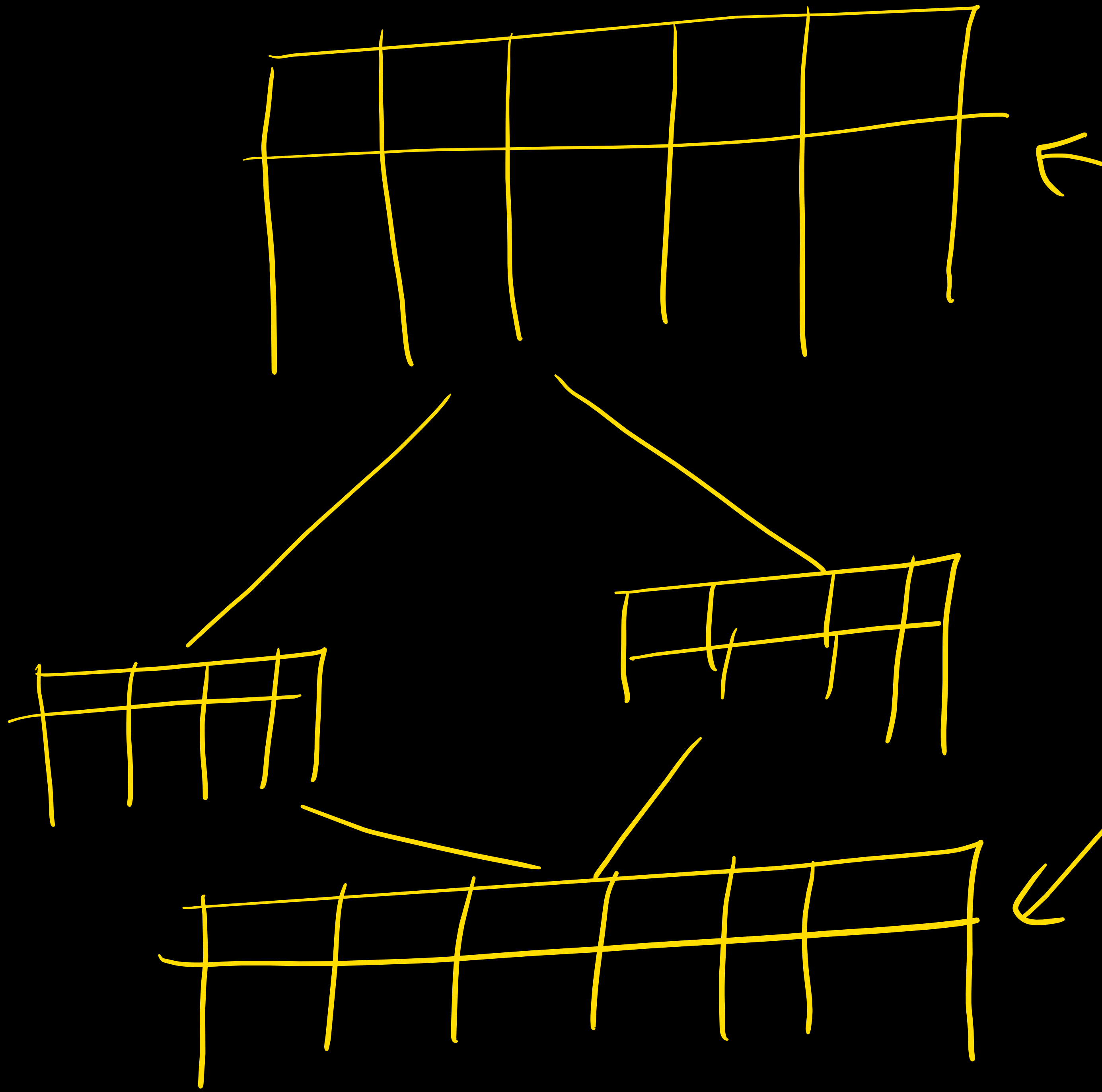
lossless join decomposition:



Same

lossless join decomp.

