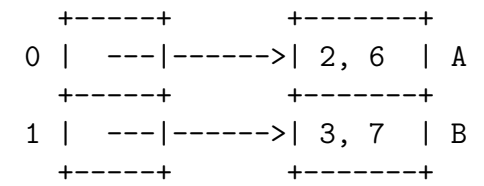
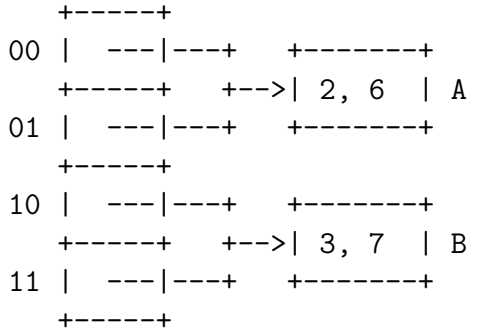
CSI2131, Winter 2004
Lab 11 Solution

Question 1

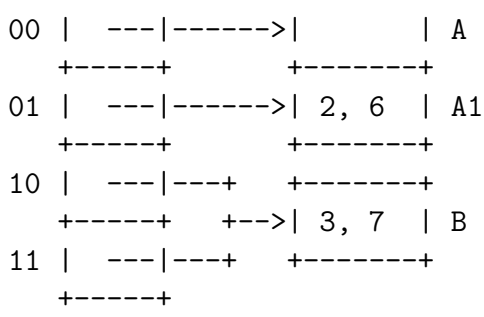


Insert 10: 10 in binary: 101$\underline{0}$

- Bucket pointed by 0 is full.
- Depth of bucket A is 1 and depth of directory is 1. Since equal, must double the directory.

