Mahlet Zemedie

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Homework4

Database Design

A. R (A, B, C, D, E)
F = {BC → D, D → E, A → C, B → C}

i. $(AB)^+$: - B→C, BC→D, D→E = {A, B, C, D, E)

ii. Yes, since BC → D and D → E, then BC → E in F^+ ……transitivity

iii.

Step1.

1. $(A)^+$: A→C = {A, C}
2. $(B)^+$: B→C = {B, C, D, E}
3. $(C)^+$: C = {C}
4. $(D)^+$: D→E = {D, E}
5. $(E)^+$: E = {E}
   - There is no candidate key in a single closure because none of their closure contains all the attributes in R

Step2

Calculating the closures of 2 attributes at once we get: AB+, AC+, AD+, AE+, BC+, BD+, BE+, CD+, CE+ DE+

1. $(AB)^+$ =A→C, B→C, BC→D, D→E = (ABCDE)……AB is a superkey and hence it is also a candidate key
2. $(AC)^+$= (AC)
3. $(AD)^+$=(ACDE)….it is not a superkey
4. $(AE)^+$=(ACE)…it is not a superkey
5. $(BC)^+$=(BCDE)… it is not a superkey
6. $(BD)^+$=(BCDE)… it is not a superkey
7. $(BE)^+$=(BCDE)… it is not a superkey
8. $(CD)^+$=(CDE)…it is not a superkey

9. $(CE)^+$=(CE)…it is not a superkey
10. $(DE)^+$=(DE)…it is not a superkey

Step3

Checking with the three attributes if they form a superkey, we need to remove any attribute that contain AB

1. $(ACD)^+$=(ACDE)
2. $(ACE)^+$=(ACE)
3. $(ADE)^+$=(ACDE)
4. $(BCD)^+$=(BCDE)
5. $(BCE)^+$=(BCDE)
6. $(BDE)^+$ =(BCDE)
7. $(CDE)^+$=(CDE)
    - All of them doesn't form a super key

Step4

Checking with the four attributes if they form a superkey, we need to remove any attribute that contain AB

1. $(ACDE)^+$=(ACDE)
2. $(BCDE)^+$=(BCDE)
    - All of them doesn't form a super key

➢ We do not need to check with five attributes because AB is subset of ABCDE and AB is the candidate key.

B. R (A, B, C, D, E)
F = {AB → D, E → C}

1. R is **not** in BCNF because the condition to be in BCNF is α→β, α should be the superkey in all the dependencies. In our function D→C, D is neither a superkey of R or trival this is D should be a subset of AB and C should be a subset of D. Therefore, R is not in BCNF.
2. R is **not** in 3NF, as D is also not contained in any candidate key of R as the only candidate key is AB.

C. R (A, B, C, D)
F = {A → B, BC → D}

1. The only candidate key is AC.
2. R is **not** in 3NF because of A → B where B is not part of any key neither A is primary key which violates the principle of 3NF because in 3NF for X → F is valid when either X is super key or attribute F is part of any key but none of them is happening in A -> B, neither A is superkey nor B is part of any key.

D. Player (ID, Name, Birthday, Address, Email, PhoneNumber, PlayPos)

1. ID→ (Name, Birthday, Address, Email, PhoneNumber, PlayPos)

Name→ (ID, Birthday, Address, Email, PhoneNumber, PlayPos)

2.The candidate keys are

{ID}

{Name}