Assignment 3

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Contents

Q1. Given the relation r(A,B,C) and the functional dependencies A→B and B→C, give a lossless join dependency preserving decomposition of R into BCNF

Answer:
R_1(A,B)
R_2(B,C)

Q2. Consider the following functional dependencies for relation schema:
$R = (A, B, C, D, E) : A \to BC, CD \to E, B \to D, E \to A.$
Compute A^+

Answer: A^+={A,B,C,D,E}

Q3. Consider the following set F of functional dependencies on the relation schema:
$r(A, B, C, D, E, F)$
$A \to BCD, BC \to DE, B \to D, D \to A$)

1. Compute B^+.

Answer: B^+={ABCDE}

2. Prove (using Armstrong's axioms) that AF is a superkey.

1. A → BCD (Given)
2. BC → DE (Given)
3. BCD → DE (Augmentation 2 & D)
4. BCD → CDE (Augmentation 3 & C)
5. BCD → BCDE (Augmentation 4 & B)
6. A → BCDE (Transitivity 1 & 5)
7. AF → BCDEF (Augmentation 6 & F)
0. AF^+ → ABCDEF (Augmentation 7 & A)

3. Compute a canonical cover for the above set fo functional dependencies F; give each step of your derivation with an explanation.

B→D is extraneous, so in the case A→BCD, so you could change it to A→BC.

D is also extraneous in BC→DE because B→D, so that would change to BC→E

4. Give a 3NF decomposition of r based on the canonical cover.

R_0(A,B,C) {A→ BC}
R_1(B,D,E) {B → DE}
R_2(A,D) {D → A}
R_3(A,F) {}

5. Give a BCNF decomposition of r using the original set of functional dependencies.

R_0(A,B,C) {A→ BC}
R_1(B,D,E) {B → DE}
R_2(A,D) {D → A}
R_3(A,F) {}

Q4. Given the following functional dependencies:
$A \rightarrow BCD, CD \rightarrow E, B \rightarrow D, E \rightarrow A, AD \rightarrow E$

1. Find a canonical cover of the above set of dependencies (you must explain how you arrived at the answer).

AD→E is not needed as this way is proven through transitivity with A→BCD and CD→E.

D is extraneous in A→BCD as B→D. Therefore, you will get A→BC instead.

2. Normalize the relation to 3nF (again, you must explain how you arrived at the answer).

R_0(A,B,C) {A→BC}
R_1(B,D) {B→ D}

R_2(A,E) {E→A}
R_3(C,D,E) {C,D→E}