Database Homework 6

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8.1

$$
\begin{aligned}
&\because r_1 \cap r_2 = A \\
&\text{Calculate } A^+ \text{ As follows:} \\
&Let A^+ = A, \because A \to BC, A^+ = ABC; \\
&\because B \to D, A^+ = ABCD \\
&\therefore \text{A is a super key of r.} \\
&\therefore \text{The decomposition is lossless.}
\end{aligned} \tag{1}
$$

8.2

The functional dependencies are as follows:

$$
A \to B,\ C \to B. \tag{2}
$$

8.6

$$
\begin{aligned}
&\text{Compute attribute closure for A,B,C,D,E:} \\
&A^+ = \{ABCDE\} \\
&B^+ = \{B\} \\
&C^+ = \{C\} \\
&D^+ = \{D\} \\
&E^+ = \{ABCDE\} \\
&\text{And compute the attribute closure for BC and CD} \\
&BC^+ = \{ABCDE\} \\
&CD^+ = \{ABCDE\} \\
&\therefore F^+ = \{B \to B, C \to C, D \to D, \\
&A* \to \delta, E* \to \delta, BC* \to \delta, CD* \to \delta\} \\
&\text{Where } \delta \text{ is all the subset of } \{\text{A,B,C,D,E}\}, \\
&\text{and * denotes any attribute combination.} \\
&\text{The candidate keys are A, E, BC, CD.}
\end{aligned} \tag{3}
$$

8.9

The query is as follows. If the functional dependency satisfies, this query should return an empty result.

```
SELECT * FROM r R1, r R2 WHERE R1.b = R2.b AND R1.c <> R2.c
```

Assertion:

```
CREATE ASSERTION fdchecker CHECK(
    NOT EXIST (SELECT * FROM r R1, r R2 WHERE R1.b = R2.b AND R1.c <> R2.c)
)
```

2

The decomposed relation schema is as follows:

teaches = (C, T)

timetable = (H, R, C)

teacherin = (H, T, R)

grade = (C, S, G)

studentin = (H, S, R)

3

By calculating $A^+, B^+, C^+, D^+, AB+$ We get:

$A^+ = A$

$B^+ = B$

$C^+ = ACD$

$D^+ = D$

$AB+ = ABCD$

So the candidate key are AB, BC, we can use AB as its primary key.

4

a): Since A->B, So AC -> BC -> D, can be derived.

b): Not possible.

c): Since A->B, so AD -> BD, so we can decompose it into AD->B and AD -> D, can be derived.

5

From X->Y and X-> Z we know X->YZ.

Similarly, we have Y->XZ, Z->XY.

Now the set is {X->YZ, Y->XZ, Z->XY}.

For X->YZ, Calculate X^+ in set {X->Z, Y->XZ, Z->XY}. $X^+ = XYZ$, so Y here is extraneous.

Now the set is {X->Z, Y->XZ, Z->XY}.

For Y->XZ, calculate Y^+ in set {X->Z, Y->Z, Z->XY}, $Y^+ = XYZ$, so X here is extraneous.

Now the set is {X->Z, Y->Z, Z->XY}.

For Z->XY, X or Y here are not extraneous. So the minimal form of FDs are {X->Z, Y->Z, Z->XY}.