ER model, can be better understood at a later point.

So I am delaying it.

*** Find all Candidate Keys 'R' with FD Set F.

R(ABCD)

$AB \rightarrow C$

$C \rightarrow D$

$D \rightarrow B$

find all CKS

Finding all CKS is a NP hard problem.

exponential time.

There is no quick algorithm.

we have to use intuition.

not in syllabus.

$(ABCD)$ $AB \to C$ $C \to D$ $D \to B$.

Rule I: check if all attributes are present in RHS of the FD.

$\overset{\times}{A}$ $\overset{\checkmark}{B}$ $\overset{\checkmark}{C}$ $\overset{\checkmark}{D}$ ∴ Every Key (CK & SK) should contain 'A'!

testing if $A^+ = (A)$. ∴ A is not SK ∴ not CK.

A is SK;

B^+ ×

C^+ ×

D^+ ×

$AB^+ = (ABCD) \Rightarrow AB$ is SK $\Rightarrow$ minimal SK = CK.

AC^+

AD^+

$A^+ = A$ ×

$B^+ = B$ ×

CK = {AB

$AB \to C \quad C \to D \quad D \to B \qquad D \to B$

Prime attri

(AB)

(AD)

If a non trivial FD $X \to Y$ with Y as prime attribute.
Then R has at least 2 Candidate keys.

$(AD)^+ = \underline{ADBC}$ $\quad AD \to$ SuK $\quad$ CK.

$A^+ = A$

$D^+ = D$

AD is CK $\quad C \to D.$

$(AC)^+ = ACDB \quad A^+ = A$

$C^+ = CD.$

AC

$(AB, AD, AC) \to$ CK.

any superset of CK is a SK.

$R(ABCDE)$ $\{AB \rightarrow C,\ BC \rightarrow D\}$ Cand Keys = ?

Rule 1: check if ~~the~~ all attributs are on RHS of non trivial FD's.

$$\begin{array}{ccccc} \times & \times & \checkmark & \checkmark & \times \\ A & B & C & D & E \end{array}$$

$\therefore$ any key should contain $\underline{\underline{ABE}}$ ✓

SK ← $(ABE)^+ = ABECD$

$A^+ = A$ $AB^+ = ABCD$

$B^+ = B$ $BE^+ = BE$

$E^+ = E$ $AE^+ = AE$

$(ABE) \rightarrow \underline{\underline{CK}}$.

only CK.

$R(ABCDEF)\ \{AB \to C,\ C \to D,\ CD \to BE,\ DE \to F,\ EF \to A\}$

Rule 1: check if attr are present in RHS of non trivial FDs

$A\ B\ C\ D\ E\ F$

$(A)^+ = A$. $(A)^+ = A$ ✓

$A^+ = \{A\}$ ✓

$B^+ = \{B\}$ ✓

✓ $C^+ = \{C\ D\ E\ F\ A\ B\}$

$D^+ = D$

$E^+ = E$

$F^+ = F$

$(AB)^+ = \underline{ABCDEF}$

CK SK

A

$AB \to C$, $C \to D$, $CD \to BE$, $DE \to F$, $EF \to A$

$\{AB, BEF, BDE, C\}$ — $(BDE)^+ = \{BDEF AC\}$ → key.

C

AB

A B

EF

EFB → CK.

$(EFB)^+ = EFBACD$

(EFB) → CK

(EFB) → SK.

CDF SK.

CK

CKeys

$DE \to F$

EFB

E DEB

⇒ BED

B^+ ✗ EF ✗ $= \{EFA\}$

F^+ ✗ EB ✗ $= \{EB\}$

E^+ ✗ FB ✗ $= \{FB\}$

$R(ABCDEF)\ \{AB \to C,\ C \to DE,\ E \to F,\ F \to B\}$

Rule 1 :

$\overset{\times}{A}\ \overset{\checkmark}{B}\ \overset{\checkmark}{C}\ \overset{\checkmark}{D}\ \overset{\checkmark}{E}\ \overset{\checkmark}{F}$

$\therefore$ Every key should contain 'A'.

