classmate
Date
Page

using FDs in F → using FD1 $A \to B$

$(A^+) = A, B, C, D$ — FD2 $B \to C$

$(B^+) = B\ C\ D$ — FD3 $C \to D$

$A \to B$
$C \to D$

$A \to C$
$AC \to D$
$A \to D$

$A \to$

using FD2 $B \to C$

$A \to D$
$C \to D$

3) $F : \{ A \to C$
$AC \to D$
$E \to AD$
$E \to H$
$\}$

$G : \{ A \to CD$
$E \to AH$

$A \to C$	$E \to A$
$A \to D$	$E \to H$

using FDs in G.

$(A^+) = A, C, D$

$(E^+) = E, A, H, D$

$(\ ) =$

$(AC^+) = ACD$

$AC \to$

→ $AC \to \cancel{A}$
$\cancel{A} \to D$
$AC \to D$ Transitive

using FD's in F

$(A^+) = A, C, D.$

$(E^+) = E\ A\ D\ H$

since FD1

$E \to H$

$E \to A$

$E \to D.$

$A \to C$

$A\cancel{C} \to D$ since FD2

$A \to D$ transitive

$\boxed{A \to CD}$

$E \to A$
$\cancel{A} \to D$
$E \to D$
transitive

since $E \to A$ &
$E \to D$
$E \to AD$

union rule
$E \to H$
$E \to A.$

$\boxed{E \to AH}$

4) Minimal Cover: or Canonical Cover

Algo ↓ fmd

Step 1: Write FD's in such a way that all RHS are single valued.

step 2: Ensure that there is no redundant or Extraneous attr in LHS

step 3: Check any dependency can be Inferred using remaining FD's

{
B → A
D → A
AB → D
}

1) B → A FD1
D → A FD2
AB → D FD3.

2) A → D
B → D

{A⁺} = {A}
{B⁺} = {B, A, D}

B → ~~A~~B
~~A~~B → D

B → A
D → A
B → D

B → D
D → A.
B → A

∴ minimal cover = {
D → A
B → D
}

classmate

Date

Page

(2) $F : \{ X \to W$

$WZ \to XY$

$Y \to WXZ$

$\}$

$X \to W$ ✓

(1) $Y \to WXZ$

$WZ \to X$ ×

$WZ \to Y$ ✓

$Y \to W$ ×

$Y \to X$ ✓

$Y \to Z$ ✓

2) $W \to X$

$Z \to X$

$W \to Y$

$Z \to Y$

$(W^+) = \cancel{\{W, X, Y\}},\ \{W\}$ | $(W^+) = \{W\}$

$(Z^+) = \cancel{\{Z, X, Y\}},\ = \{Z\}$ | $(Z^+) = \{Z\}$.

(3) $\cancel{X \to W}$ $\quad Y \to \cancel{X}$

$\cancel{Y \to X}$ $\quad X \to W$

$\cancel{Y \to}$ $\quad Y \to W$ } remove

$WZ \to \cancel{Y}$

$\cancel{Y} \to X$

$WZ \to X$ } remove

⟹

$X \to W$

$WZ \to Y$

$Y \to X$

$Y \to Z$

classmate
Date
Page

2nd method

2) $R(A, B, C, D)$

FD: $\{ AB \to C$

$C \to D$

$D \to A$

$\}$.

$R_1 (ABC)$ $R_2 (CD)$

$R_1 (ABC)$

$(A^+) = \{A\}$

$(B^+) = \{B\}$

$(C^+) = \cancel{\{C, D\}}, A\}$ $\{C, \cancel{D}, A\}$

because there is no D in our R_1

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

$(BC)^+ = \{BC\cancel{D}A\}$

$(AC)^+ = \{AC\cancel{D}\}$

$$\boxed{\begin{array}{l} C \to A \\ AB \to C \\ BC \to A \end{array}}$$ ✓

$R_2 (CD)$

$C^+ = \{C, D\}$.

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

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

$\boxed{C \to D}$ ✓

$(D \to A)$ is not there

$\{C \to A, C \to D, AB \to C, BC \to A\}$

Not preserving because $D \to A$ is not here.

$\Rightarrow$ R (A, B, C, D)

FDs : { A → B
B → C
C → D
D → B
}

R_1(AB) R_2(BC) R_3(BD)

R_1 (AB)

$(A^+) = \{A, B, \cancel{C}, \cancel{D}, B\}$

$(B^+) = \{B, \cancel{C}, \cancel{D}\}$

$(AB)^+ = \{AB\,\cancel{C}\,\cancel{D}\}$

R_2 $\boxed{A \to B}$ ✓

R_2 (BC)

$(B^+) = \{B, C, \cancel{D}\}$

$(C^+) = \{C, \cancel{D}, B\}$

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

$\boxed{\begin{array}{l} B \to C \\ C \to B \end{array}}$ ✓

R_3 (BD)

