Tobin deKorne
4/30/18

CS443 -- Lab 5

Question 1:
A PARTS file with Part# as hash key includes records with the following
Part# values: 2369, 3760, 4692, 4871, 5659, 1821, 1074, 7115, 1620, 2428, 3943, 4750, 6975, 4981, 9208
The file uses 8 buckets, numbered 0 to 7.
Each bucket is one disk block and holds two records.
Load these records into the file in the given order using the hash function

h(K)=K mod 8.

2369 mod 8 = 1
3760 mod 8 = 0
4692 mod 8 = 4
4871 mod 8 = 7
5659 mod 8 = 3
1821 mod 8 = 5
1074 mod 8 = 2
7115 mod 8 = 3
1620 mod 8 = 4
2428 mod 8 = 4
3943 mod 8 = 7
4750 mod 8 = 6
6975 mod 8 = 7
4981 mod 8 = 5
9208 mod 8 = 0

Note: highlighted values must go into overflow area

Bucket 0	Bucket 1	Bucket 2	Bucket 3	Bucket 4	Bucket 5	Bucket 6	Bucket 7
3760	2369	1074	5659	4692	1821	4750	4871
9208			7115	1620	4981		3943
Overflow area:							
				2428			6975

Calculate the average number of block accesses for a random retrieval on Part#.

$$average\ block\ accesses = \left(\frac{Accesses\ without\ overflow}{Total\ accesses}\right) + 2\left(\frac{Total\ overflow\ accesses}{Total\ accesses}\right)$$

$$\frac{13}{15} + 2\left(\frac{2}{15}\right) \approx 1.133$$

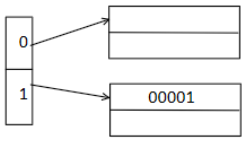
Question 2:
Consider the following records of question 1:

2369, 3760, 4692, 4871, 5659, 1821, 1074, 7151, 1620

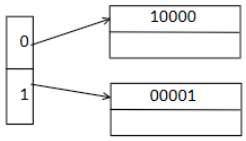
Load the records into expandable hash files based on extendible hashing. You can put two records per block. Show the directory at each step, and the global and local depths. Use the hash function h(k) = K mod 32 to find the bucket number. For example,

Record#	***K***	***h(K) bucket number***	***binary h(K)***
record1	2369	1	00001
record2	3760	16	10000
record3	4692	20	10100
record4	4871	7	00111
record5	5659	27	11011
record6	1821	29	11101
record7	1074	18	10010
record8	7151	15	01111
record9	1620	20	10100

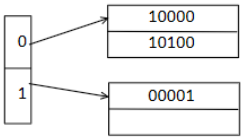
00001



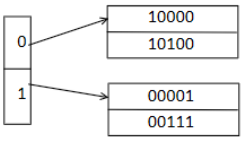
10000



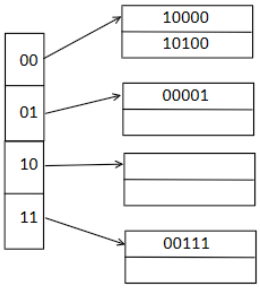
10100



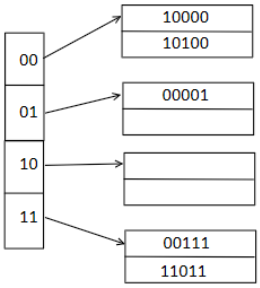
00111



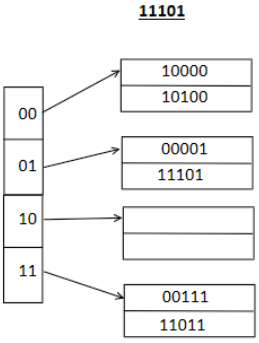
Split here because we are at 100% capacity



