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Answers are highlighted in blue text

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Database Management Systems - I (CS 157A)

Homework #2 (5 pts)

Questions on Chapters (3 + 6): Please answer the following questions:

• Q1 [1.5 pts]: For each of the following relation schemas and set of FD's:

o R(A,B,C,D) with FD's AB → C, C → D, and D → A

o R(A,B,C,D) with FD's B → C and B → D

o R(A,B,C,D) with FD's AB → C, BC → D, CD → A and AD → B

o R(A,B,C,D) with FD's A → B, B → C, C → D and D → A

o R(A,B,C,D,E) with FD's AB → C, DE → C, and B → D

o R(A,B,C,D,E) with FD's AB → C, C → D, D→ B, and D → E

Do the following:

a) Indicate all the BCNF violations. Do not forget to consider FD's that are not in the given set, but follow from them. However, it is not necessary to give violations that have more than one attribute on the right side?

o R(A,B,C,D) with FD's AB → C, C → D, and D → A

BCNF violations are C → D, D → A, C → A

o R(A,B,C,D) with FD's B → C and B → D

BCNF violations are B → C, B → D

o R(A,B,C,D) with FD's AB → C, BC → D, CD → A and AD → B

No BCNF violations

o R(A,B,C,D) with FD's A → B, B → C, C → D and D → A

No BCNF violations

o R(A,B,C,D,E) with FD's AB → C, DE → C, and B → D

BCNF violations are AB → C, DE → C, and B → D

o R(A,B,C,D,E) with FD's AB → C, C → D, D→ B, and D → E

BCNF violations are C → D, D→ B, and D → E

b) Decompose the relations, as necessary, into collections of relations that are in BCNF?

o R(A,B,C,D) with FD's AB → C, C → D, and D → A

Schemas in BCNF are:

{A, B, C}, {C, D}, {D, A}, {C, B}

o R(A,B,C,D) with FD's B → C and B → D

Decomposing R₁(B, C, D) and R₂(B, A)

Schemas in BCNF are:

(B, C, D) and (B, A)

o R(A,B,C,D) with FD's AB → C, BC → D, CD → A and AD → B

No need for decomposition

o R(A,B,C,D) with FD's A → B, B → C, C → D and D → A

No need for decomposition

o R(A,B,C,D,E) with FD's AB → C, DE → C, and B → D

Decomposing R into R₁(A, B, C, D) and R₂(A, B, E)

Decomposing R_1 into $R_3(A, B, C)$ and $R_4(B, D)$

Schemas in BCNF are:

{A, B, C}, {B, D}, {A, B, E}

o R(A,B,C,D,E) with FD's AB → C, C → D, D→ B, and D → E

Decomposing R into $R_1(C, D, B, E)$ and $R_2(A, C)$

Decomposing R_1 into $R_3(D, B, E)$ and $R_4(C, D)$

Schemas in BCNF are:

{C, D}, {D, B, E}, {A, C}

• **Q2 [1 pt]: Let R(A,B,C,D,E) be decomposed into relations with the following three sets of attributes: {A,B,C}, {B,C,D}, and {A,C,E}. For each of the following sets of FD's, use the chase test to tell whether the decomposition of R is loosless. For those that are not loosless, give an example of an instance of R that returns more than R when projected onto the decomposed relations and rejoined:**

a) B → E and CE → A

b) AC → E and BC → D

c) A → D, D → E, and B → D

d) A → D, CD → E, and E → D.

a)   This is the initial tableau:

A	B	C	D	E
a	b	c	d_1	e_1
a_1	b	c	d	e_1

a	b_1	c	d_1	e

After applying FD's B→ E and CE → A, this is the tableau:

A	B	C	D	E
a	b	c	d_1	e_1
a	b	c	d	e_1
a	b_1	c	d_1	e

There is no unsubscripted row, so the decomposition is not lossless.

b) This is the initial tableau:

A	B	C	D	E
a	b	c	d_1	e_1
a_1	b	c	d	e_1
a	b_1	c	d_1	e

This is the final tableau after applying FD's AC → E and BC → D:

A	B	C	D	E
a	b	c	d	e
a_1	b	c	d	e_1

a	b_1	c	d_1	e

There is an unsubscripted row, so the decomposition is lossless.

c)   This is the initial tableau:

A	B	C	D	E
a	b	c	d_1	e_1
a_1	b	c	d	e_1
a	b_1	c	d_1	e

Table after applying FD's A → D, D → E, and B → D:

A	B	C	D	E
a	b	c	d	e
a_1	b	c	d	e
a	b_1	c	d	e

There is an unsubscripted row, therefore decomposition for R is lossless for this set of FDs.

d)   This is the initial tableau:

A	B	C	D	E
a	b	c	d_1	e_1
a_1	b	c	d	e_1
a	b_1	c	d_1	e

This is the final tableau after applying FDs A →D, CD → E and E → D

A	B	C	D	E
a	b	c	d	e
a_1	b	c	d	e
a	b_1	c	d	e

The first row is an unsubscripted row, so the decomposition for R is lossless

• **Q3 [1.5 pts]: Write the following queries based on the following schema:**

Movies(title, year, length, genre, studioName, producerC#)
StarsIn(movieTitle, movieYear, starName)

MovieStar(name, address, gender, birthdate)

MovieExec(name, address, cert#, netWorth)

Studio(name, address, presC#)

in SQL:

a) Find the address of MGM studios?

b) Find Sandra Bullock's birthdate?

c) Find all the stars that appeared either in a movie made in 1980 or a movie with "Love" in the title?

a)　SELECT address

　　FROM studio

　　WHERE name = 'MGM';

b)　SELECT birthdate

　　FROM moviestar

　　WHERE name = 'Sandra Bullock';

c)　SELECT starName

　　FROM StarsIn

　　WHERE movieYear = 1980 OR movieTitle LIKE '%Love%';

• Q4 [1 pt]: Write the following queries based on the following schema:

Movies(title, year, length, genre, studioName, producerC#)
StarsIn(movieTitle, movieYear, starName)

MovieStar(name, address, gender, birthdate)

MovieExec(name, address, cert#, netWorth)

Studio(name, address, presC#)

Write the following queries in SQL:

a) Who were the male stars in Titanic?

b) Which stars appeared in movies produced by MGM in 1995?

c) Who is the president of MGM studio?

d) Which movies are longer than "Gone With the Wind"?

a)   SELECT name

        FROM MovieStar

        WHERE gender = 'M'

        and name IN (SELECT starName FROM StarsIn)

        WHERE movieTitle = 'Titanic')

b)   SELECT starName

        FROM StarsIn

        WHERE movieTitle in (

        SELECT title

        FROM Movies

        WHERE studioName = 'MGM' and year = '1995');

c)   SELECT presC#

        FROM Studio

        WHERE name = 'MGM';

d)   SELECT M1.title

        FROM Movie AS M1, Movie AS M2

        WHERE M2.title = 'Gone With the Wind' AND

        M1.length > M2.length;