$(B^+) = \{B, \cancel{C}, D\}$

$(D^+) = \{D, B\}$

$(BD^+) = \{BD\cancel{C}\}$

$\boxed{\begin{array}{l} B \to D \\ D \to B \end{array}}$ ✓

{ A → B
B → C
~~C → B~~
B → D
D → B }

⇓

C → B
B → D
C → D

C → D is not there

∴ ~~Not~~ it is preserving dependency

$R(A, B, C, D)$

$FD = \{ \quad AB \to CD$

$\quad D \to A$

$\}$

$R_1(AD)$

$R_2(BCD)$

$R_1(AD)$

$A^+ = \{A\}$ $\qquad R_1 \quad \boxed{D \to A}$

$(D^+) = \{D, A\}$

$(AD^+) = \{AD\}$

$R_2 \cdot (BCD)$

$B^+ = \{B\}$

$C^+ = \{C\}$

$D^+ = \{D, \cancel{A}\}$ $\qquad D \to A$

~~BCD = {BCD}~~

$BC^+ = \{BC\}$

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

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

$\Rightarrow (D \to A)$

$\Rightarrow$ Not preserving because $AB \to CD$ is determined

classmate
Date
Page

$D_2 = \{R_1, R_2, R_3\}$
$R_1 = \{A, B, D, E\}$
$R_2 = \{B, F, G, H\}$
$R_3 = \{D, I, J\}$

$D_3 = \{R_1, R_2, R_3, R_4, R_5\}$
$R_1 = \{A B C D\}$
$R_2 = \{D, E, \}$
$R_3 = \{B, F\}$
$R_4 = \{F, G, H\}$
$R_5 = \{D, I, J\}$.

Decomposition

loss less

Loss Decomposition

$R(ABCD)$

$R_1(ABC)$ $(R_2(CD))$

$R(A\ B\ C)$

extra tuple

$R_1(A, B)$ $R_2(B, C)$

A	B	C
1	2	1
2	5	3
3	3	3

R_1

A	B
1	

→ R(A B C)
R1 (A, B)
R2 (B, C)

R

A	B	C
1	2	1
2	5	3
3	3	3

R1

A	B
1	2
2	5
3	3

R2

B	C
2	1
5	3
3	3

R1 * R2.

A	B	C
1	2	3
2	5	3
3	3	3

⇒ R (A, B, C)
R1 (A, C)
R2 (B, C)

R

A	B	C
1	2	1
2	5	3
3	3	3

R1

A	C
1	1
2	3
3	3

R2

B	C
2	1
5	3
3	3

R1 * R2.

R1 * R2.

A	B	C
1	2	1
2	5	3
3	3	3
2	5	3
3	3	3

Loss Key
1) Attr (R1)
2) Attr (R1)

3) super key

1) ⇒ R (A, B, C, D)
R1 (A, B, C)
R2 (B, D)
FD: A →
B →
C →
D →

1) R1 U R
2) R1 ∩ R
3) (B+)
↓
common

classmate
Date
Page

Loss Key

1) Attr (R_1) $\cup$ Attr (R_2) = R
2) Attr (R_1) $\cap$ Attr (R_2) $\neq \phi$
3) Super key of R_1 & R_2 should determine R_1 & R_2

$R(A, B, C, D)$
$R_1(A, B, C)$
$R_2(B, D)$

FD: $A \rightarrow B$
$B \rightarrow C$
$C \rightarrow D$
$D \rightarrow B$

1) $R_1 \cup R_2 = (A, B, C, D)$ ✓
2) $R_1 \cap R_2 = B \neq \phi$ ✓
3) $(B^+) = \{B, C, D\}$

common attribute

$B \rightarrow C$
$B \rightarrow D$ } from R1

only C & D can be determine

so R1 can't be determine

but R2 can be determined

$\therefore$ R_2 is loss less dependency.

Date
Page

a) R (A, B, C)
R1 (A, B)
R2 (A, C)

FD: { A → B }

i) $R_1 \cup R_2$ = A, B C ✓
ii) $R_1 \cap R_2$ = A ✓
$(A^+) = \{ \}$. $(A^+) \rightarrow (A, B)$

∴ It is ~~loo~~ ~~lossy~~ loss less
~~both, can't be determined~~
R_2 can be determined

2) R(A, B, C, D)
{ A → B
A → C
C → D
}

R1 (ABC)
R2 (CD)

i) $R_1 \cup R_2$ = ABCD
ii) $R_1 \cap R_2$ = C.
$C^+ = \{C, D\}$
C → D
∴ R_2 is loss less.

	A	B	C	D
R1	α	α	α	α
R2			α	α

→ if there is full count then it is loss y-

3)
4)
5)
R (A
F :
}
R1
R

3) R (ABCDE)

F: { AB → CD

A → E

C → D

}

	A	B	C	D	E
R_1	α	α	α	α	α
R_2		α	α	α	
R_3			α	α	α

R_1 (ABC)

R_2 (BCD)

R_3 (CDE)

i) $R_1 \cup R_2 \cup R_3$ = ABCDE

ii) $R_1 \cap R_2 \cap R_3$ = ~~BCD~~ C

iii) $B^+ = \{B\}$ $(BC)^+ = \{BC$

$C^+ = \{C, D\}$

$D^+ = \{D\}$ $\{C^+\} = \{C, D\}$.

C → D

∴ lossy

4) R (A, B, C, D)

R_1 (A, B)

R_2 (C, D)

i) $R_1 \cup R_2$ = ABCD

ii) $R_1 \cap R_2 = \phi$

∴ it is not lossless

∴ lossy.

5) R (A, B, CD)

R_1 (A, B)

R_2 (B, C)

i) $R_1 \cup R_2$ = (ABC)

ii) $R_1 \cap R_2$ = B.