Check if A is CK.

$A^+ = A$

$\times$ CK

AB $\to$ start.

length 2 $\begin{cases} AC \\ AD \\ AE \\ AF \end{cases}$

$(AB)^+ = ABCDEF$

$\to$ SK

$A^+ \times$

$B^+ = B$

$\therefore AB \to CK$

ABF

$\Downarrow$

$F \to B$

$(AF)^+ = ABCDEF$

$\to$ SK. $\underline{AF \to CK}$

$A^+ \times$

$F^+ = FB \times$

AF

$E \to F$

$(AE)^+ = (ABCDEF)$

$\to$ CK.

$A^+ \times$

$E^+ = \{EFB\} \times$

AE

$C \to DE$

$\Rightarrow C \to D$ & $C \to E$

AC

$(AC)^+ = \{A\,C\,D\,E\,F\,B\}$ → SK

$\{AB, AF, AE, AC.\}$

AC ই CK.

A^+ ✗

$C^+ = \{C\ \cancel{A}\ D\,E\,F\,B\}$

AC

$AB \to C$

$A\ AB$

$AB \to CK$

R(ABCDE) $\{A \to B, B \to C, C \to D, D \to A\}$

Rule: 1

✓ ✓ ✓ ✓ ✗
A B C D E

∴ ~~every CK should key E~~

every SK & CK should contain E

$E^+ = \{E\}$

$(AE)^+ = \{A B C D E\}$

→ SK → CK

✗ A^+

✗ E^+

$\{AE, DE, CE, BE\}$

DE → CK.

$C \to D$

$(CE)^+ = \{ABCDE\}$

C^+ ✗

E^+ ✓.

BE

AE.

$D \to A$

$(DE)^+ = (ABCDE)$

E^+ ✓

D^+ ✗

$A \to B$.

AE^+

CE

$B \to C$.

$BE^+ = (ABCDE)$

E^+

B^+

AB

$C \rightarrow B$.

$(AC)^+ = ACB$

CK.

(AB) CK.

$C \rightarrow B$ ✓

$(AC)^+ = (ACB)^+$

SK.

R(ABCDEF)

{AB → C, C → A, BC → D, ACD → B,

BE → C, EC → FA, CF → BD, D → E}

Korth → exercise problem

~~Dont~~ read any books.

I will cover everything.

Ans:

{AB, CB, CD, BD, CF, EC, BE}

not for gate.

membership test:

$X \to Y$ FD is a member of FD set (F) iff x^+ ~~rea~~ determines Y in FD set (F).

FD set = $\{ \ldots\ldots\ldots \}$? $X \to Y$?

X^+

if X^+ containing Y then $X \to Y$ is present in F

$X \to$ an attribute set

$Y \to$ an attribute set

→ Give FD set $\{AB \to C, C \to D, D \to E, E \to F, F \to B\}$ which of the FD's are members of given FD set?

(i) $AB \to F \Rightarrow (AB)^+$ from FD set $\quad AB^+ = \{ABCDEF\}$

$AB \to F.$

(ii) $AC \to B$

(iii) $BC \to A$ $\qquad AB.$

$(AC)^+ = \{ACDEFB\}$

$AC \to B.$

'A' is not in RHS,

∴ it can never be determined except when it is in LHS.

Equality of FDS:

Let two FD sets F & G be there. They are logically equal iff

1) F covers G : Every FD of G must be member of F set.

$$F \supseteq G$$

2) G covers F: Every FD of F must be a member of G set.

$F \equiv G$ iff F covers G and G covers F

✓ F covers G	✓ G covers F	
Yes	Yes	$F \equiv G$
Yes	NO	$F \supset G$
NO	Yes	$G \supset F$
NO	NO	Cannot be compared.