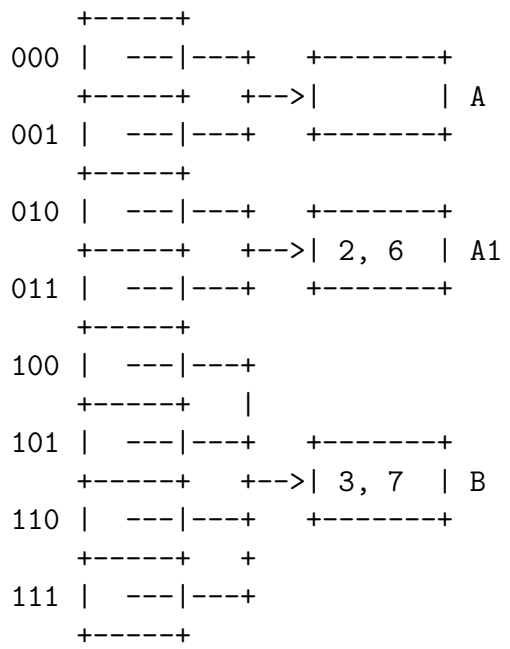


- Now split bucket A.
- 2: 00$\underline{10}$
- 6: 01$\underline{10}$

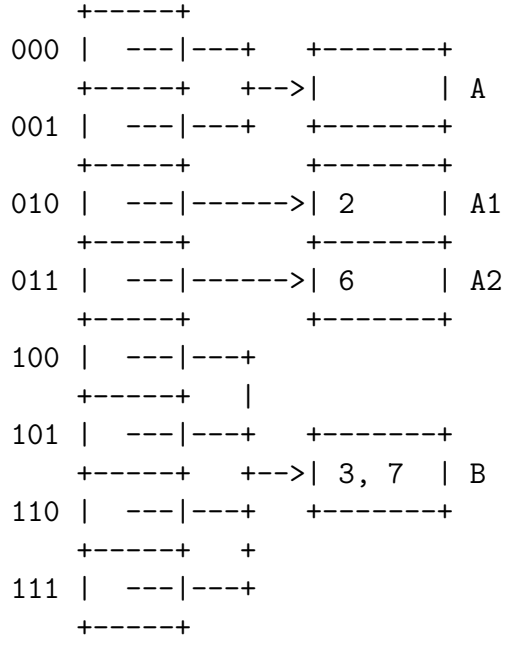


- Recursive call to insert 10.
- 10: 10$\underline{10}$

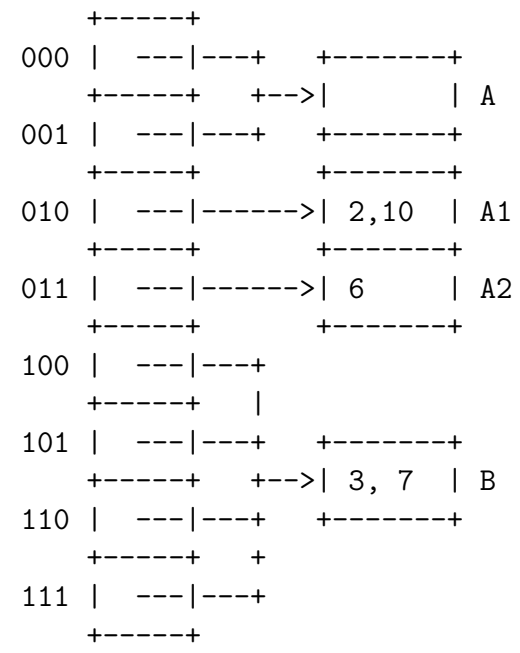
- Bucket pointed by 01 is full.
- Depth of bucket A1 is 2 = depth of the directory. So must double the size.



- Now Split bucket A1.

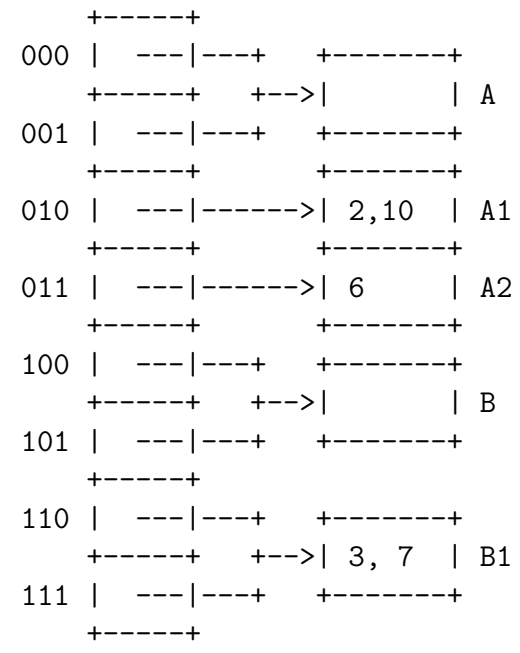


- 10: 1<u>010</u>
- Now bucket pointed by 010 is not full. Just place 10 there.

