Database Management Systems (COP 5725)

(Spring 2018)

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Homework 5

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Pledge (Must be signed according to UF Honor Code)

On my honor, I have neither given nor received unauthorized aid in doing this assignment.

J. Srikanth

Signature

For scoring use only:

	Maximum	Received
Exercise 1	20	
Exercise 2	20	
Exercise 3	25	
Exercise 4	15	
Exercise 5	20	
Total	100	

Q1)

1.1) 1 NF

Customer ID	Customer name	Item	Shipping Address	Newsletter	Supplier	Supplier Phone	Price
1	John Smith	Xbox One	15 Main St, Pasadena	Xbox News	Microsoft	(808) BUY-XBOX	250
2	Roger Hicks	PS4	47 SW 13th, Gainesville	PlayStation News	Sony	(808) BUY-SONY	300
3	Paul Kerbatian	Xbox One	28 Bellevue Av, Seattle	Xbox News	Microsoft	(808) BUY-XBOX	250
3	Paul Kerbatian	PS Villa	28 Bellevue Av, Seattle	PlayStation News	Sony	(808) BUY-SONY	300
4	John Smith	PS4	47 SW 13th, Gainesville	PlayStation News	Sony	(808) BUY-SONY	300

1.2) 2NF

CustomerID	**CustomerName**	**ShippingAddress**
1	John Smith	15 Main St, Pasadena
2	Roger Hicks	47 SW 13th, Gainesville
3	Paul Kerbatian	28 Bellevue Av, Seattle
4	John Smith	47 SW 13th, Gainesville

Item table:

Item	**Supplier**	**SupplierPhone**	**Price**	**Newsletter**
Xbox One	Microsoft	(808) BUY-XBOX	250	Xbox News
PS4	Sony	(808) BUY-SONY	300	PlayStation News
PS Vita	Sony	(808) BUY-SONY	200	PlayStation News

Customer-Item mapping:

CustomerID	**Item**
1	Xbox One
2	PS4
3	Xbox One
3	PS Vita
4	PS4

Q 1.3) 3 NF

Customer ID	Customer	Shipping Address
1	John Smith	15 Main St, Pasadena
2	Roger Hicks	47 SW 13th, Gainesville
3	Paul Kerbatian	28 Bellevue Av, Seattle
4	John Smith	47 SW 13th, Gainesville

:- ItemID	Item	Supplier	Supplier Phone	Price
1	Xbox One	Microsoft	(808) BUY-XBOX	250
2	PS 4	Sony	(808) BUY-SONY	300
3	Xbox One	Wholesale	Toll Free	450
4	PS Vita	Wholesale	Toll Free	450

Customer ID	**ItemID**
1	1
2	2
3	3
3	4
4	2

Q.2

2.1 Given $\{AB \to C, C \to D, B \to E\}$

I	L	B	R
-	AB	C	DE

$AB^+ = \{A, B, C, D, E\}$ hence AB is the candidate key

in $B \to E$, E is partially dependent on candidate key

R is not in 2NF.

we can decompose R into R_1, R_2 such that they will be in 2NF

R_1 (ABCD) with $FD_1 \{AB \to C, C \to D\}$

R_2 (BE) with $FD_2 \{B \to E\}$

Now, R_1, R_2 are in 2NF

2.2 Given: $\{A \to BCDE, BC \to ADE, D \to E\}$

I	L	B	R
-	-	A, B, C D,	E

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

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

Both A, BC are candidate keys

D, E non prime attributes have full dependencies on candidate key hence R is in 2NF

From, $BC \rightarrow D$ and $D \rightarrow E$ creates a transitive dependence

Hence R is not in 3NF

Applying 3NF Synthesis algorithm on R

Step 1:- Find minimal cover of R

$F_C : \{A \rightarrow BC, BC \rightarrow AD, D \rightarrow E\}$

$R_1(A,B,C)$ $R_2(B,C,A,D)$ $R_3(D,E)$

Since R_2 contains R_1, so R_1 can be removed

R_1 (A,B,C,D) with $FD_1 = \{A \rightarrow BC, BC \rightarrow AD\}$

R_2 (D,E) with $FD_2 = \{D \rightarrow E\}$

NOW, R_1, R_2 in 3NF

2.3 Given $\{A \rightarrow BC, AD \rightarrow E, B \rightarrow C\}$

I	L	B	R
-	AD	B	CE

$AD^+ = \{A,B,C,D,E\}$ hence AD is the candidate key

Check 1NF : all the attributes are atomic R is in 1NF.

Check R is in 2NF:

in $A \to BC$ given $A \to B$, $A \to C$, since non prime attributes are partially dependent on candidate key

R is not in 2NF.

