CS2102 Database Systems

Semester 1 2019/2020

Tutorial 08

Quiz

1. Given schema $R(A, B, C, D)$ with FDs $F = \{A \rightarrow BCD,\ C \rightarrow D\}$, find all the completely non-trivial FDs in the following FD projections:
   a) F_{ABC}
   b) F_{CD}
   c) F_{AC}
   d) F_{ABD}
   e) F_{BCD}
   f) F_{AB}
2. Given schema $R(A, B, C, D)$ with FDs $F = \{A \rightarrow BCD,\ C \rightarrow D\}$, determine whether or not the following decompositions are lossless-join decomposition.
   a) Decomposition $\{R_1(A, B, C),\ R_2(C, D)\}$
   b) Decomposition $\{R_1(A, C),\ R_2(A, B, D)\}$
   c) Decomposition $\{R_1(B, C, D),\ R_2(A, B)\}$
3. Given schema $R(A, B, C, D)$ with FDs $F = \{A \rightarrow BCD,\ C \rightarrow D\}$, determine whether or not the following decompositions are dependency-preserving decomposition.
   a) Decomposition $\{R_1(A, B, C),\ R_2(C, D)\}$
   b) Decomposition $\{R_1(A, C),\ R_2(A, B, D)\}$
   c) Decomposition $\{R_1(B, C, D),\ R_2(A, B)\}$
4. Is there a dependency-preserving decomposition that is not a lossless-join decomposition? If yes, give an example. If no, explain.

Tutorial Questions *[Discussion: 5(ab), 5(cd), 5(ef), 6(ab), 6(cd), 6(ef), 7(a), 7(b)]*

5. Given schema $R(A, B, C, D, E)$ with FDs $F = \{AB \rightarrow C,\ AC \rightarrow D,\ E \rightarrow ABCD\}$ and decomposition $\delta = \{R_1(A, B, C),\ R_2(A, B, E),\ R_3(A, C, D)\}$.
   a) Is δ a lossless-join decomposition? Explain.
   b) Is δ a dependency-preserving decomposition? Explain.
   c) Is R in BCNF? Explain.
   d) Is δ in BCNF? Explain.
   e) Is R in 3NF? Explain.
   f) Is δ in 3NF? Explain.

6. Given schema $R(A, B, C, D, E)$ with FDs $F = \{A \rightarrow E,\ AB \rightarrow D,\ CD \rightarrow AE,\ E \rightarrow B,\ E \rightarrow D\}$ and decomposition $\delta = \{R_1(B, D, E),\ R_2(A, C, E)\}$.
   a) Is δ a lossless-join decomposition? Explain.
   b) Is δ a dependency-preserving decomposition? Explain.
   c) Is R in BCNF? Explain.
   d) Is δ in BCNF? Explain.
   e) Is R in 3NF? Explain.
   f) Is δ in 3NF? Explain.

7. Given schema $R(A, B, C, D, E)$ with FDs $F = \{AB \rightarrow CDE,\ AC \rightarrow BDE,\ B \rightarrow D,\ C \rightarrow B,\ C \rightarrow D,\ B \rightarrow E\}$.
   a) Find a lossless-join BCNF decomposition of R. Is your BCNF decomposition dependency-preserving?
   b) Find a lossless-join and dependency-preserving 3NF decomposition of R.