Prob1: Equivalence of Functional Dependencies

R=(A C D E H)

F: $A \rightarrow C$

$AC \rightarrow D$

$E \rightarrow AD$

$E \rightarrow H$

G: $A \rightarrow CD$

$E \rightarrow AH$

a) $F \subseteq G$ b) $F \supseteq G$ c) $F = G$ d) $F \neq G$

use G –FD's to compute closure of F Attributes

$(A)^+ = ACD$

$(AC) = ACD$

$(E) = EAHCD$

$F \subseteq G$ All the FD of F is computed using G FD

use F –FD's to compute closure of G Attributes

$(A)^+ = ACD$

$(E)^+ = EADHC$

$G \subseteq F$ All the FD of G is computed using F FD's

$F \subseteq G$ & $G \subseteq F$

therfore $F=G$

Closure of set of FD

Closure of set of FD F is set of all FD's that include F as well as all dependencies that can be inferred from F denoted as F^+

- R(A B C G H I)
- F={ A → B,A → C,CG → H,CG → I,B → H}

F^+ = { A → H (as per transitivity rule If X → Y and WY → Z, then WX → Z)

CG → HI (as per Union rule If X → Y and X → Z, then X → YZ)

AG → H

AG → I }

Minimal/Canonical Cover

- R(A B C)

  F={ A → B, AB → C } B is erroneous att

  FD's are Redundant

  $A^+ = ABC$

  A → B, A → C (B can be removed)

R(A B C)

F={ A → B,B → C,A → C }

A → C is redundant FD

F' = { A → B,B → C}

1. Single RHS
2. No Extraneous attribute in LHS
3. No redundant FD

Minimal set of FD(cannonical form)

- R(W X Y Z)
- $X \rightarrow W$
- $WZ \rightarrow XY$
- $Y \rightarrow WXZ$

Decomposition rule $\alpha \rightarrow \beta r$

$\alpha \rightarrow \beta$

$\alpha \rightarrow r$

$X \rightarrow W$

$WZ \rightarrow X$

$WZ \rightarrow Y$

$Y \rightarrow W$

$Y \rightarrow X$

$Y \rightarrow Z$

FDs maybe Redundant

1. L.H.S Redundancy
2. R.H.S Redundancy
3. $\alpha \rightarrow \beta$ is redundant
4. One attribute in R.H.S
5. No erroneous attr in L.H.S
6. No redundant FD

Compute Closure

$x^+ = xw$

$x^+ = x$

$(wz)^+ = wzxy$

$(wz)^+ = wzyx$

$(wz)^+ = wz$

$y^+ = ywxz$

$y+ = y^+ = yz$

$y^+ = yxw$

$x \to w$

$wz \to y$

$y \to x$

$y \to z$

$X \to W$

$WZ \to X$

$WZ \to Y$

$Y \to W$

$Y \to X$

$Y \to Z$

LHS att are redundant

$(wz)^+ = wzyx$

$w^+ = w$

$z^+ = z$ WZ is essential

$x \rightarrow w$

$wz \rightarrow y$

$y \rightarrow xz$ (Union Rule $y \rightarrow x$

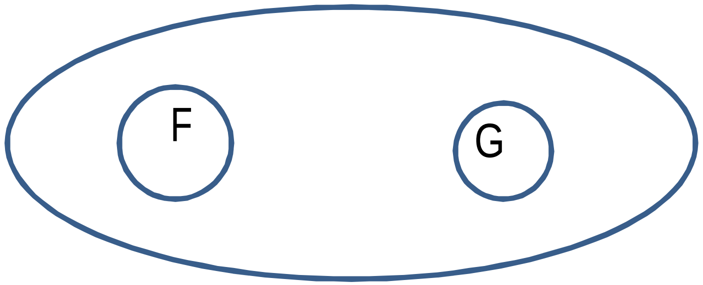
$y \rightarrow z$)

$x \rightarrow w$		$x \rightarrow w$	
$wz \rightarrow xy$	$\rightarrow$	$wz \rightarrow y$	(x is redt)
$y \rightarrow w\,xz$		$y \rightarrow xz$	(w is redt)

Cover of set of FD’s

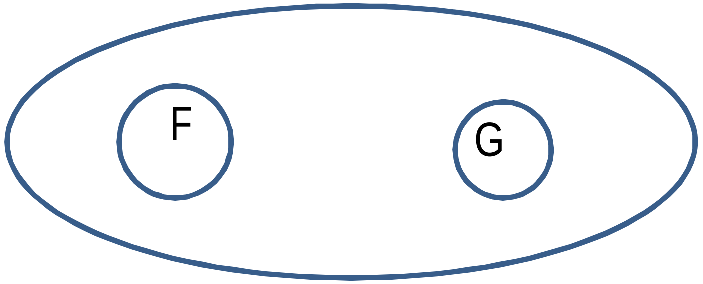
- A set of functional dependency F is said to be the cover of another set of FD’s G if every FD in G is also in F^+.

F^+



$G \subseteq F^+ =$ F covers G

G^+



$F \subseteq G^+ =$ G covers F

if both $F \equiv G$ – no common set

$G \subseteq F^+, F \subseteq G^+ = F^+ = G^+$

Equivalence Example

R(A B C)

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

$G=\{C \rightarrow B, B \rightarrow A, A \rightarrow C\}$

$F \equiv G$

$F \subseteq G^+$ $G \subseteq F^+$ $G^+ = F^+$

If F covers G

Use function dependency in G

Ring Closure

$C_F^+ = CAB$ $C \rightarrow B$ in G is derived using F

$B_F^+ = BCA$ $B \rightarrow A$ in G is derived using F

$A_F^+ = ABC$ $A \rightarrow C$ in G is derived using F

All FD in G is derived using F. so F cover G.

If G covers F

A_G^+ = ACB A $\rightarrow$B is derived using G.

B_G^+ = BAC B$\rightarrow$C is derived using G.

C_G^+ = CBA C $\rightarrow$B is derived using G.

All FD in F is derived using G,SO G Covers F.

$F \subseteq G^+$

$G \subseteq F^+$

$G^+ = F^+$

$F \equiv G$

F^+ ={ ABC}

G^+ ={CBA}

Minimal Cover

R(A B C D E)

F={ A → D,BC → AD,C → B,E → A,E → D}

Single att in RHS

A → D,C → B,E → A,E → D

but BC → AD

BC → A

BC → D

Compute B^+ = B (can't eliminate

C^+ = CBAD (we can eliminate since C^+ closure include B remove B.

So BC → A will become C → A

$BC \rightarrow D$

$B^+ = B$ $C^+ = CBD$ (remove B)

$C \rightarrow D$

$A \rightarrow D$ $C \rightarrow A$ $C \rightarrow A$

$C \rightarrow B$ $E \rightarrow A$ $E \rightarrow D$

$A^+ = A$ $A \rightarrow D$

$C \rightarrow A$, $C^+ = CDB$ no A present

$C \rightarrow D$ $C^+ = CBAD$ D is present

Remove $C \rightarrow D$

$C \rightarrow B$

$C^+ = CAD$

B is not present.

$E \rightarrow A$

$E^+ = ED$

$E \rightarrow D$

$E^+ = EAD$

Remove $E \rightarrow D$

$A \rightarrow D$

$C \rightarrow A$

$C \rightarrow B$

$E \rightarrow A$