

① $R(\underline{A} \underline{B} \underline{C} \underline{D} \underline{E})$

$F(A \rightarrow B; BC \rightarrow E; ED \rightarrow A)$

B	JB	J	R
C	A		
D	E	1	

$$\{CD\}^+ = C, D$$

$$\{CDA\}^+ = (C, D, A, B, E) \quad \boxed{PK}, CK$$

$$\{CDB\}^+ = (C, D, B, E, A) \quad CK$$

$$\{CDE\}^+ = (C, D, E, A, B) \quad CK$$

Prime
~~PRIMARY~~ ATTRIBUTUM: $AB CDE$

1NF ✓

2NF ✓ & Primary attr.

3NF ✓ - " -

BCNF

$R_1(\underline{A} \underline{B})$

$F_1 = \{A \rightarrow B\}$ BCNF ✓

$R_2(\underline{A}, \underline{C}, \underline{D}, \underline{E})$ $[A \rightarrow B \quad BC \rightarrow E \quad AC \rightarrow E]$

$F_2 \{AC \rightarrow E, ED \rightarrow A\}$

1NF ✓
2NF ✓
3NF ✓
BCNF

B	JB	J	R
C	A		
D	E		

$$\{ACD\}^+ = A, C, D, E \in \boxed{PK}, CK$$

$$\{ECD\}^+ = E, C, D, A \quad CK$$

Prime
~~PRIMARY~~ ATTR: $ACDE$

$R_{21}(\underline{A} \underline{C} \underline{E})$

$F_{21} \{AC \rightarrow E\}$ BCNF ✓

$R_{22}(\underline{A} \underline{C} \underline{D})$

$F_{22} \{ACD \rightarrow A\}$ Trivialis

$[AC \rightarrow E \quad ED \rightarrow A]$ BCNF ✓

(2) $R = (B, I, \underline{BE}, \underline{R}, D, O)$

$F = \{B \rightarrow I; R \rightarrow O; \underline{BE}R \rightarrow D; \underline{BE} \rightarrow B\}$ 1NF✓
2NF×
2

B	I	O	D
B	I	O	D
BE			

$\{RBE\}^+ = BE, R, D, O, B, I$ CK, PK

Prime
~~Primary~~ ATTR: R, BE

$R_1(\underline{R}, O)$

$F_1 = \{R \rightarrow O\}$ BCNF

$R_2(B, I, \underline{BE}, R, D)$

$F_2 = \{B \rightarrow I; \underline{BE}R \rightarrow D; \underline{BE} \rightarrow B\}$ 1NF✓
2NF×

$\{RBE\}^+ = R, BE, D, B, I$

Prime
~~Primary~~ ATTR: R; BE

$R_{21}(\underline{BE}, B)$

$F_{21}(\underline{BE} \rightarrow B)$ BCNF✓

$R_{22}(I, \underline{BE}; \underline{R}, D)$ ~~Primary~~

$F_{22} \{ \underline{BE} \rightarrow I; \underline{BE}R \rightarrow D \}$

$\{BER\}^+ = \underline{BE}, R, D, I$ Prime ATTR BE, R

$R_{221}(\underline{BE}; I)$

$F_{221} \{ \underline{BE} \rightarrow I \}$ BCNF✓

$R_{222}(\underline{BE}, R, D)$

$F_{222} \{ \underline{BE}R \rightarrow D \}$ BCNF✓

③ $R(A, B, C, D, E)$

$F\{A \rightarrow BC; ACD \rightarrow E; B \rightarrow D; C \rightarrow D; AB \rightarrow E; E \rightarrow BC\}$

B	AB	BC	CD
A	B	C	D
		E	

1NF ✓

2NF ✓

3NF ✗

$\{A\}^+ = A; B; C; D, E \checkmark$ CK, PK

Prime attr: A

$R_1(\underline{B}; D)$

$F_1 = \{B \rightarrow D\}$ BCNF ✓

$R_2\{A, B, C, E\}$

$B \rightarrow D$

$F_2 = \{A \rightarrow BC; ACB \rightarrow E; AB \rightarrow E; E \rightarrow BC\}$

B	AB	BC	CD
A	B	C	D
		E	

1NF ✓

2NF ✓

3NF ✗

$\{A\}^+ = A; B; C; E \checkmark$

Prime attr: A

$R_{2.1} E \rightarrow B \{E; B, C\}$

$F_{2.1} \{E \rightarrow BC\}$ BCNF ✓

$R_{2.2} \{A, E\}$

$F_{2.2} \{AE \rightarrow E\}$

~~$AE \rightarrow E$~~

$A \rightarrow E \{E \rightarrow BC \text{ Transd } C\}$

$ACB \rightarrow E$

BCNF ✓

④ $R = \{B, O, \underline{I}, \underline{S}, Q, D\}$

$F = \{I \rightarrow B, IS \rightarrow Q; B \rightarrow O; S \rightarrow D\}$

1NF ✓
2NF ✗

B	O	I	Q
1	B	Q	
S		O	D

$\{IS\}^+ = \{IS, B, Q, O, D\}$ CK = PK
prime attr: IS

$R_1 (\underline{I}; B)$

$F_1 \{I \rightarrow B\}$ BCNF ✓

$R_2 (\underline{I}, O, \underline{S}, Q, D)$

$F_2 \{IS \rightarrow Q; I \rightarrow O; S \rightarrow D\}$

1NF ✓
2NF ✗

Kules Zavislosti LD fent: PK = CK = SI prime attr: IS

$R_{21} (\underline{I}; O)$

$F_{21} \{I \rightarrow O\}$ BCNF ✓

$R_{22} (\underline{I}, \underline{S}, Q, D)$

$F_{22} \{IS \rightarrow Q; S \rightarrow D\}$

1NF ✓
2NF ✗

$R_{221} \{\underline{S}, D\}$

$F_{221} \{S \rightarrow D\}$ BCNF ✓

$R_{222} \{\underline{IS}; Q\}$

$F_{222} \{IS \rightarrow Q\}$ BCNF