Task 1.

a) $\{C\} \Rightarrow \{B\}$

We know that

FC2: $\{C\} \Rightarrow \{A, D\}$

↓ decomposition.

$\{C\} \Rightarrow \{A\}$

+

$\{AE\} \Rightarrow \{BC\}$

↓ Transitivity

$\{C\} \Rightarrow \{B, C\}$

↓ decomposition

$\{C\} \Rightarrow \{B\}$

b) $\{AB\} \Rightarrow \{F\}$

$\{A\} \Rightarrow \{B, C\}$

↓ augmentation

$\{AE\} \Rightarrow \{BCE\}$

↓ decomposition

$\{AE\} \Rightarrow \{C\}$ $\{AE\} \Rightarrow \{E\}$

$\{C\} \Rightarrow \{AD\}$

↓ transitivity

$\{AE\} \Rightarrow \{AD\}$

+ Union → $\{AB\} \Rightarrow \{ADE\}$

↓ decomposition

$\{AB\} \Rightarrow \{DE\}$

+

$\{DE\} \Rightarrow \{F\}$

↓ transitivity

$\{AE\} \Rightarrow \{F\}$.

task2

a) $X = \{A\}$

$X^+ = \{A\}$

FD1: $\{A\} \Rightarrow \{BC\}$

$Y = \{A\}$, $Z = \{BC\} \Rightarrow Y$ in X^+, Z not in X^+

$X^+ = \{A\} \cup \{BC\} \Rightarrow \{ABC\}$

FD2: $Y = \{C\}$, $Z = \{AD\}$

Y in X^+, Z not in X^+

$X^+ = \{ABC\} \cup \{AD\} \rightarrow \{ABCD\}$.

b) $X = \{CE\}$

$X^+ = \{CE\}$

FD2: $Y = \{C\}$, $Z = \{AD\}$

Y in X^+, Z not in X^+

So $X^+ = \{CE\} \cup \{AD\} \rightarrow \{ACDE\}$.

FD3: $\{DE\} \Rightarrow \{F\}$

$Y = \{DE\}$, $Z = \{F\}$.

Y in X^+, Z not in X^+

So $X^+ = \{ACDE\} \cup \{F\} \rightarrow \{ACDEF\}$

According task1. we got a brand new FD, namely $\{C\} \Rightarrow \{B\}$. $Y = \{C\}$ $Z = \{B\}$

Y in X^+, Z not in $\Rightarrow X^+$ $X^+ = \{ACDEF\} \cup \{B\} = \{ABCDEF\}$.

task3

a) Determine the candidate keys (cks) for R

According to trick one, A should be kept

According to trick two, & A

So cks should be {AB} {AD} {AI}

b) {F}→{F}, {D}→{B} violate the condition

c) R(ABCDEF)

{F}→{F} violate the BCNF condition

R1 {ABCDE} R2 {EF}

FD: {AB}→{CD}

{D}→{B}

cks: {AB} {AD}

We can see {D}→{B} violate the BCNF condition

R4 {ACDE} R5 {DB}

FD: {A}→{CE} FD: {D}→{B} ck: {D}

ck: {AD}

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task4

R(A, B, C, D, E) B→E

ck: {BC}

FD: {C}→{D} violate the BCNF condition.

R2 {ABCI} R3 {CD}

FD: {BC}→{AE} FD: {C}→{D} ck: C

ck: {BC}