

ARIES

1. Your database server has just crashed due to a power outage. You boot it up, find the following log and checkpoint information on disk, and begin the recovery process. Assume we use a STEAL/NO FORCE recovery policy.

LSN	Record	prevLSN
30	update: T3 writes P5	null
40	update: T4 writes P1	null
50	update: T4 writes P5	40
60	update: T2 writes P5	null
70	update: T1 writes P2	null
80	begin checkpoint	-
90	update: T1 writes P3	70
100	end checkpoint	-
110	update: T2 writes P3	60
120	T2 commit	110
130	update: T4 writes P1	50
140	T2 end	120
150	T4 abort	130
160	update: T5 writes P2	null
180	CLR: undo T4 LSN 130	150

Transaction table at time of checkpoint		
Transaction	lastLSN	Status
T1	70	Running
T2	60	Running
T3	30	Running
T4	50	Running

Dirty Page Table at time of checkpoint	
Page ID	recLSN
P5	50
P1	40

(a) The log record at LSN 60 says that transaction 2 updated page 5. Was this update to page 5 successfully written to disk? The log record at LSN 70 says that transaction 1 updated page 2. Was this update to page 2 successfully written to disk?

(b) At the end of the analysis phase, what transactions will be in the transaction table, and what pages will be in the dirty page table?

Transaction Table			Dirty Page Table	
Transaction	lastLSN	Status	Page ID	recLSN

(c) At which LSN in the log should redo begin? Which log records will be redone (list their LSNs)? All other log records will be skipped.

2. Consider the execution of the ARIES recovery algorithm given the following log (assume a checkpoint is completed before LSN 0 and the Dirty Page Table and Transaction Table for that checkpoint are empty):

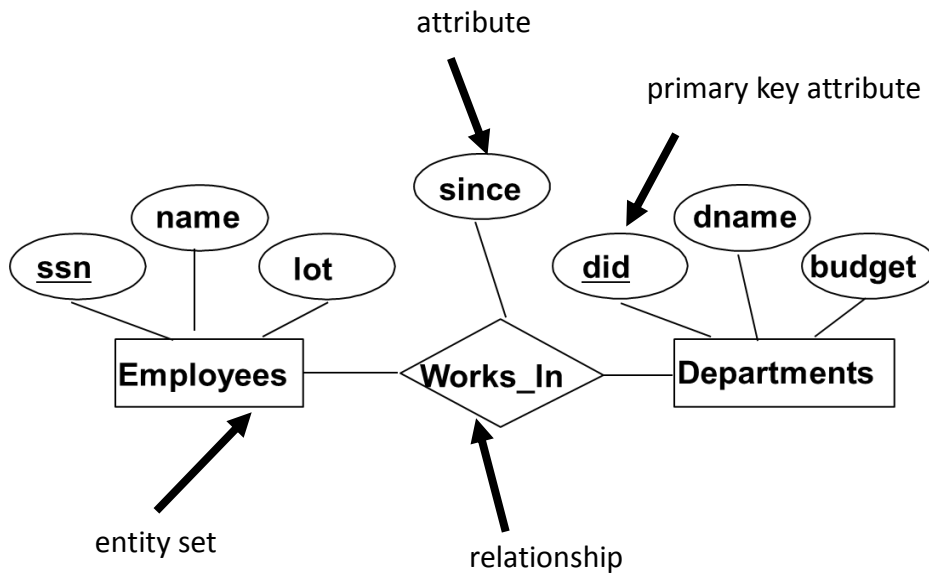
LSN	Log Record
10	update: T1 writes P1
20	update: T2 writes P3
30	T1 commit
40	update: T3 writes P4
50	update: T2 writes P1
60	T1 end
70	update: T3 writes P2
80	T2 abort
X - crash, restart	

(a) During Analysis phase, what log records are read? What are the contents of the dirty page table and the translation table at the end of the analysis stage?

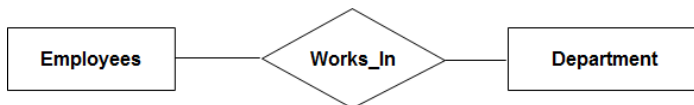
(b) During Redo, what log records are read? What data pages are read? What operations are redone (assuming no updates made it out to disk before the crash)?

(c) During Undo, what log records are read? What operations are undone? Show any new log records that are written for CLRs. Be sure to show the undoNextLSN?

Entity Relationship Diagrams

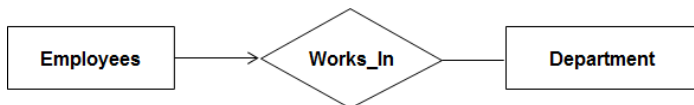


1. Normal Line ————— Entity may participate in a relationship zero or more times



An employee may work in zero or more departments. A department may have zero or more employees in it.

2. Normal arrow (aka key constraint) —————> Entity may participate in relationship at most one time



An employee may work in zero or exactly one department.

3. Bolded line (aka total participation constraint) — Entity must participate in relationship at least once



Each department must have at least one employee (but may have several)

4. Bolded arrow (aka total participation with key constraint) —————>
Entity must participate in relationship exactly once



Each employee must work in exactly one department

- Assume that a player can play in more than one team (Yes, our league has different rules !) and that a team needs **at least** one player. Draw an ER diagram for our database
- Now let's say we want to also track who is the **captain** of every team. How will the ER diagram change from the previous case? Note: Every team needs to have exactly one captain!
- Are there any weak-entity relationships in either of our ER diagrams?