$F = \{ A \to B, B \to C, C \to A \}$

$G = \{ A \to BC, B \to AC, BC \to A, AB \to C \}$

which of the following is true

a) $F \subset G$ b) $F \supset G$ c) $F = G$ d) none

I F covers G ✓

$\{A \to B, B \to C, C \to A\}$

✓ $A \to BC$ $A^+ = ABC$

✓ $B \to AC$ $B^+ = BCA$

✓ $BC \to A$ $BC^+ = BCA$

✓ $AB \to C$ $AB^+ = ABC$

F covers G

$F \supseteq G$. ✓

G covers F

$\{A \to BC, B \to AC, BC \to A, AB \to C\}$

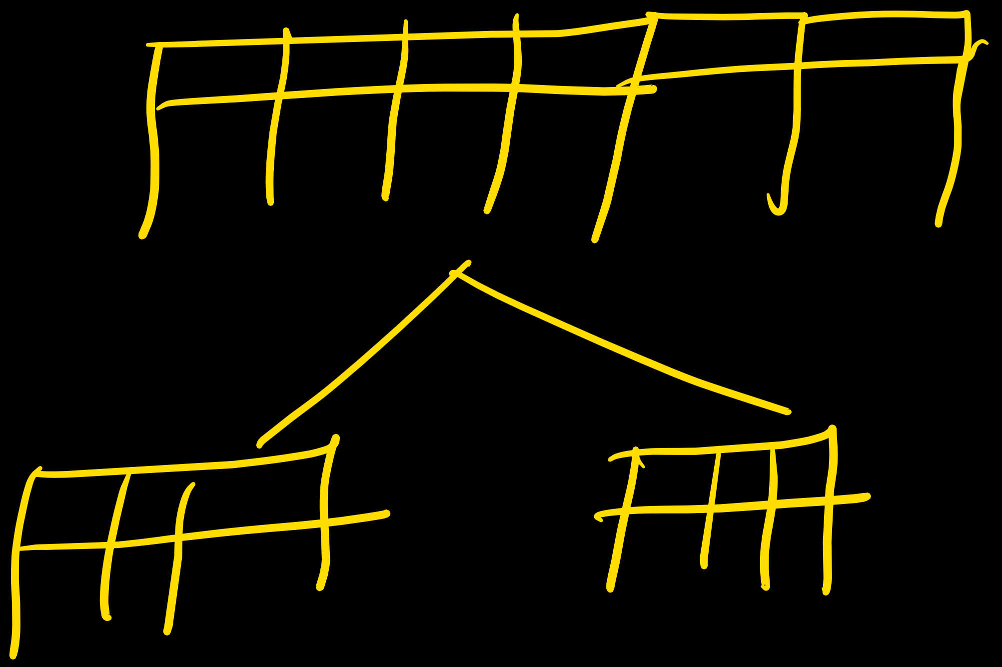
✓ $A \to B$ $A^+ = BC$ . . . .

✓ $B \to C$ $B^+ = AC$ . . . .

✗ $C \to A$ $C^+ = C$

G doesnot cover F.

Redundancy in tables of relations can be eliminated by decomposing the relation.



Properties of decomposition:

1) lossless join decomposition

2) Dependency preserving decomposition

Lossless join decomposition:-

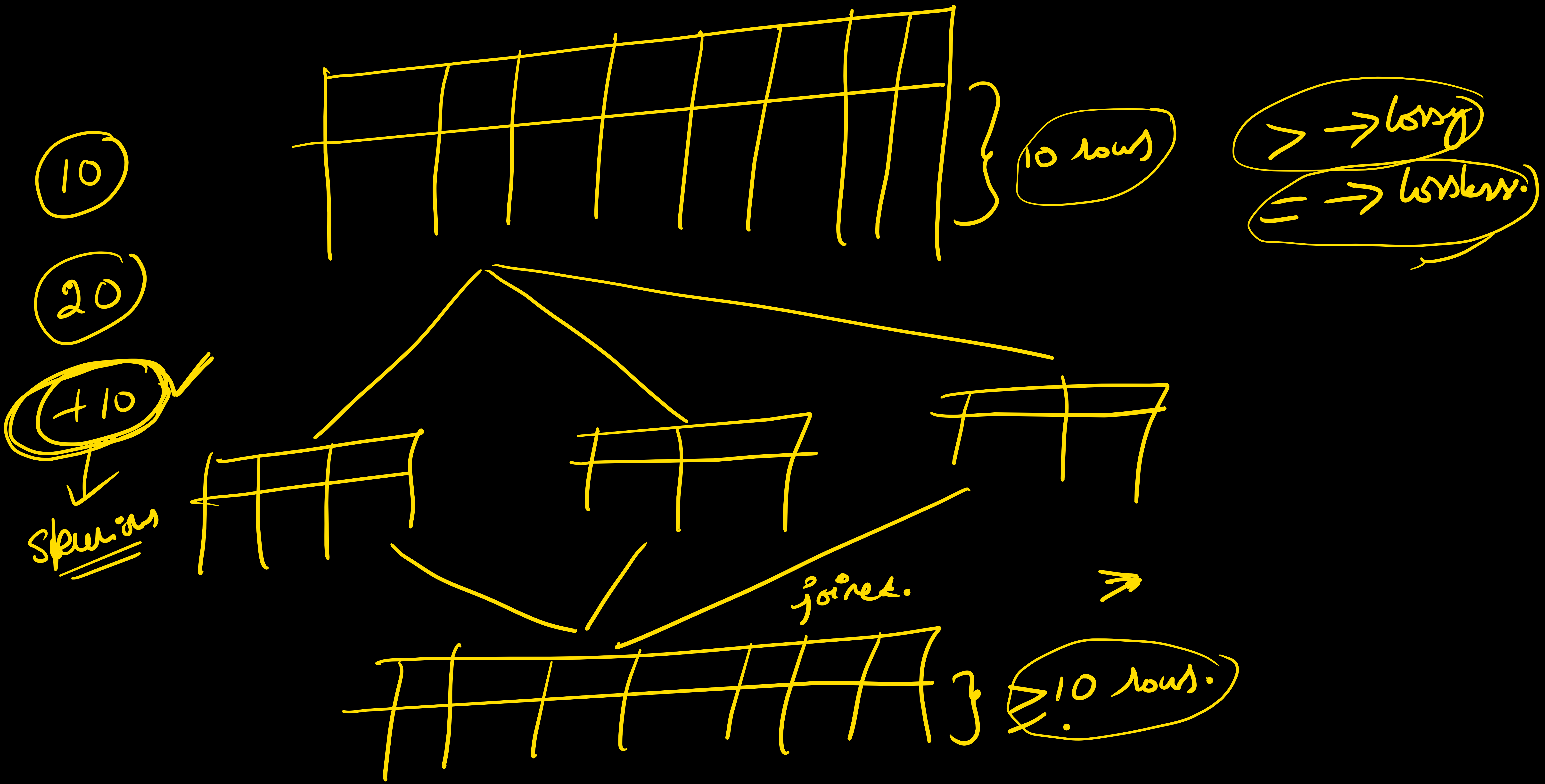
Relational schema R with instance r decomposed into sub relations $R_1, R_2, R_3 \ldots\ldots R_n$

$\bowtie \rightarrow$ join

a) In general $R_1 \bowtie R_2 \bowtie R_3 \bowtie R_4 \bowtie \ldots\ldots R_n \supseteq R$

b) If $R_1 \bowtie R_2 \bowtie R_3 \ldots\ldots R_n = R$, then it is lossless join decomposition

c) If $R_1 \bowtie R_2 \bowtie R_3 \ldots\ldots R_n \supset R$ then it is lossy join decomposition


10
20
+10
spurious
10 rows
> → lossy
= → lossless.
joint.
≥10 rows.