Schema Refinement Tutorial (Part II)

Exercise

- Consider a relation R(A,B,C,D,E,F). It has FDs: AC → F, B → D, AB → CEF, ACE → B, and AEF → BC

1. Find all candidate keys of R
2. Is relation R in the 3NF? If not, give an example of FD that violates the 3NF condition and explain why.
3. Is relation R in BCNF? If not, give an example FD that violates the BCNF condition and explain why.
4. If R does not satisfy BCNF, how to decompose R into BCNF tables?

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   - R is not in 3NF (B->D violates 3NF)
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Final step

- All candidate keys of R: AB, ACE, AEF
- FDs that violate BCNF: AC->F, B->D
- BCNF decomposition

- Final answer: ABCE, ACF, BD

Dependency-preserving Decomposition into 3NF

Consider relation R with FDs F. Let F' be the minimal cover of F. Let R1…Rn be a lossless-join decomposition of R (can be obtained by BCNF decomposition).

- Step 1: Identify the dependencies N in F' that is not preserved by {R1, …Rn}
- Step 2: For each X-> A in N, create a relation schema XA and add it to {R1…Rn}

- It guarantees lossless-join, dependency-preserving decomposition!!!

3NF Decompostion Exercise

Consider a relation R(ABCDE), and its FDs F={ABCD→E,E→D,A→B,AC→D}.

Question: decompose R into 3NF tables.

- **Step 1:** Find keys
- **Step 2**: find minimal cover G of F
- **Step 3**: BCNF decomposition R(<u>AC</u>BDE) in BCNF according to G
- **Step 4**: Dependency-preserving decomposition:

  /* If X→Y is not preserved, add (XY) into the decomposition */

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- **Step 1:** Find keys

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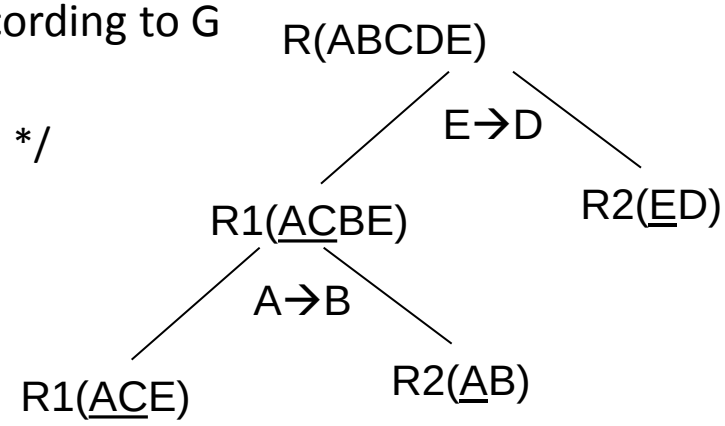

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BCNF decomposition: ACE, AB, DE

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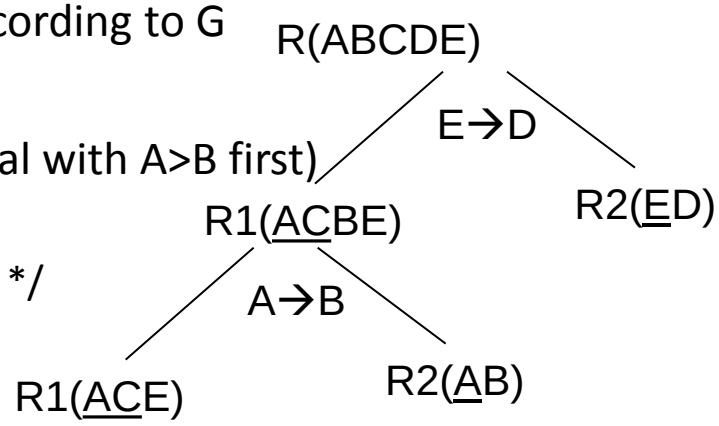

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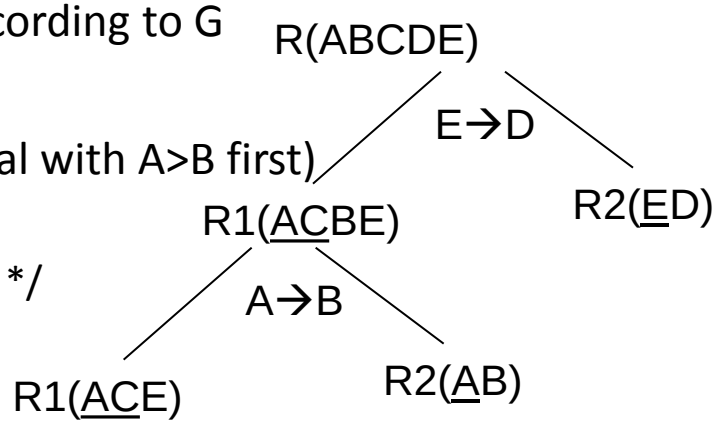
  There is no new table added by Step 4



3NF decomposition (same as BCNF decomposition): ACE, AB, DE