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 R1 = DoctorID, DoctorName, DoctorArea, Office

and R2 = ConsultationCode, DoctorID, PatientID, PatientName

Compute the restrictions F1 of F for R1 and F2 of F for R2:

F1 : DoctorArea→Office;

DoctorID→DoctorName, DoctorArea

F2 : PatientID→PatientName;

ConsultationCode→DoctorID, PatientID, DoctorID

PatientID→ConsultationCode

Decompose R1(DoctorID, DoctorName, DoctorArea, Office) with dependencies:

DoctorArea→Office;

DoctorID→DoctorName, DoctorArea

Split R1 into R1.1 = DoctorArea, Office

and R1.2 = 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 → B;

R2 (B, C, D) – B → C D → C

R3 (D, E) – E → D

3b)

No, because the union of the projections is not equivalent to F; for example, {E}+= {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 → 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 → 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.