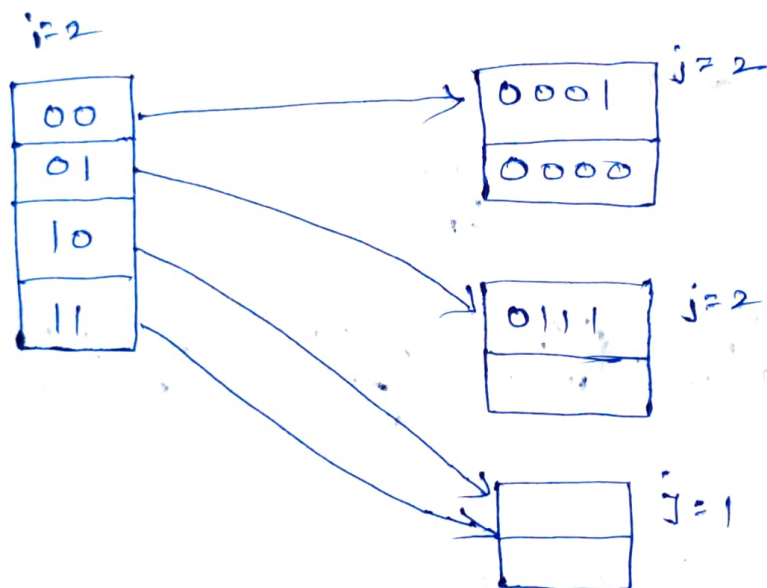
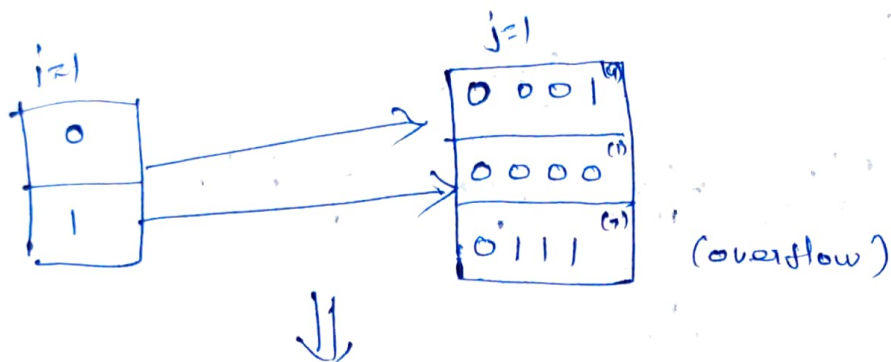
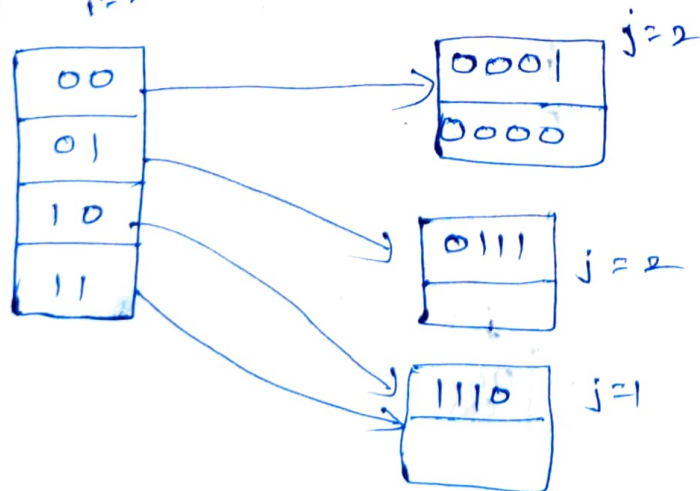
$j=1$



(10)

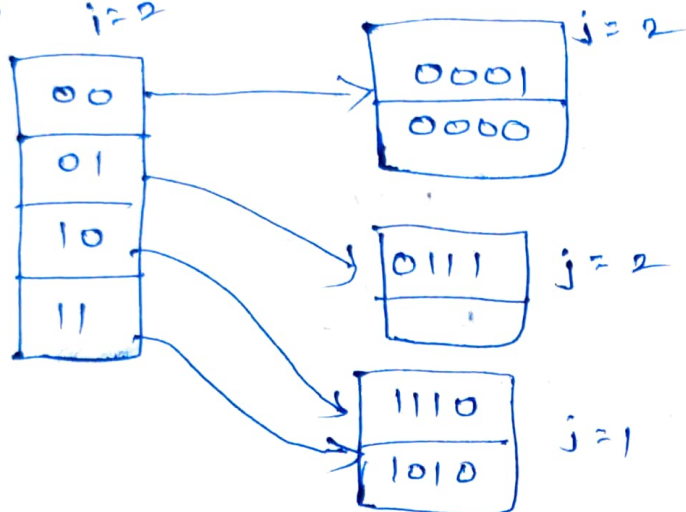
Insert (1) $i=1$ 

Insert (4)