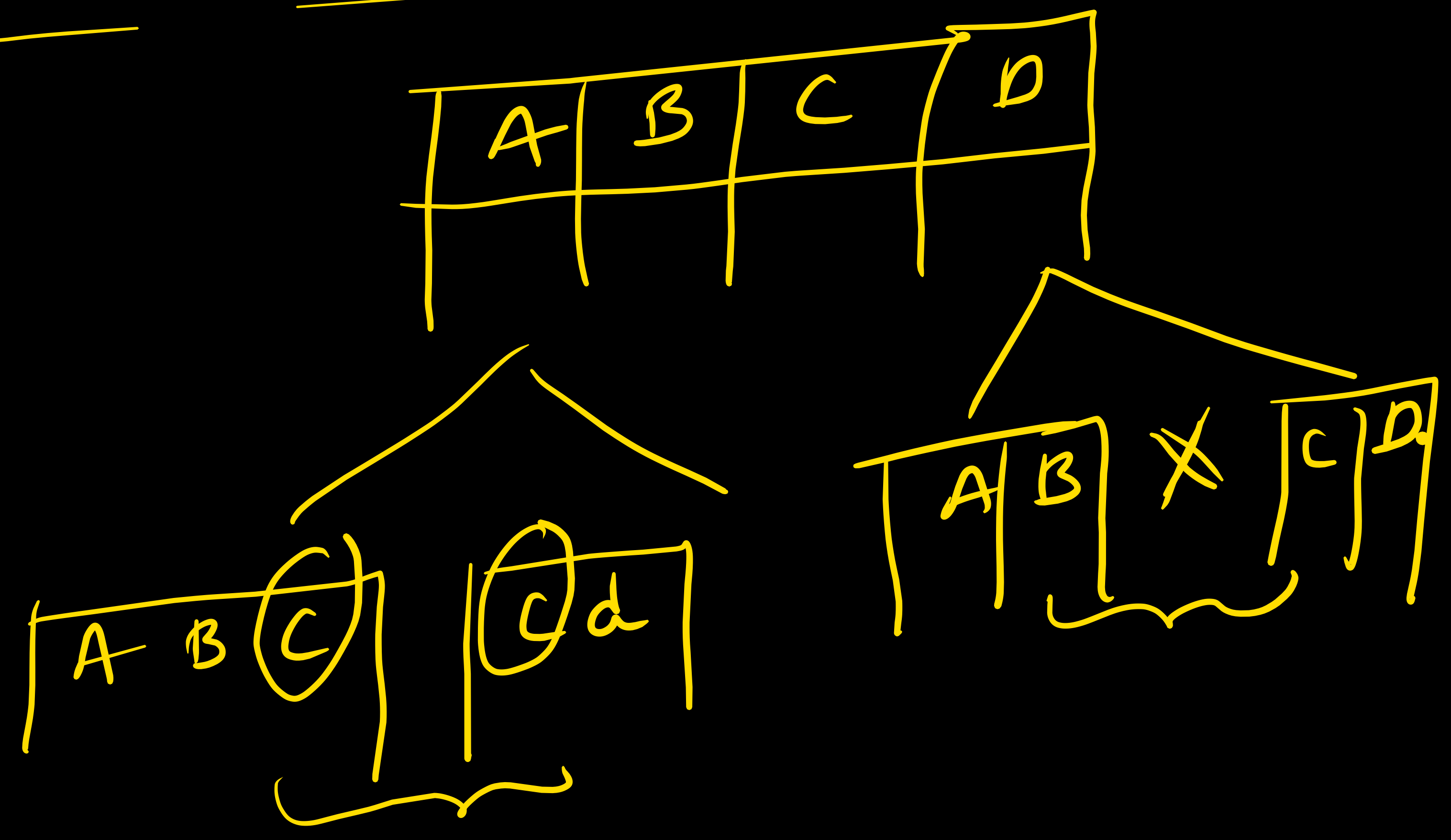
R

$R_1, \; R_2 \; R_3 \; \cdots \cdots \; R_n$

$R_1 \bowtie R_2 \bowtie R_3 \cdots\cdots R_n \supseteq R$

$= \rightarrow$ lossless join.

whereever we break a table into subtables, there should be attributes in common.



why LLD?

R

Sid	Sname	Cid
S_1	A	C_1
S_1	A	C_2
S_2	B	C_2
S_3	D	C_3

{Sid → Sname} ∴ lossless join decomposition.