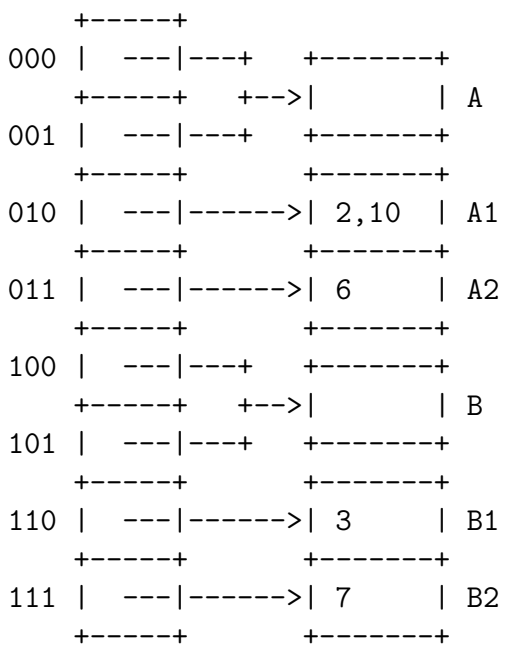


Insert 15: 15 in binary: 1111

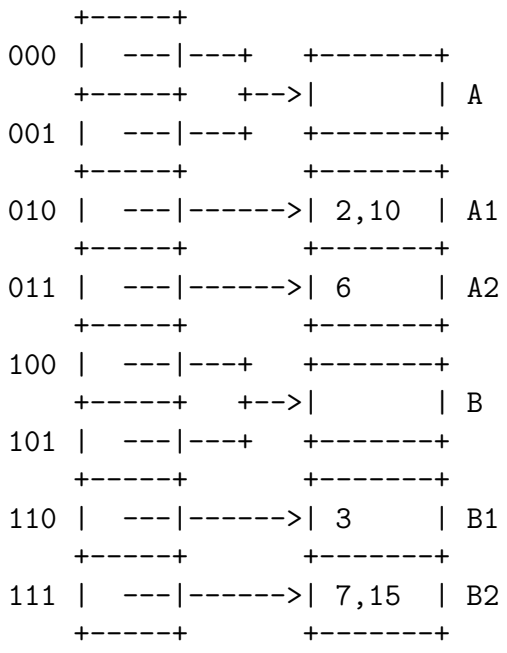
- Bucket pointed by 111 is full.
- Depth of bucket B is 1 ¡ depth of directory which is 3. So no need of doubling directory.
- Split bucket B.
- 3: 110
- 7: 111



- Recursive call to insert 15.
- 15: 1111
- Bucket pointed by 111(B1) is full.
- Depth of bucket B1 is 2 ¡ depth of the directory which is 3. So no need to doubling directory.
- Now, split B1.

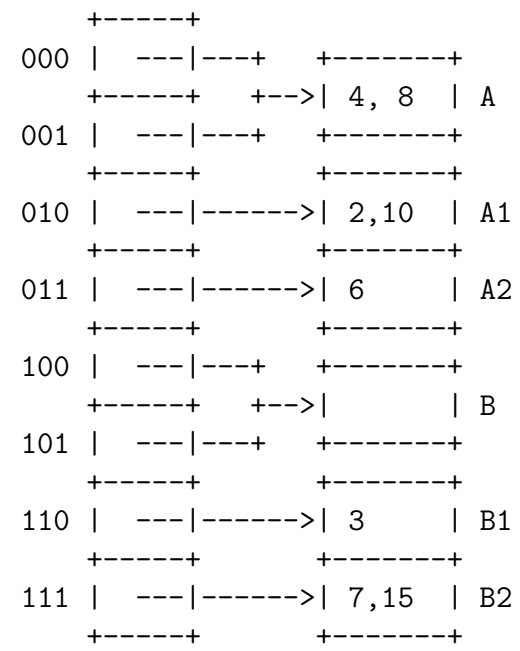


- Recursive call to insert 15 will find that there is space in bucket pointed by 111.

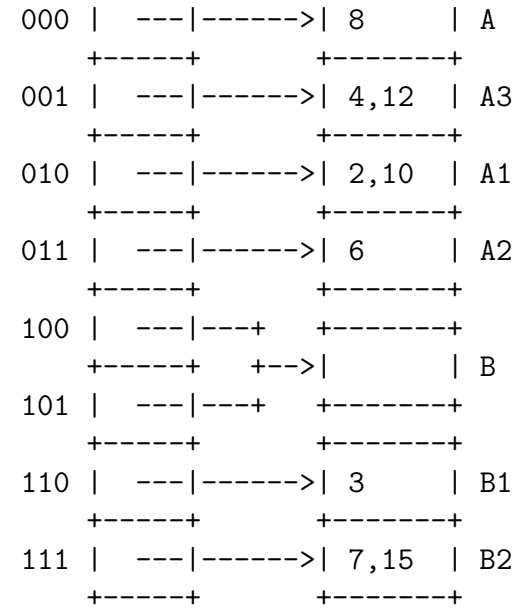


Insert 4, 8:

- This is the summary, please do it one at a time.

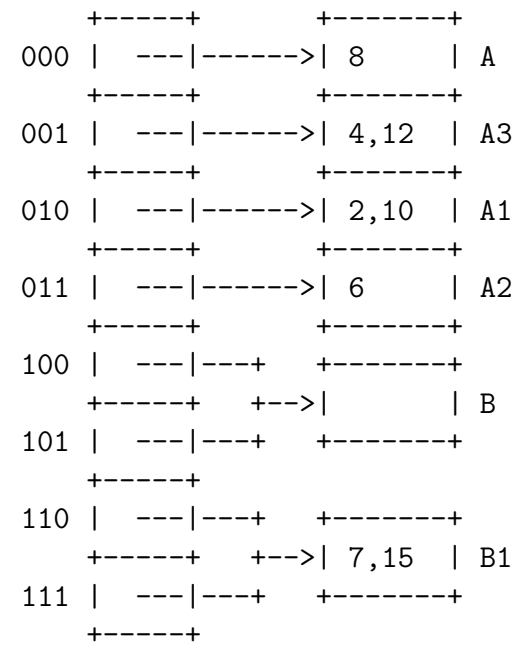


- After insert 12 (1100) (split A).