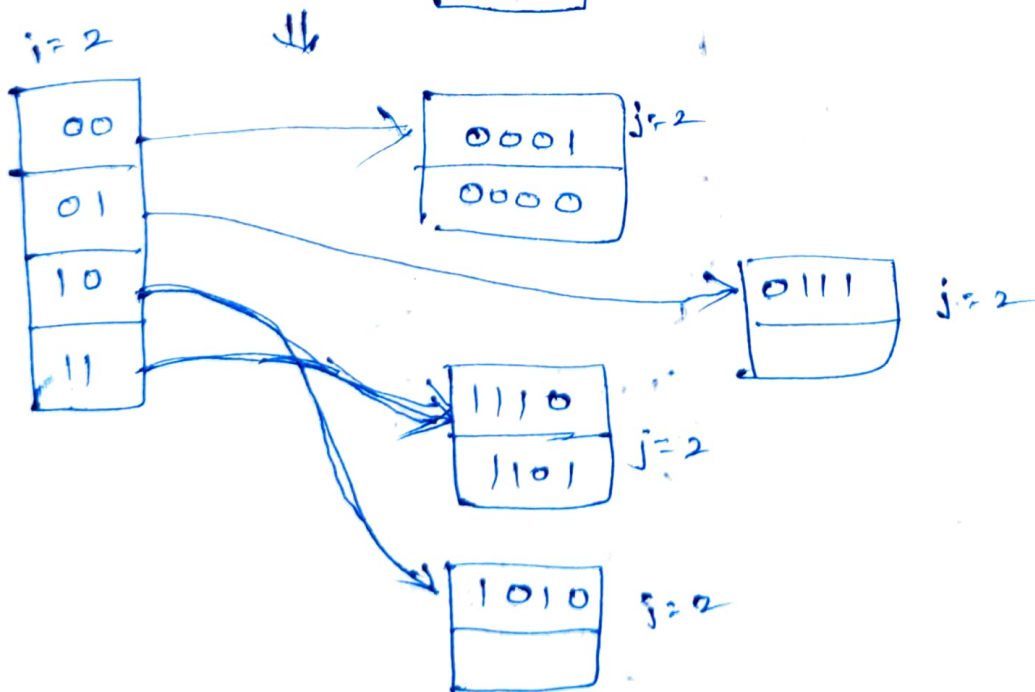
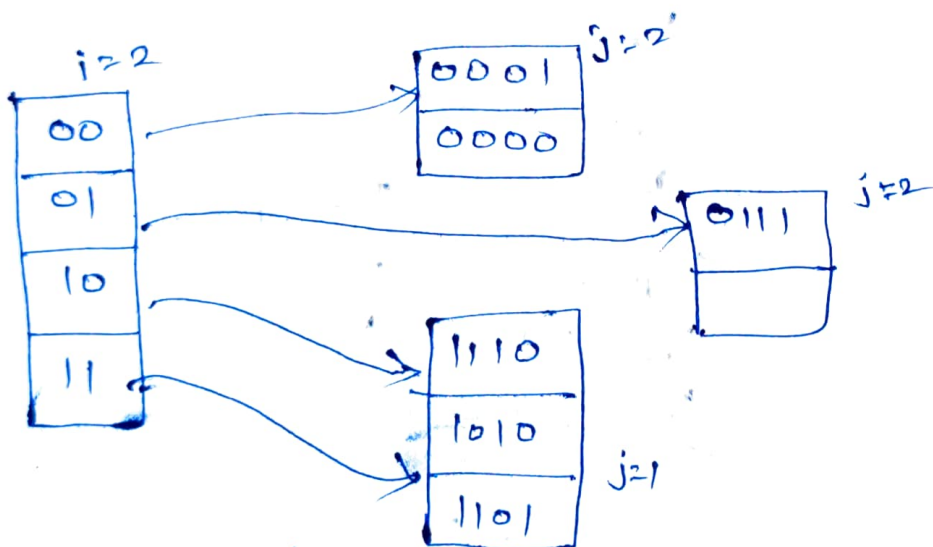
Insert 8 $i=2$ 

11

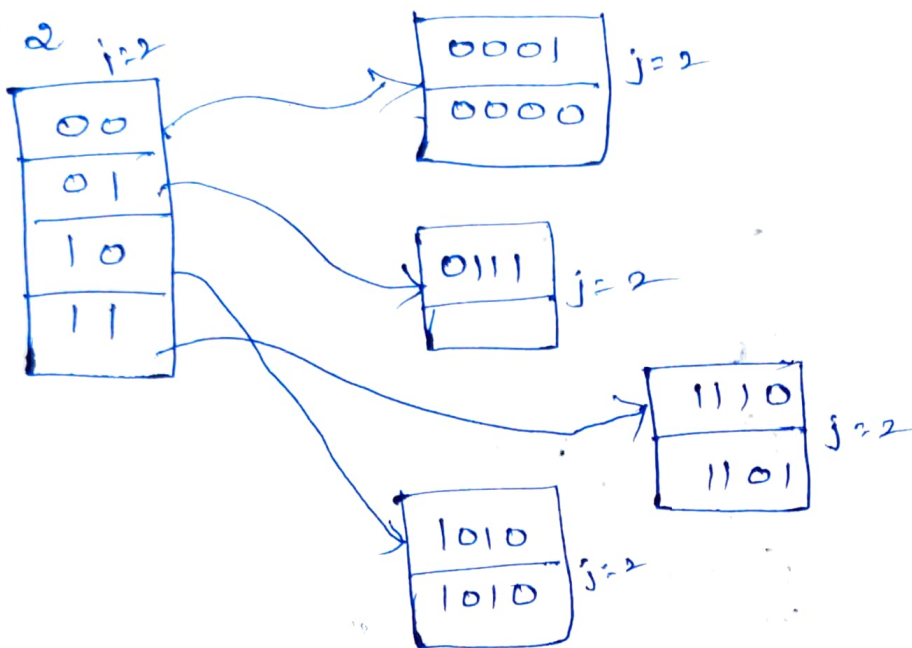
Insert 6 $i=2$



Insert 0



Insert 2 $j=2$



Insert 3

