Identifying Equivalence of FDs

Equivalence set of FDs

- F: { }   G: { }

i. Is F cover G? $G^+ \subseteq F^+$

Following steps are followed to determine whether F covers G or not−
a. Take the functional dependencies of set G into consideration.
b. For each functional dependency $X \rightarrow Y$ of G, find the closure of X using the functional dependencies of set F.
c. If the functional dependencies of set F has determined all those attributes that were determined by the functional dependencies of set G, then it means F covers G.

ii. Is G cover F? $F^+ \subseteq G^+$

iii. Are both equivalent? $G^+ \equiv F^+$

If F1 and F2 are said to be equivalent then all FDs in F1 must be covered by F2 and all FDs in F2 must be covered by F1.

Q. 1 F: {A → B, B → C, C → D}; G: {A → BC, C → D}

i. Is F cover G?

Take closure of L.H.S. attributes' of G from F's FD.

$A^+ = \{A, B, C, D\}$ i.e., A → BC of G will be covered from A^+.

$C^+ = \{C, D\}$ i.e., C → D of G will be covered from C^+.

Yes.

ii. Is G cover F?

Take closure of L.H.S. attributes' of F from G's FDs.

$A^+ = \{A, B, C, D\}$ i.e., A → B of F will be covered from A^+.

$B^+ = \{B\}$

$C^+ = \{C, D\}$ i.e., C → D of F will be covered from C^+.

No. Because B→ C can't be covered.

Q. 2 P: {$A \rightarrow B$, $AB \rightarrow C$, $D \rightarrow ACE$}; Q: {$A \rightarrow BC$, $D \rightarrow AE$}

i. Is P cover Q?

Take closure of L.H.S. attributes' of Q from P's FD.

A^+ = {A, B, C, D, E} i.e., $A \rightarrow BC$ of Q will be covered from A^+.

D^+ = {D, A, E} i.e., $D \rightarrow AE$ of Q will be covered from D^+.

Yes.

ii. Is Q cover P?

Take closure of L.H.S. attributes' of P from Q's FDs.

A^+ = {A, B, C} i.e., $A \rightarrow B$ of P will be covered from A^+.

AB^+ = {A, B, C} i.e., $AB \rightarrow C$ of P will be covered from AB^+.

D^+ = {D, A, E, B, C} i.e., $D \rightarrow ACE$ of P will be covered from D^+.

Yes. Thus, $P \equiv Q$.

Q. 3 $F1 = \{A \rightarrow C, AC \rightarrow D, E \rightarrow AD, E \rightarrow H\}$; $F2 = \{A \rightarrow CD, E \rightarrow AH\}$

i. Is F1 cover F2?

Take closure of L.H.S. attributes' of F2 from F1's FD.

$A^+ = \{A, C, D\}$ i.e., $A \rightarrow CD$ of F2 will be covered from A^+.

$E^+ = \{E, A, D, H, C\}$ i.e., $E \rightarrow AH$ of F2 will be covered from E^+.

Yes.

ii. Is F2 cover F1?

Take closure of L.H.S. attributes' of F1 from F2's FDs.

$A^+ = \{A, C, D\}$ i.e., $A \rightarrow C$ of F1 will be covered from A^+.

$AC^+ = \{A, C, D\}$ i.e., $AC \rightarrow D$ of F1 will be covered from AC^+.

$E^+ = \{D, A, E, H, C\}$ i.e., $E \rightarrow AD$, $E \rightarrow H$ of F1 will be covered from E^+.

Yes.

Thus, $F1 \equiv F2$.

Q. 4 Check the following sets F1 and F2 of FDs for the equivalence.

F1 = {XY → W, Y → Z, WZ → P, WP → QR, Q → X}

F2 = {XY → Q, WX → PZ, X → ZP, Q → ZR}

i. Is F1 cover F2?

Take closure of L.H.S. attributes' of F2 from F1's FD.

$XY^+ = \{X, Y, W, Z, P, Q, R, X\}$ i.e., XY → Q of F2 will be covered from XY^+.

$WX^+ = \{W, X\}$

$X^+ = \{X\}$

$Q^+ = \{Q, X\}$

No. because FDs WX → PZ, X → ZP, Q → ZR of F2 cant be covered from F1.

ii. Is F2 cover F1?

Take closure of L.H.S. attributes' of F1 from F2's FDs.

$XY^+ = \{X, Y, Q, Z, R, P\}$

$Y^+ = \{Y\}$

$WZ^+ = \{W, Z\}$

$WP^+ = \{W, P\}$

$Q^+ = \{Q, Z, R\}$

No. none of the FDs of F1 covered from F2.

Thus, neither F1 covers F2, nor F2 covers F1.