$R_1(ABC)$ with $FD_1 \{A \to BC, B \to C\}$

$R_2(ADE)$ with $FD_2 \{AD \to E\}$

R_1 is not in 3NF since $A \to B$, $B \to C$ is a transitive relation.

decompose R_1 into R_1' and R_2''

$R_1'(AB)$ with FD $\{A \to B\}$

$R_1''(BC)$ with FD $\{B \to C\}$

So finaly R is in 3NF with

$R_1(AB)$ with $FD_1 \{A \to B\}$

$R_2(BC)$ with $FD_2 \{B \to C\}$

$R_3(ADE)$ with $FD_3 \{AD \to E\}$

R is also in BCNF after decomposition into R_1, R_2

Exercise 3

3.1)
Initial Mapping:

a	b	c1	d1	e1	f1
a2	b	c	d2	e2	f2
a	b	c3	d	e	f3
a4	b4	c4	d4	e	f

Transforming using E -> F:

a	b	c1	d1	e1	f1
a2	b	c	d2	e2	f2
a	b	c3	d	e	f
a4	b4	c4	d4	e	f

Transforming using B -> D:

a	b	c1	d	e1	f1
a2	b	c	d	e2	f2
a	b	c3	d	e	f
a4	b4	c4	d4	e	f

Transforming using AD -> E:

a	b	c1	d	e	f1
a2	b	c	d	e2	f2
a	b	c3	d	e	f
a4	b4	c4	d4	e	f

Transforming using AB -> C:

a	b	c1	d	e	f1
a2	b	c	d	e2	f2
a	b	c1	d	e	f
a4	b4	c4	d4	e	f

Transforming using E -> F:

a	b	c1	d	e	f
a2	b	c	d	e2	f2
a	b	c1	d	e	f
a4	b4	c4	d4	e	f

Since, There is no row with abcdef as value hence he decomposition is not lossless

Checking for dependency preserving:
In R1(AB),
we do not have any FD that has relation between on A and B. (We only have Trivial FD's i.e AB -> AB)
AB+ = ABC (C is not present in R1)
Therefore, F1 = ∅

In R2(BC),
we do not have any FD that has relation between on B and C. (We only have Trivial FD's i.e BC -> BC)
BC+ = ABC (A is not present in R2)
Therefore, F2 = ∅

In R3(ABDE),
B+ = BD
F3 = B -> D (contained)
AD+ = ADE
Therefore F3 = {B -> D, AD -> E}

In R4(EF),
E+ = EF
Therefore F4 = {E -> F}
Fr = F1 ∪ F2 ∪ F3 ∪ F4 = { B -> D, AD -> E, E -> F }

But it doesn't cover AB -> c, AC -> B, BC -> A.
Therefore its not dependency preserving.

3.2.a.)

R1(BCD), R2(ACE)
R1∩R2 = {C}

R1= { B, C, D} or R2 = {A,C,E}

F = {AB->C, C->E, B->D, E->A}
Applying union rule on C -> E and E -> A => C -> ACE

(R1∩R2)->(R2)

C->AE belongs to F+

Hence, the decomposition of R into R1 and R2 is lossless.

3.2.b. And 3.2.c)

A->CD, B->CE, E->B

I	L	B	R
	A	B,E	C,D

A->CD which is not equal to R.

Augmenting with B
AB->BCD from B->CE and AB->BCD

Candidate keys AB->ABCDE (A combining with B),
AE->ABCDE (A with E)

Non prime attributes are C,D

R is not in 2NF. A->C from A->CD and A->D

Decomposition of R:

F= {A->CD, B->CE, E->B}
Compute Fc = {A->CD, B->CE, AE->B}
Decomposing gives R1(ACD) : {A->CD}, R2(BCE) : {B->CE}
Each R1, R2 are in BCNF now.

Q5)

1)

```
Alter table takes
Add constraint fk
Foreign key(student_no,course_no) references (student(stno), course(cno))
On delete cascade;
```

2)

```
Alter table student add constraint pk primarykey(stno);

Alter table course add constraint ckey primarykey(crno);

Alter table student add constraint unique_email Unique(email);

Alter table takes add constraint takes_grade check ( takes.grade <= 4);

Alter table course add constraint course_credit check (course.credit <9);
```

3) create trigger answer

```
Before insert on takes
Referencing new row as newrow
For each row
when(newrow.course_no = course_no)
Begin
Select avg(grades) from takes group by course_no;
End;
```

4)

```
Create trigger answer
After insert, update on takes
Referencing new row as newrow
For each row
Begin
Insert into student_log (ID, Student_No, course_no, time)
values ((select max(ID) from student_log)+1, newrow.student_no, newrow.course_no,
current_timestamp);
End;
```