Common attributes is a PK of one of the tables.

same

decomposition

Table

CK

Sid

↓

PK.

Sid	Sname
S_1	A
S_2	B
S_3	D

Sid → Sname

Sid	Cid
S_1	C_1
S_1	C_2
S_2	C_2
S_3	C_3

join

Sid	Sname	Cid
S_1	A	C_1
S_1	A	C_2
S_2	B	C_2
S_3	D	C_3

why lossy?

Common attri Sname is not a PK for one of the tables

Sid	Sname	Cid
S_1	A	C_1
S_1	A	C_2
S_2	B	C_2
S_3	B	C_3

Sid → Sname

Sid Cid PK

lossy join decomposition

Sid	Sname
S_1	A
S_2	B
S_3	B

Sname	Cid
A	C_1
A	C_2
B	C_2
B	C_3

Sid	Sname	Cid
S_1	A	C_1
S_1	A	C_2
S_2	B	C_2
S_2	B	C_3
S_3	B	C_2
S_3	B	C_3

spurious tuples

row

lossless join decomposition:

Relational schema 'R' with FD set (F) is divided into sub relations R_1, R_2.

The decomposition is lossless if

① $R_1 \cup R_2 = R$.

② $\underbrace{R_1 \cap R_2}_{SK \text{ of } R_1} \to R_1$ → SK

or

$\underbrace{R_1 \cap R_2}_{SK \text{ of } R_2} \to R_2$ → SK.

R ✓

✓ R_1 ✓ R_2

HOW

✓ normalization

R

R_1 R_2

$\underbrace{R_1 \cap R_2}_{SK} \to$ either R_1 or R_2

→ If relation 'R' with record set is given, the use natural join method.

FD ✗.

use

Lossy or lossless

→ If Relation R is given with FD set, then used the ~~also~~ below method.

① $R_1 \cup R_2 = R$

② $R_1 \cap R_2 \to R_1$
or
$R_1 \cap R_2 \to R_2$

↓

FD are ~~gi~~ given

R(ABCDE)

FD set: { AB → C, C → D, B → E }

Decomp : { ABC, CD }

(ABC) ∪ (CD) = ABCD.

E is missing.

∴ lossy.

$R(ABCDE)$

$FD = \{ AB \rightarrow C,\ C \rightarrow D,\ B \rightarrow E \}$

Decompose $(\overset{R_1}{ABC}, \overset{R_2}{DE})$

$R_1 \cup R_2 = \underline{\underline{ABCDE}}$

$R_1 \cap R_2 = \phi$

$\underline{\underline{\text{lossy}}}$.

$R(ABCDE)$

FD $\{AB \to \underline{\underline{C}},\ C \to \underline{\underline{D}},\ B \to \underline{\underline{E}}\}$

Decomp: $\{\underset{R_1}{ABC},\ \underset{R_2}{CDE}\}$

$R_1 \cup R_2 = \{ABCDE\} = R.$

$R_1 \cap R_2 = \{ABC\} \cap \{CDE\}$

$= \text{'}C\text{'}$

$C^+ = \underline{\underline{C}}D \neq ABC$

$\neq CDE$

Lossy.

$R(ABCDE)$

$FD\{AB \to C,\ C \to D,\ B \to E\}$

$R_1 \cup R_2 \cup R_3 = R$. ✓

Decompose $\{R_1(ABC)\ R_2(CD)\ R_3(DE)\}$ ✓

R_1 join R_2

$R_1 \cap R_2 = C$

$C^+ = \underline{CD} \to C^+$ is SK for $\underline{R_2}$.

$(R_1 \bowtie R_2) R_4$

$ABCD$. ✓

$R_4 \cap R_3$

$= D$

$D^+ = \underline{D}$

$\therefore$ lossy.

$R(ABCDE)$

FD: $\{AB \to C,\ C \to D,\ B \to F\}$

Decomp: $\{\ R_1(AB)\quad R_2(CD)\quad R_3(BC)\}$

$R_1 \cup R_2 \cup R_3 = \{ABCD\}$

E is missing.

$\therefore$ lossy.

