Course Name: **A Level (1st Sem)**

Subject : **Introduction to DBMS**

Topic: **FD – Exercise practices on canonical cover (Part 10)**

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Canonical Cover - Exercise Practices

Q. Suppose a relational schema R(w x y z), and set of functional dependency as following

$$
\begin{aligned}
F : \{ & x \rightarrow w, \\
& wz \rightarrow xy, \\
& y \rightarrow wxz \}
\end{aligned}
$$

Find the canonical cover F_c (Minimal set of functional dependency).

Solution:

Step1: First we will check if there is any extra attribute for each FD at right side:

For this, we will decompose all the FD

$x \rightarrow w$,

$wz \rightarrow x$,

$wz \rightarrow y$,

$y \rightarrow w$,

$y \rightarrow x$,

$y \rightarrow z$

Important: Decomposition is always done at right side of FD. Never try to decompose at left side. It makes FDs invalid.

We can decompose	We can't decompose
$AB \rightarrow CD$	$AB \rightarrow CD$
$AB \rightarrow C$	$A \rightarrow CD$
$AB \rightarrow D$	$B \rightarrow CD$

Now compute

$x^+ = xw$ (using all FDs)

$x^+ = x$ (without using $x \rightarrow w$)

It implies that $x \rightarrow w$ is **essential** because without this FD, x^+ is different.

Like wise

$wz^+ = wzxy$ (using all FDs)

$wz^+ = wzyx$ (without using $wz \rightarrow x$)

It implies that $wz \rightarrow x$ is **not essential** because without this FD, wz^+ is same.

$wz^+ = wz$ (without using $wz \rightarrow y$)

It implies that $wz \rightarrow y$ is **essential** because without this FD, wz^+ is different.

$y^+ = ywxz$ (using all FDs)

$y^+ = yxzw$ (without $y \rightarrow w$)

$y^+ = yz$ (without $y \rightarrow x$)

$y^+ = yxw$ (without $y \rightarrow z$)

Note: Once the non essential FD is identified, then do not include that non essential FD while computing the closure of attributes further. Exclude that FD immediately.

It implies that $y \rightarrow w$ is **not essential** whereas $y \rightarrow x$ and $y \rightarrow z$ are **essential.**

Now FD set (all essential FDs)

$x \rightarrow w$
$wz \rightarrow y$
$y \rightarrow x$
$y \rightarrow z$

Step 2: Now we will check if there is any extra attribute at left side of FD.

For this

$wz \rightarrow y$ (only this FD has more than one attribute at left side, it may only contain extra attribute at left side)

compute $wz^+ = wzyx$
$w^+ = w$
$z^+ = z$

{ If wz^+ and w^+ are same, it implies that z is extra in $wz \rightarrow y$.
Likewise if wz^+ and z^+ are same, it implies that w is extra in $wz \rightarrow y$. }

$wz \rightarrow y$ is **essential** because wz^+ and w+ are different, wz^+ and z+ are different .

Therefore, the minimal set of FD is whereas

F_c : { $\mathbf{x \rightarrow w}$,
$\mathbf{wz \rightarrow y}$,
$\mathbf{y \rightarrow xz}$ }

F : { $x \rightarrow w$,
$wz \rightarrow \mathbf{x}y$,
$y \rightarrow \mathbf{w}xz$ }

x was extraneous.

w was extraneous.

Exercise:

Suppose a relational schema R(P, Q, R, S), and set of functional dependency as following

$$F : \{ P \rightarrow QR,\ Q \rightarrow R,\ P \rightarrow Q,\ PQ \rightarrow R \}$$

Find the canonical cover F_c (Minimal set of functional dependency).