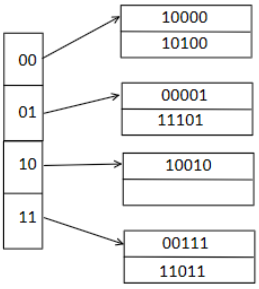
11011



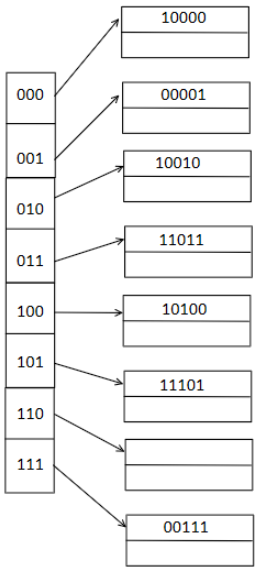
11101



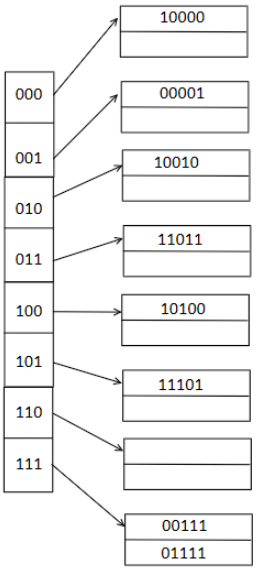
10010



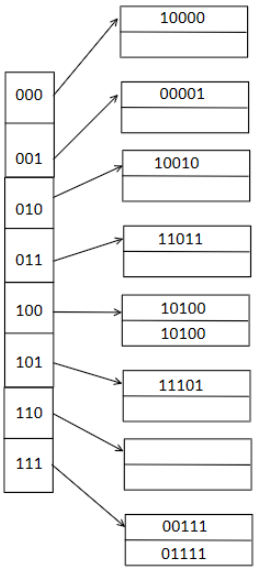
Split here because we are at $\frac{7}{8} = 87.5\% > 75\%$ capacity



01111



10100

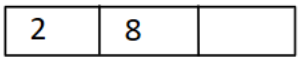


Question 3:
Insert the following into B-tree of order **4**. Show your work step by step with proper illustration of pointers as shown in pages 20-29 in multi-way trees lecture

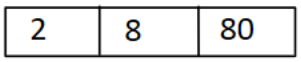
8, 2, 80, 25, 26, 27, 28, 55, 71, 15, 51, 20, 21, 22, 23, 24, 63, 90, 35