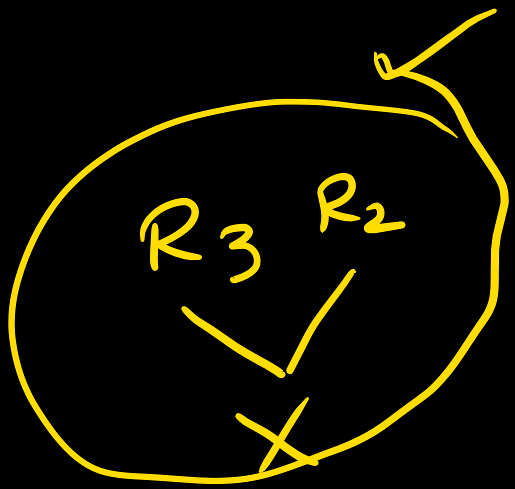
R(ABCDE)

{AB → C, C → D, B → E}

Decomp {ABC, CD, BE}

R1 R2 R3

$R_1 \cup R_2 \cup R_3 = ABCDE$



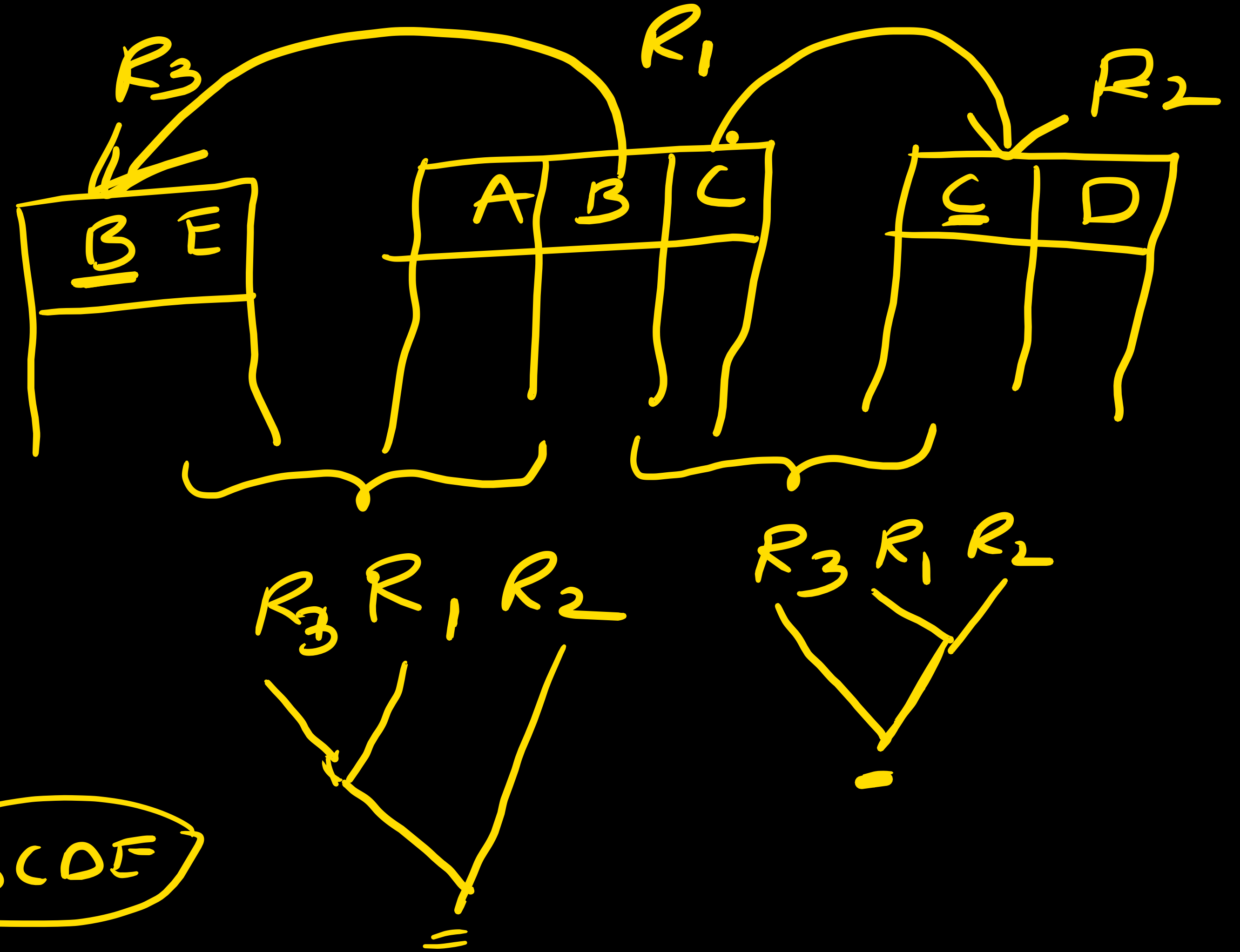
$C^+ = CD$ → SK

ABCD ⋈ BE

ABCDE

lossless join

$B^+ = BE$ → SK of R_3



Dependency preserving decomposition:

Relational Schema 'R' with FD set (F) decomposed into Sub relations $R_1, R_2, R_3, \ldots R_n$ with FD sets $F_1, F_2, F_3 \ldots F_n$

a) in general $F_1 \cup F_2 \cup F_3 \ldots F_n \subseteq F$

b) If $\{F_1 \cup F_2 \cup F_3 \ldots F_n\} = F$ then it is dependency preserving decomposition

c) If $\{F_1 \cup F_2 \ldots F_n\} \subset F$ then not DP preserving decomposition

$R.$ $\quad F$

$\{ \rightarrow \rightarrow \rightarrow \rightarrow \} = F.$

$R_1 \quad R_2 \quad \cdots\cdots \quad R_3 \quad \cdots \quad R_n.$

$F_1 = \{ \quad \}$ $\quad F_2\{ \quad \}$ $\quad F_3 = \{ \quad \}$ $\quad F_n = \{ \quad \}$

$F_1 \cup F_2 \cup F_3 \cdots F_n \subset F$ → general.

$F_1 \cup F_2 \cup F_3 \cdots F_n = F$

$F_1 \cup F_2 \cup F_3 \cdots F_n \subset F.$

$R(ABCDE)$

$FD = \{A \to B,\ B \to C,\ C \to D,\ D \to BE\}$ F.

HW: Lossy & lossless

