

Jonathon Doretti

CSC 355 401T

Database Systems

Assignment 5

1a)

$\{A\}^+=\{A\}$ $\{B\}^+=\{B,D\}$ $\{C\}^+=\{C,A\}$ $\{D\}^+=\{D\}$
 $\{A,B\}^+=\{A,B,D\}$ $\{A,C\}^+=\{A,C\}$ $\{A,D\}^+=\{A,D,C\}$
 $\{B,C\}^+=\{B,C,A,D\}$ $\{B,D\}^+=\{B,D\}$
 $\{C,D\}^+=\{C,D,A\}$
 $\{A,B,C\}^+=\{A,B,C,D\}$ $\{A,B,D\}^+=\{A,B,D,C\}$ $\{A,C,D\}^+=\{A,C,D\}$
 $\{B,C,D\}^+=\{B,C,D,A\}$
 $\{A,B,C,D\}^+=\{A,B,C,D\}$

1b)

$\{A,B\}$ $\{B,C\}$

1c)

$\{A,B\}$ $\{B,C\}$ $\{A,B,C\}$ $\{A,B,D\}$ $\{B,C,D\}$ $\{A,B,C,D\}$

1d)

N, R is not in BCNF because $\{A\}^+=\{A\}$.

2a)

Split R into $R_1 = \text{DoctorID, DoctorName, DoctorArea, Office}$
and $R_2 = \text{ConsultationCode, DoctorID, PatientID, PatientName}$

Compute the restrictions F_1 of F for R_1 and F_2 of F for R_2 :

$F_1 : \text{DoctorArea} \rightarrow \text{Office};$
 $\text{DoctorID} \rightarrow \text{DoctorName, DoctorArea}$

$F_2 : \text{PatientID} \rightarrow \text{PatientName};$
 $\text{ConsultationCode} \rightarrow \text{DoctorID, PatientID, DoctorID}$
 $\text{PatientID} \rightarrow \text{ConsultationCode}$

Decompose $R_1(\text{DoctorID, DoctorName, DoctorArea, Office})$ with dependencies:

$\text{DoctorArea} \rightarrow \text{Office};$
 $\text{DoctorID} \rightarrow \text{DoctorName, DoctorArea}$

Split R_1 into $R_{1.1} = \text{DoctorArea, Office}$
and $R_{1.2} = \text{DoctorID, DoctorName, DoctorArea}$

Compute the restrictions F1.1 of F for R1.1 and F1.2 of F for R1.2

F1.1 : DoctorArea→Office,

F1.2 : DoctorID→DoctorName, DoctorArea

Decompose R1.1(DoctorArea, Office)

with dependencies: DoctorArea→Office

DoctorArea, Office it is in BCNF

Decompose R12(DoctorID, DoctorName, DoctorArea)

with dependencies: DoctorID→DoctorName, DoctorArea

DoctorID, DoctorName, DoctorArea it is in BCNF

Decompose R2(ConsultationCode, DoctorID, PatientID, PatientName) with dependencies:

PatientID→PatientName

ConsultationCode→DoctorID, PatientID

DoctorID, PatientID→ConsultationCode

Split R2 into R2.1 = PatientID, F and R2.2 = ConsultationCode, DoctorID, PatientID

Compute the restrictions F2.1 of F for R2.1 and F2.2 of F for R2.2

F2.1 : PatientID→PatientName

F2.2 : ConsultationCode→DoctorID, PatientID

DoctorID, PatientID→ConsultationCode

Decompose R2.1(PatientID, PatientName) with dependencies:

PatientID→PatientName

PatientID, PatientName it is in BCNF

Decompose R2.2(ConsultationCode, DoctorID, PatientID) with dependencies:

ConsultationCode → DoctorID, PatientID

DoctorID, PatientID→ConsultationCode

ConsultationCode, DoctorID, PatientID it is in BCNF

2b)

No because DoctorID → DoctorName, DoctorArea, Office does not have a superkey or any prime attributes.

3a)

R1 (A, B) - $A \rightarrow B$;

R2 (B, C, D) - $B \rightarrow C$ $D \rightarrow C$

R3 (D, E) - $E \rightarrow D$

3b)

No, because the union of the projections is not equivalent to F; for example, $\{E\}^+ \neq \{E, D, C\}$.

3c)

R1(A,B) R2(B, C, D) R3(D, E)

R1(A1, A2) R2(A2, A3, A4) R4(A4, A5)

Changes in -- highlight

Matrix #1	A1	A2	A3	A4	A5
R1	B11	B12	B13	B14	B15
R2	B21	B22	B23	B24	B25
R3	B31	B32	B33	B34	B35

#2 - Changed all cells correlated to row R1

Matrix #2	A1	A2	A3	A4	A5
R1	A1	A2	B13	B14	B15
R2	B21	B22	B23	B24	B25
R3	B31	B32	B33	B34	B35

#3 - Changed all cells correlated to row R2

Matrix #3	A1	A2	A3	A4	A5
R1	A1	A2	B13	B14	B15
R2	B21	A2	A3	A4	B25
R3	B31	B32	B33	B34	B35

#4 - Changed all cells correlated to row R3

Matrix #4	A1	A2	A3	A4	A5
R1	A1	A2	B13	B14	B15
R2	B21	A2	A3	A4	B25
R3	B31	B32	B33	A4	A5

#5 - Apply functional dependency of R2 to R1: $A2 \rightarrow A3, A4$

Matrix #5	A1	A2	A3	A4	A5
R1	A1	A2	A3	A4	B15
R2	B21	A2	A3	A4	B25
R3	B31	B32	B33	A4	A5

#6 - Apply functional dependencies of A5 in R3: $A5 \rightarrow A3, A4$

Matrix #6	A1	A2	A3	A4	A5
R1	A1	A2	A3	A4	B15
R2	B21	A2	A3	A4	B25
R3	B31	B32	A3	A4	A5

Answer for 3c: All functional dependencies have been applied and there is no row filled with A's in the matrix - therefore, it does not have the lossless join property.