insert 8

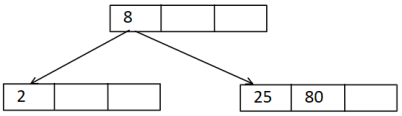
insert 2



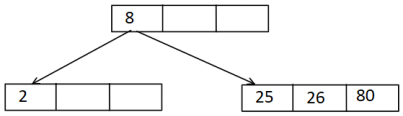
insert 80



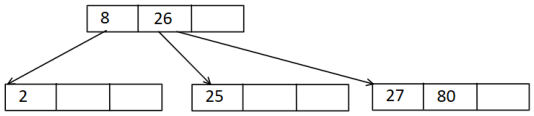
insert 25



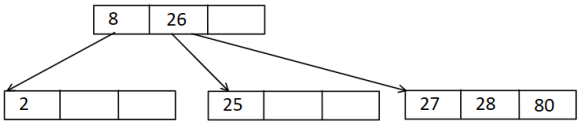
insert 26



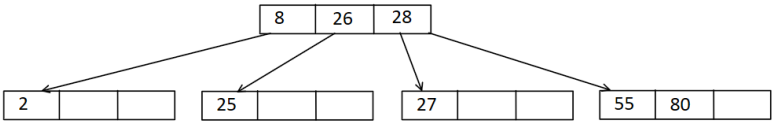
insert 27



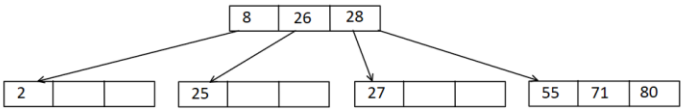
insert 28



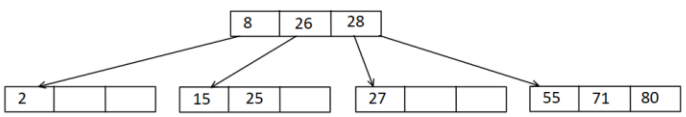
insert 55



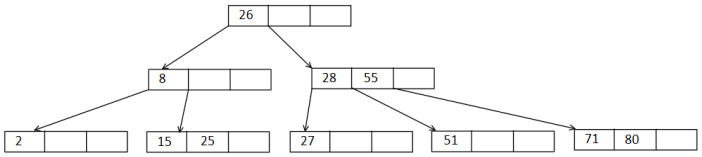
insert 71



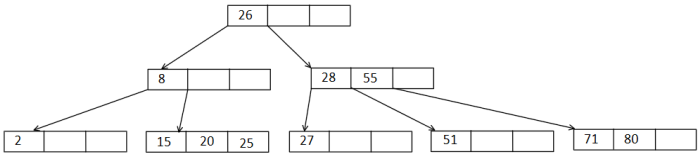
insert 15



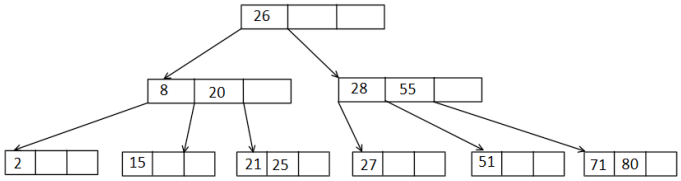
insert 51



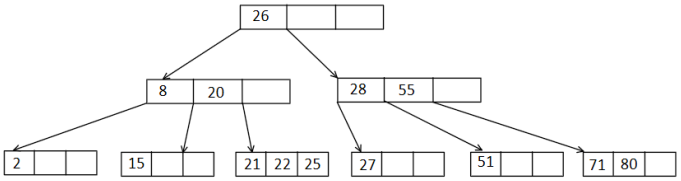
insert 20



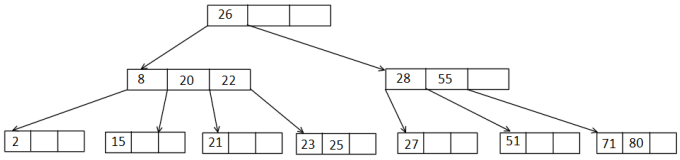
insert 21



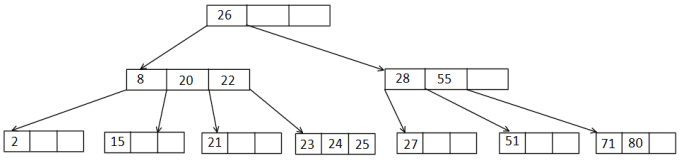
insert 22



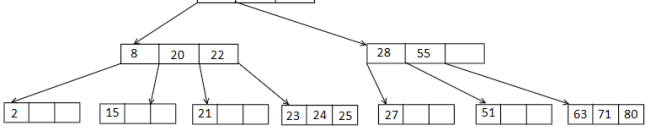
insert 23



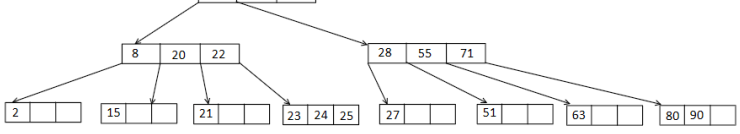
insert 24



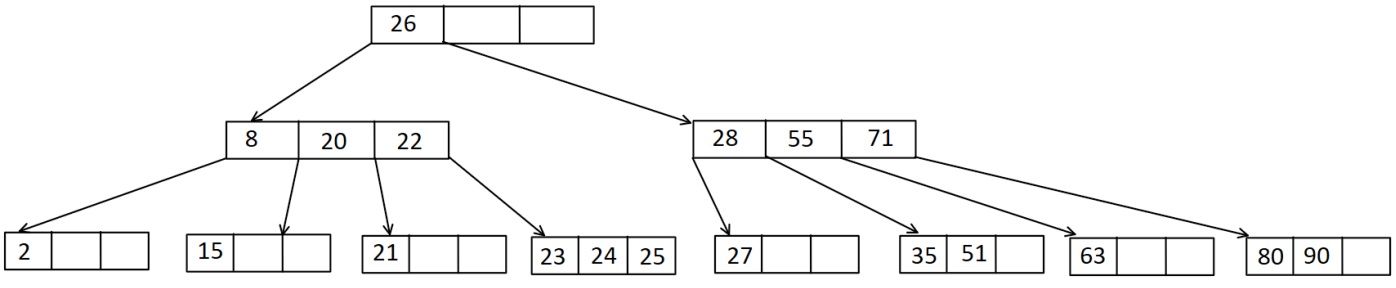
insert 63



insert 90



insert 35



Question 4:

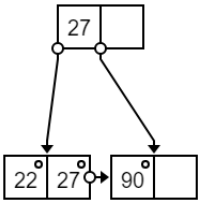
Insert the following into B+ tree of order **3**. Show your work step by step with proper illustration of pointers as shown in pages 47-54 in multi-way trees lecture

90, 22, 27, 24, 28, 20, 51, 63, 8, 80, 15, 71, 35, 55

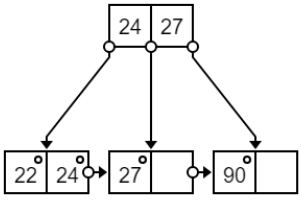
Insert 90

Insert 22

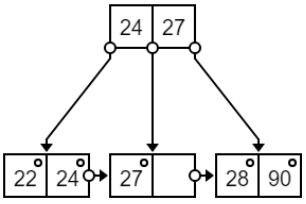
Insert 27



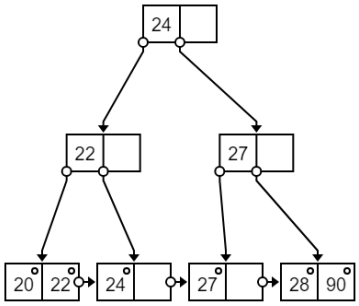
Insert 24



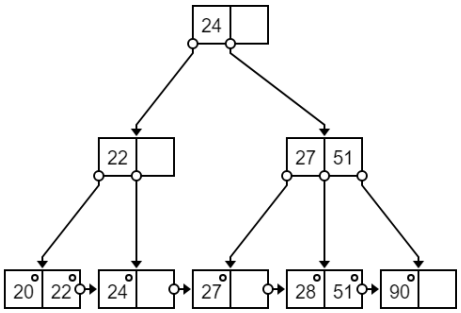
Insert 28



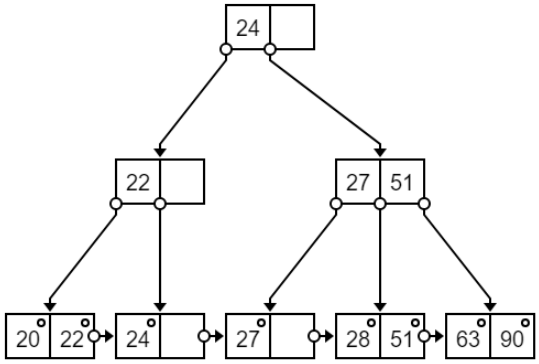
Insert 20



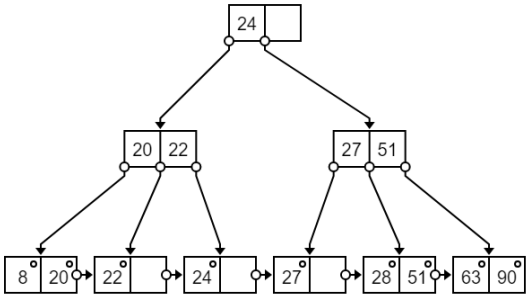
Insert 51



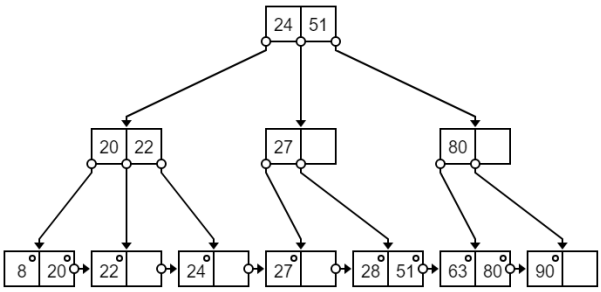
Insert 63



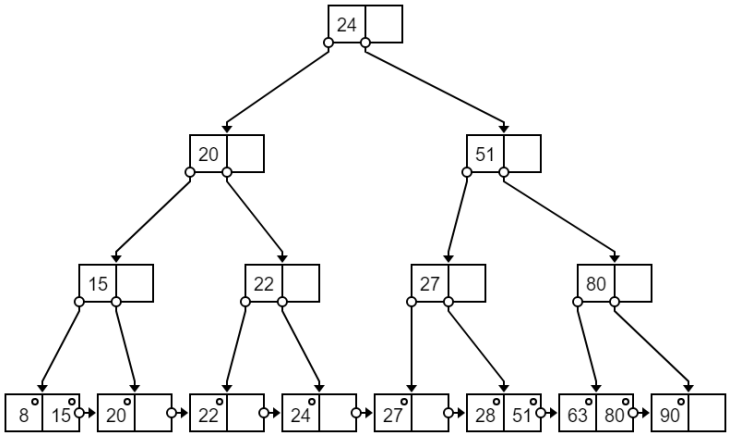
Insert 8



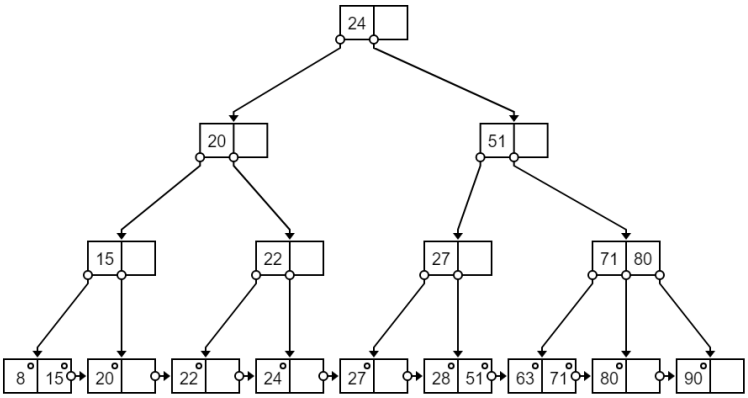
Insert 80



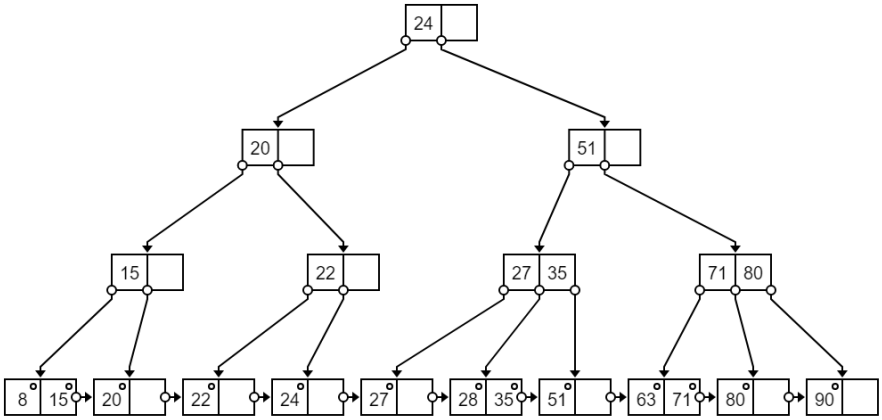
Insert 15



