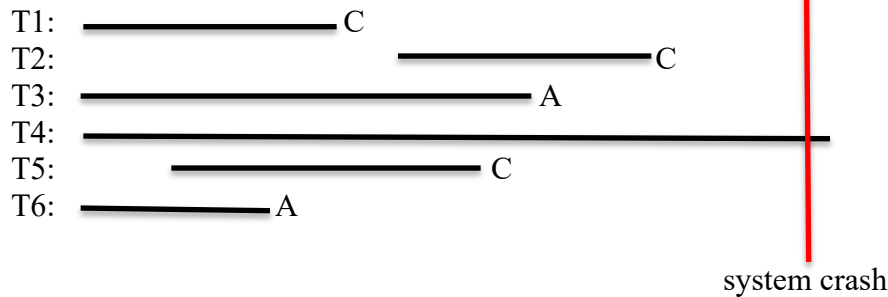# CS1555/CS2055 Recitation 13 Solution

Objective: Practice recovery, operations on static hashing and extendible hashing

Part 1. Recovery
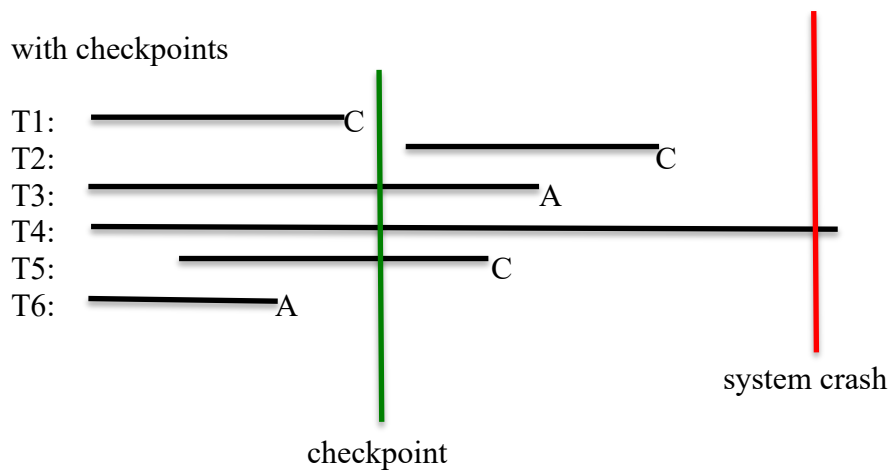
For the following transaction executions, state what the system should do when it restarts after a crash:

    a. without checkpoints:

system crash

REDO (to preserve DURABILITY)	T1, T2, T5
UNDO (to preserve ATOMICITY)	T3, T4, T6

    b. with checkpoints

checkpoint

system crash

REDO (to preserve DURABILITY)	T2, T5
UNDO (to preserve ATOMICITY)	T3, T4

T1 is not included anymore because it committed before the checkpoint;
T6 is not included anymore because it aborted before the checkpoint and the system already rolled back everything at the checkpoint

Part 2. Hash Files

1) Static Hashing

Consider the following record keys: (3, 2, 1, 8, 6, 4, 14, 5, 9). Create the static hash structure, with M=4 main buckets, that will contain the provided records, using the chaining technique. Use h(k) =k mod M as a hashing function. Each bucket can hold 2 records.

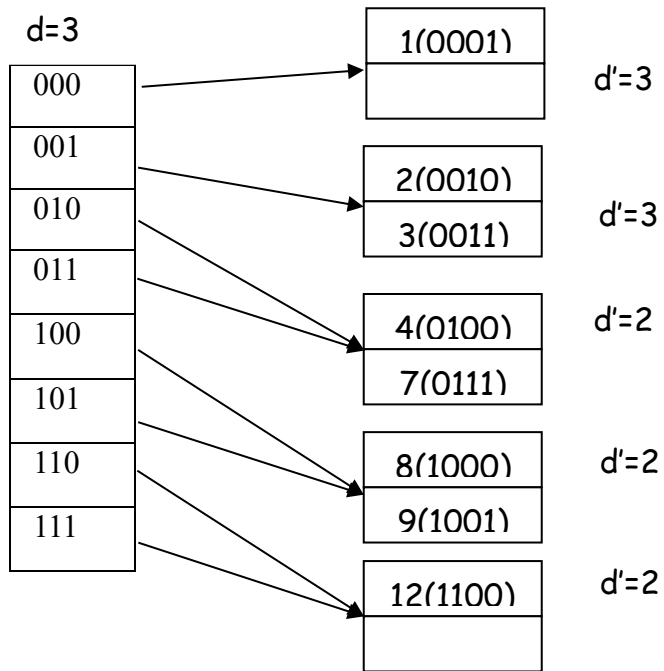| 0	1	2	3
8	1	2	3
4	5	6	

2) Extendible Hashing

Create an extensible hash structure for these record keys: (2, 3, 4, 8, 1, 12, 9, 7). Use the 4 bit binary representation of the keys (2=0010, 3=0011, 4=0100, 8=1000, 1=0001, 12=1100, 9=1001, 7=0111). Use a bfr=2.