decomp $\{AB,\ BC,\ CD,\ DE\}$

what could be Relationship

∴ It is dependency preserving.

AB.	BC	CD	DE
$A^+ = \cancel{A}BC\cancel{DE}$	$B^+ = \cancel{B}C\cancel{DE}$	$C^+ = \cancel{C}D\cancel{B}\cancel{E}$	$D^+ = \cancel{D}BE\cancel{C}\cancel{D}$
$B^+ = \cancel{B}CDE$	$C^+ = \cancel{C}\cancel{D}B\cancel{E}$	$D^+ = \cancel{B}\cancel{E}C\cancel{D}$	$E^+ = E$
	$BC^+ \times$	$CD^+ \times$	
$A \to B$	$B \to C$	$C \to D$	$D \to E$
	$C \to B$	$D \to C$	

G

$A \to B.$

$D^+ = DECB$

$D \to BE.$

If G covers F, then it is FD preserving.

$R(ABCD)$

$\{AB \rightarrow CD, \quad D \rightarrow A\}$

decompose into $\{ABC, BCD, AD\}$

$R_1(ABC)$

$A^+ = A$

$B^+ = B$

$C^+ = C$

$AB^+ = ABC\cancel{D}$

$BC^+ = BC$

$AC^+ = AC$

$AB \rightarrow C$

$R_2(BCD)$

$B^+ = B$

$C^+ = C$

$D^+ = D\cancel{A}$

$BC^+ = BC$

$BD^+ = \cancel{B}\cancel{D}\cancel{A}C$

$CD^+ = CD\cancel{A}$

$BD \rightarrow C$

$R_3(AD)$

$A^+ = A$

$D^+ = DA$

$D \rightarrow A$ ✓

not dependency preserving.

$AB \rightarrow C$

$BD \rightarrow C$

$D \rightarrow A$ ✓

$AB^+ = ABC$

$AB \rightarrow CD$

$\Downarrow$

$AB \rightarrow C$ ✓

$AB \rightarrow D$ ✗

$D \rightarrow A$ ✓

Named forms → tomorrow