

wed solutions

Q1b

$A \rightarrow B$ holds

$B \rightarrow A$ does not hold

$A \rightarrow C$ does not hold

$C \rightarrow B$ does not hold

Q2

a. $A^+ = \{A, B\}$

b. $ACEG^+ = \{A, B, C, E, F, G\}$

c. $BD^+ = \{A, B, C, D, E, F, G\}$

Q3

a. $ACD^+ = \{A, B, C, D, E\}$

$CDE^+ = \{A, B, C, D, E\}$

$BCD^+ = \{A, B, C, D, E\}$

b. not in 3NF

c. not in BCNF

Q4

i. candidate key: B

not BCNF: $C \rightarrow D$ and $C \rightarrow A$ does not contain key on LHS

not 3NF: $C \rightarrow D$ and $C \rightarrow A$ does not contain partial key on RHS

.i. candidate key: BD

not BCNF: $B \rightarrow C$ and $D \rightarrow A$ does not have key on LHS

not 3NF: neither RHS contains part of key

.i. candidate key: ABC,BCD

not BCNF: $D \rightarrow A$ does not have key on LHS

in 3NF

.v. candidate key: A

not BCNF: $BC \rightarrow D$ does not have key on LHS

not 3NF: $BC \rightarrow D$ does not have part of key on RHS

v. candidate key: AB, AD, BC, CD

not BCNF: if we choose key AB, $C \rightarrow A$ and $D \rightarrow B$ does not have key on LHS

in 3NF for AB

.i. candidate key: A

in BCNF

in 3NF

Q5

Team(name, captain): $\text{name} \rightarrow \text{captain}$

Player(name, teamPlayedFor): $\text{name} \rightarrow \text{teamPlayedFor}$

Fan(name, address): $\text{name} \rightarrow \text{address}$

TeamColours(teamName, colour): no non-trivial fd

yes in BCNF because every single relation is in BCNF because the fds in those relations are in BCNF

Q7

$R(A, B, C, D)$

i. candidate key: B

BCNF

reduced minimal cover = $\{C \rightarrow AD, B \rightarrow C\}$

ABCD

choose fd $\{C \rightarrow AD\}$ and split tables

CAD $\{C \rightarrow AD\}$ key: $C \Rightarrow$ is in BCNF

BC $\{B \rightarrow C\}$ key: $B \Rightarrow$ is in BCNF

result

CAD, BC

3NF

minimal cover = $\{C \rightarrow D, C \rightarrow A, B \rightarrow C\}$

reduced minimal cover = $\{C \rightarrow AD, B \rightarrow C\}$

split table

CAD $\{C \rightarrow AD\}$

BC $\{B \rightarrow C\}$

result

CAD, BC

.i. candidate key: BD

BCNF

reduced minimal cover = $\{B \rightarrow C, D \rightarrow A\}$

ABCD

choose fd $\{B \rightarrow C\}$ and split tables

BC $\{B \rightarrow C\}$ key: $B \Rightarrow$ is in BCNF

ABD $\{D \rightarrow A\}$ key: BD

choose fd $\{D \rightarrow A\}$ and split tables

AD $\{D \rightarrow A\}$ key: $D \Rightarrow$ is in BCNF

BD $\{\}$ key: $BD \Rightarrow$ in BCNF

result

BC, AD, BD

3NF

minimal cover = $\{B \rightarrow C, D \rightarrow A\}$

reduced minimal cover = $\{B \rightarrow C, D \rightarrow A\}$

split table

BC $\{B \rightarrow C\}$

AD $\{D \rightarrow A\}$

add table with candidate key

BD

result

BC, AD, BD

i. candidate key: ABC,BCD

BCNF

ABCD

reduced minimal cover = $\{ABC \rightarrow D, D \rightarrow A\}$

choose fd $\{D \rightarrow A\}$ and split tables

AD $\{D \rightarrow A\}$ key: $D \Rightarrow$ in BCNF

BCD $\{\}$ key: $BCD \Rightarrow$ in BCNF

result

AD, BCD

ABCD

reduced minimal cover = $\{ABC \rightarrow D, D \rightarrow A\}$

choose fd $\{ABC \rightarrow D\}$ and split tables

ABCD $\{ABC \rightarrow D, D \rightarrow A\}$ key: ABC

ABC $\{\}$ key: $ABC \Rightarrow$ in BCNF

choose fd $\{D \rightarrow A\}$ and split tables

AD $\{D \rightarrow A\}$ key: $D \Rightarrow$ in BCNF

BCD $\{\}$ key: $BCD \Rightarrow$ in BCNF

result

ABC, AD, BCD

.v. candidate key: A

3NF

minimal cover = $\{A \rightarrow B, BC \rightarrow D, A \rightarrow C\}$

reduced minimal cover = $\{A \rightarrow BC, BC \rightarrow D\}$

split table

ABC $\{A \rightarrow BC\}$

BCD $\{BC \rightarrow D\}$

result

ABC, BCD