d=1

0
1

2(0010)
3(0011)
d'=1

d'=1
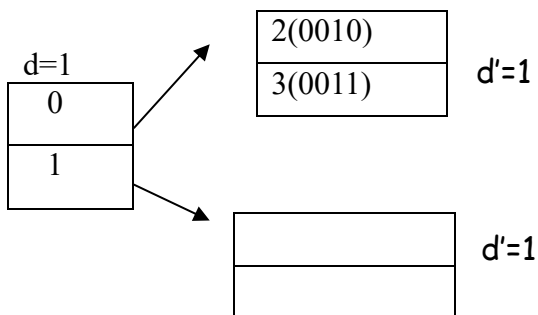
Insert 4. There is no space. Split the first bucket. Since d'$_1$ = d, increase d (double the directory)

d=2

00
01
10
11

2(0010)
3(0011)
d'=2

4(0100)
d'=2

8(1000)
d'=1
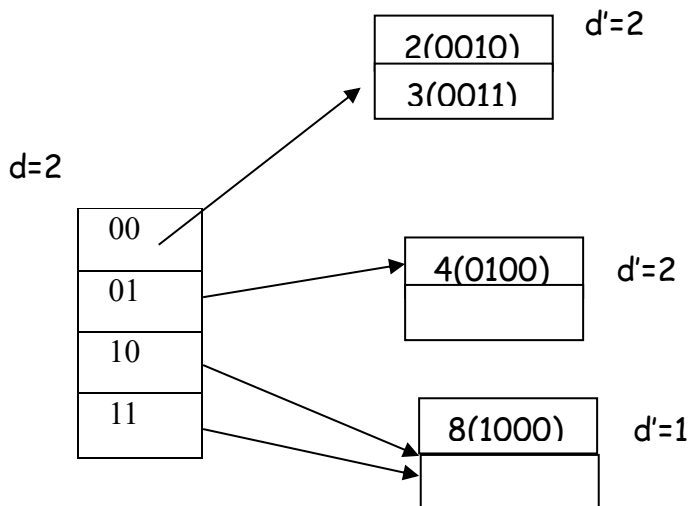
Insert 1. There is no space. Split the first bucket into 2 and because d'$_1$ = d, double the directory

d=3

000	
001	
010	
011	
100	
101	
110	
111	

1(0001)	d'=3

2(0010)	d'=3
3(0011)	

4(0100)	d'=2

8(1000)	d'=1
12(1100)	

d=3

000	
001	
010	
011	
100	
101	
110	
111	

1(0001)	d'=3

2(0010)	d'=3
3(0011)	

4(0100)	d'=2
7(0111)	

8(1000)	d'=2
9(1001)	

12(1100)	d'=2
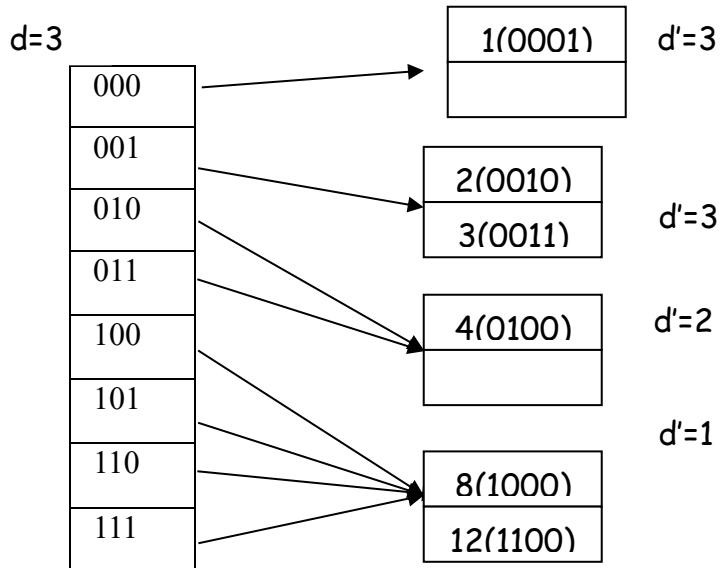
Insert 9. There is no space. Split the fourth bucket into 2 and because $d'_1 < d$, the directory is not split.