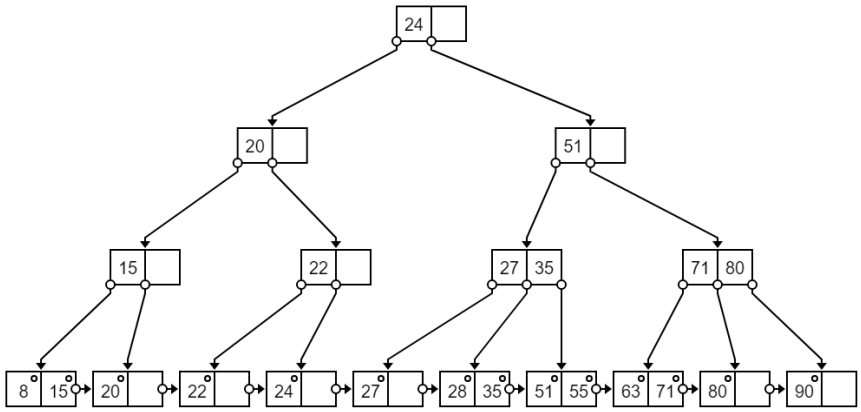
Insert 71



Insert 35



Insert 55



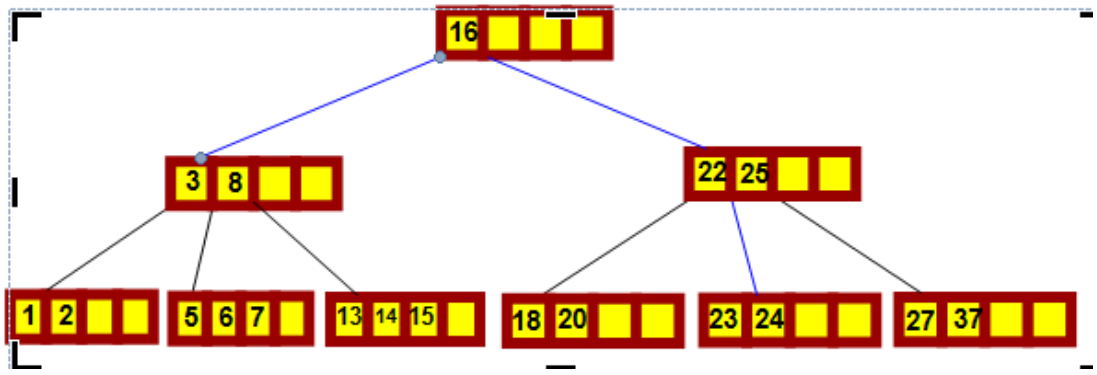
Question 5:

Consider the following B-tree.

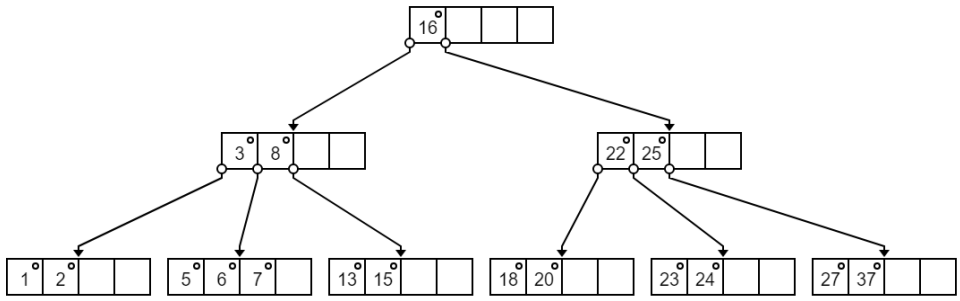
a) Redraw the tree after deleting 14.

b) Again, redraw the tree after deleting 15.

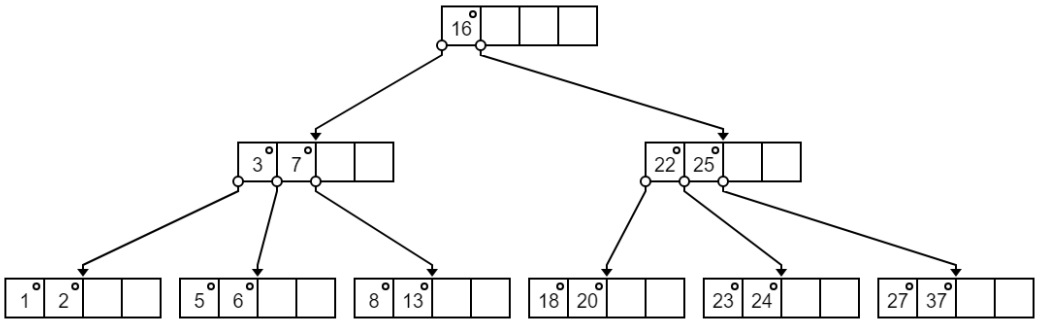
c) Again, redraw the tree after deleting 25.



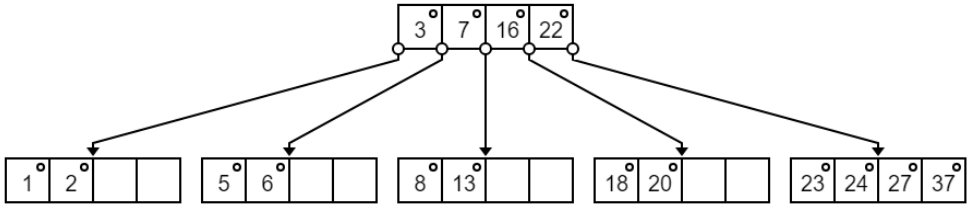
a)