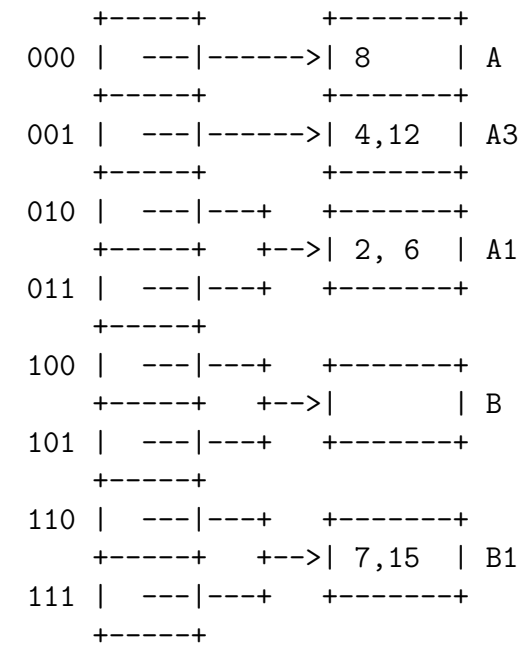


Delete 3:

- Remove from B1.
- Run TryCombine(B1)
- 110 points to B1.
- 111 points to B2(buddy bucket).
- Combine B1 and B2.



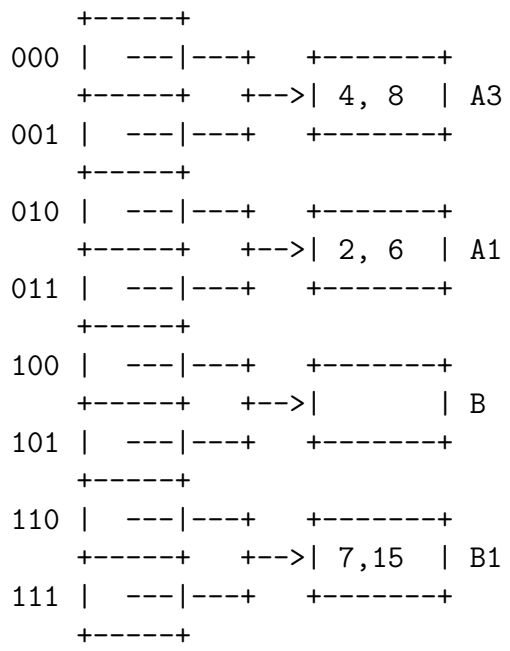
- Cannot collapse directory.
- After delete 10.
- Run TryCombine(A1).
- 010 points to A1.
- 011 points to A2 (buddy bucket).
- Combine A1 and A2.



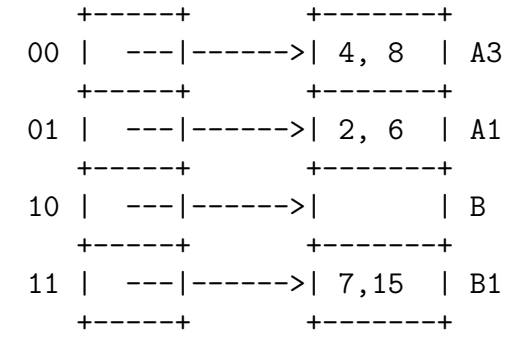
- Cannot collapse directory.

