

thu solutions

Q1b

$A \rightarrow B$ holds

$B \rightarrow A$ not hold

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

BCD

ACD

b. not in third normal form

c. not in BCNF

Q4

a. candidate key: B

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

not 3NF: $C \rightarrow D$ and $C \rightarrow A$ does not have part of key on RHS

b. candidate key: BD

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

not 3NF: $B \rightarrow C$ and $D \rightarrow A$ does not have part of key RHS

c. candidate key: ABC, BCD

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

in 3NF: for key ABC, $ABC \rightarrow D$ is ok because LHS is key, $D \rightarrow A$ is ok because RHS is part of key

d. 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

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

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

in 3NF for key AB

f. candidate key: A

in BCNF

in 3NF

Q5

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

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

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

Q7

a. candidate key: B

BCNF Normalisation

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

ABCD

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

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

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

result

CAD, BC

3NF Normalisation

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

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

split into tables

CAD $\{C \rightarrow AD\}$ key: C

BC $\{B \rightarrow C\}$ key: B

result

CAD, BC

b. candidate key: BD

BCNF Normalisation

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

ABCD

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

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

BCD $\{B \rightarrow C\}$ key: BD

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

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

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

result

AD, BC, BD

3NF Normalisation

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

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

split into tables

BC $\{B \rightarrow C\}$ key: B

AD $\{D \rightarrow A\}$ key: D

no table has key BD so add table

BD $\{\}$ key: BD

result

BC, AD, BD

c. candidate key: ABC, BCD

BCNF Normalisation

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

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

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

result

ABC, AD, BCD

3NF Normalisation

!!! I MADE A MISTAKE HERE. THIS IS NOT NEEDED BECAUSE IT WAS ALREADY 3NF

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

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

split tables

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

DA $\{D \rightarrow A\}$ key: D

result

ABCD, AD

d. candidate key: A

BCNF Normalisation

3NF Normalisation

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

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

split tables

ABC $\{A \rightarrow BC\}$ key: A

BCD $\{BC \rightarrow D\}$ key: BC

result

ABC, BCD

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

BCNF Normalisation