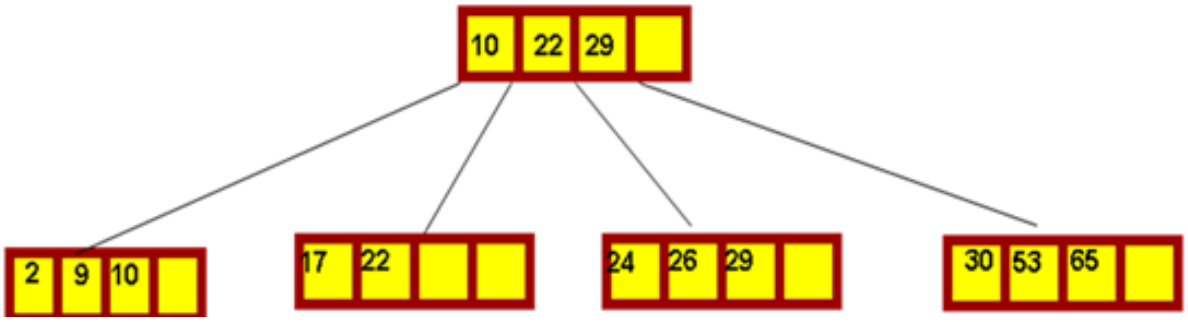
b)



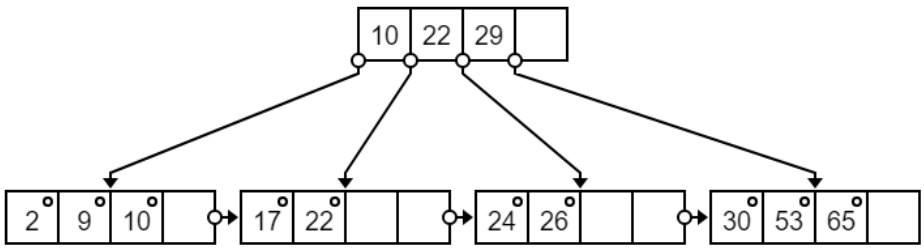
c)



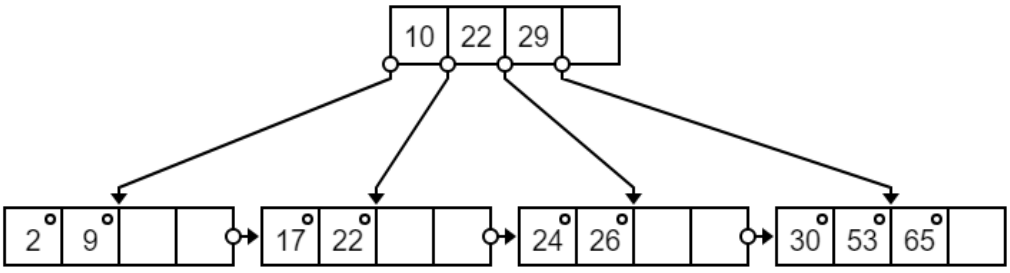
Question 6:
Consider the following B+ tree:



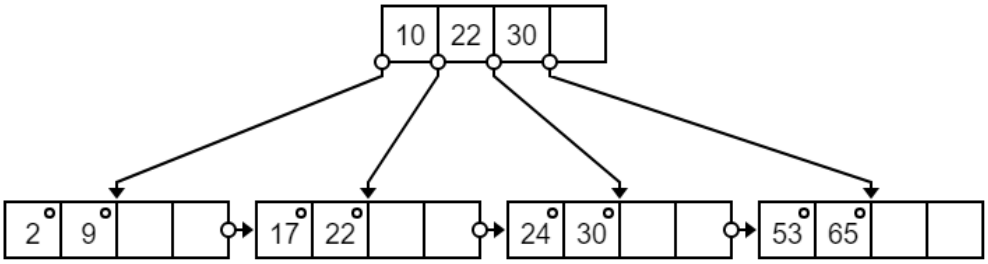
a) Delete 29 and redraw the tree after that



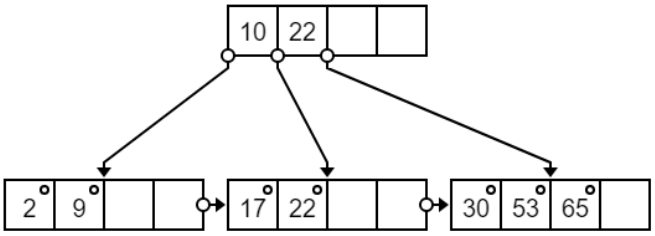
b) Next delete 10 and redraw the tree after that



c) Next delete 26 and redraw the tree after that



d) Next delete 24 and redraw the tree after that



e) Next delete 9 and redraw the tree after that