Delete 12:

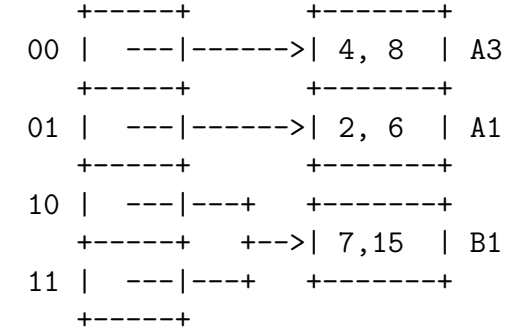
- Remove from A3.
- Run TryCombine(A3).
- 001 points to A3.
- 000 points to A (buddy bucket).
- Combine A3 and A.



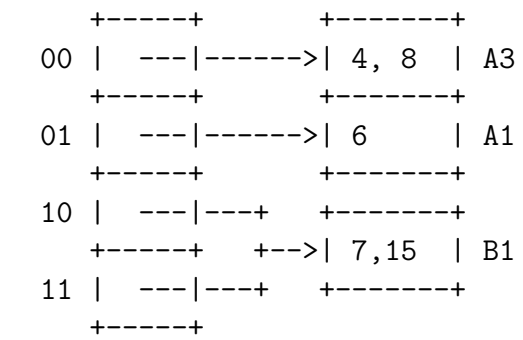
- This time we can collapse the directory.



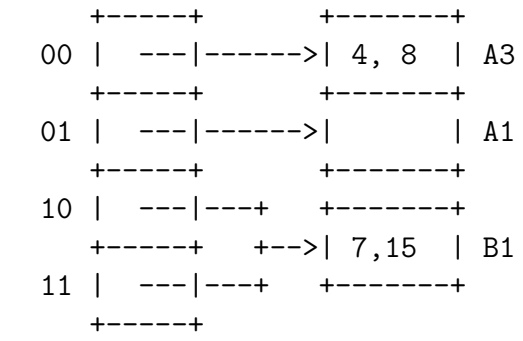
- Try Combine(B1) is called recursively.



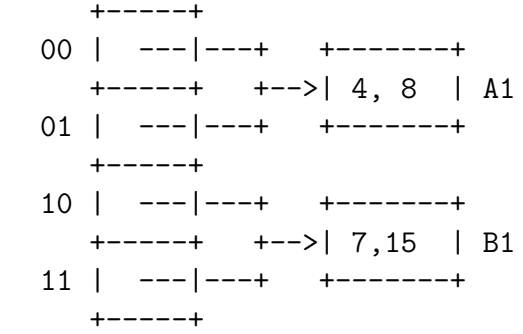
Delete 2:



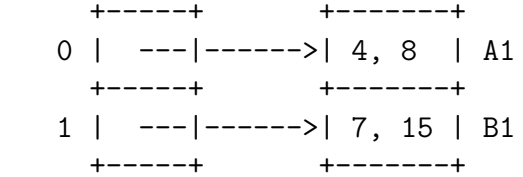
Delete 6:



- Try Combine(A1) with buddy bucket A3.



- Now we can collapse the directory.



Question 2

A) Hash('PAL') $= (2 \times 80 + 65 + 3 \times 76)\ mod\ 6$
$= 453\ mod\ 6 = 3$

Hash('LAP') $= (2 \times 76 + 65 + 3 \times 80)\ mod\ 6$
$= 457\ mod\ 6 = 1$

B) As follows:

0	SET
1	LAV
2	PET
3	VAL
4	PAT
5	MAP

C) As follows:

Key	**Home Address**	**Search Length**
VAL	3	1
LAV	1	1
MAP	5	1
PAT	3	2
PET	1	2
SET	1	6

Average search length $= \frac{1+1+1+2+2+6}{6} = \frac{13}{6} \cong 2.17$

Question 3

A) As follows:

0	CAT	-1
1	PET	2
2	SET	-1
3	PAT	4
4	SAT	0
5	MAP	-1

B) As follows:

Key	**Home Address**	**Search Length**
MAP	5	1
PAT	3	1
PET	1	1
SET	1	2
SAT	3	2
CAT	3	3

Average search length $= \frac{1+1+1+2+2+3}{6} = \frac{10}{6} \cong 1.67$

C) As follows:

Hashed File

0		
1	PET	0
2		
3	PAT	1
4		
5	MAP	-1

Overflow Area

0	SET	-1
1	SAT	2
2	CAT	-1