Canonical cover F_c of F

Note: only one attribute right-side of FD.
eg. $A \to C$, which is extraneous,
then right-side of FD is empty.
Such FDs should be deleted.

Ex: $F = \{A \to D,\ A \to C,\ \underbrace{AB \to D,\ AB \to C}_{AB \to CD},\ C \to B\}$

$A \to D$: check D extraneous.

$F' = \{A \to C,\ AB \to CD,\ C \to B\}$

$\boxed{A \to D \overset{?}{\in} F'^+}$

$(A)^+ = A$
$= AC,\ A \to C$
$= ACB,\ C \to B$
$= ACBD,\ AB \to CD$

$A \to D \in F'^+$
$\therefore$ D extraneous

Algorithm: Canonical Cover

$F_c = F$

Repeat

1). Use union rule to replace any dependency in F_c of the form $\alpha_1 \to \beta_1$ and $\alpha_1 \to \beta_2$ with $\alpha_1 \to \beta_1\beta_2$

2). Find a FD $\alpha \to \beta$ in F_c with an extraneous attribute either in α or β.

3). If EA found, delete it form $\alpha \to \beta$ in F_c.

Until (F_c does not change).

EX: $F = \{A \to BC,\ B \to AC,\ C \to AB\}$

Q: Find F_c ?

$$\boxed{\begin{array}{l} \alpha_1 \to \beta_1 \\ \alpha_1 \to \beta_2 \end{array}}$$

Sol: First check left-side of FD is unique.

Next, check for extraneous attribute.

$A \to B$ ✗
$A \to C$ ✓

$A \to BC$

(1). consider $A \to BC$

→ check B: $F' = \{A \to C,\ B \to AC,\ C \to AB\}$

$$\boxed{A \to B \underset{?}{\in} F'^{+}}$$

$(A)^+ = A$?

$= AC$, $A \to C$

$= ACB$, $C \to AB$

$= ACB$, $B \to AC$

$\therefore A \to B \in F'^{+}$

$F_{1c} = \{A \rightarrow C,\ B \rightarrow AC,\ C \rightarrow AB\}$

Note C is not extraneous in $A \rightarrow C$.

(2). Consider $B \rightarrow AC$ from F_{1c}

$\rightarrow$ <u>check A</u> is extraneous

$$F'_{1c} = \{A \rightarrow C,\ B \rightarrow C,\ C \rightarrow AB\}$$

$$B \rightarrow A \overset{?}{\in} F'^{+}_{1c}$$

$$(B)^{+} = B$$
$$= BC,\ B \rightarrow C$$
$$= BCA,\ C \rightarrow AB$$
$$\Rightarrow B \rightarrow A \in F'^{+}_{1c}.$$

$F_{2c} = \{A \rightarrow C,\ B \rightarrow C,\ C \rightarrow AB\}$

$F = \{A \to BC, B \to AC, C \to AB\}$

consider $A \to BC$:

<u>check C:</u> $F' = \{A \to B, B \to AC, C \to AB\}$

$A \to C \overset{?}{\in} F'^+$

$(A)^+ = A$

$= AB, \; A \to B$

$= ABC, \; B \to AC$

$\Rightarrow A \to C \in F'^+$.

$$\boxed{F_{2c} = \{\underline{A} \to C,\ \underline{B \to C},\ C \to AB\}}$$

(3). Consider $C \to AB$ from F_{2c}.

<u>check A</u>: $F'_{2c} = \{A \to C, B \to C, C \to B\}$

$$C \to A \underset{?}{\in} F'^{+}_{2c}$$

$$(C)^+ = C$$
$$= CB \;,\; C \to B$$
$$= CB \;,\; B \to C$$

$$\Rightarrow C \to A \notin F'^{+}_{2c}.$$

<u>check B</u>: $F'_{2c} = \{A \to C, B \to C, C \to A\}$

$$C \to B \underset{?}{\in} F'^{+}_{2c}$$

$$(C)^+ = C$$
$$= CA \;,\; C \to A$$

$$\Rightarrow C \to B \notin F'^{+}_{2c}.$$