solutions

Q1b

A → B holds

B → A does not hold

A → C does not hold

C → 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 → D and C → A does not contain key on LHS

   not 3NF: C → D and C → A does not contain partial key on RHS

ii. candidate key: BD

   not BCNF: B → C and D → A does not have key on LHS

not 3NF: neither RHS contains part of key

iv. candidate key: ABC,BCD

not BCNF: D → A does not have key on LHS

in 3NF

v. candidate key: A

not BCNF: BC → D does not have key on LHS

not 3NF: BC → D does not have part of key on RHS

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

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

in 3NF for AB

vi. candidate key: A

in BCNF

in 3NF

Q5

Team(<u>name</u>, captain): name → captain

Player(<u>name</u>, teamPlayedFor): name → teamPlayedFor

Fan(<u>name</u>, address): name → address

TeamColours(<u>teamName</u>, <u>colour</u>): no non-trivial fd

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

Q7

R(A,B,C,D)

i. candidate key: B

   BCNF

   reduced minimal cover = {C → AD, B → C}

   ABCD

   choose fd {C → AD} and split tables

   CAD {C → AD} key: C ⇒ is in BCNF

   BC {B → C} key: B ⇒ is in BCNF

   result

   CAD, BC

   3NF

   minimal cover = {C → D, C → A, B → C}

   reduced minimal cover = {C → AD, B → C}

   split table

   CAD {C → AD}

   BC {B → C}

   result

   CAD, BC

i. candidate key: BD

   BCNF

reduced minimal cover = {B → C, D → A}

ABCD

choose fd {B → C} and split tables

BC {B → C} key: B ⇒ is in BCNF

ABD {D → A} key: BD

choose fd {D → A} and split tables

AD {D → A} key: D ⇒ is in BCNF

BD {} key: BD ⇒ in BCNF

result

BC, AD, BD

3NF

minimal cover = {B → C, D → A}

reduced minimal cover = {B → C, D → A}

split table

BC {B → C}

AD {D → A}

add table with candidate key

BD

result

BC, AD, BD

i. candidate key: ABC,BCD

ABCD

reduced minimal cover = {ABC → D, D → A}

choose fd {D → A} and split tables

AD {D → A} key: D ⇒ in BCNF

BCD {} key: BCD ⇒ in BCNF

result

AD, BCD

ABCD

reduced minimal cover = {ABC → D, D → A}

choose fd {ABC → D} and split tables

ABCD {ABC → D, D → A} key: ABC

ABC {} key: ABC ⇒ in BCNF

choose fd {D → A} and split tables

AD {D → A} key: D ⇒ in BCNF

BCD {} key: BCD ⇒ in BCNF

result

ABC, AD, BCD

v. candidate key: A

not BCNF: BC → D does not have key on LHS

3NF

minimal cover = {A → B, BC → D, A → C}

reduced minimal cover = {A → BC, BC → D}

split table

ABC {A → BC}

BCD {BC → D}

result

ABC, BCD

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

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

in 3NF for AB

vi. candidate key: A

in BCNF

in 3NF