

Information and Database Management Systems I

(CIS 4301)

Spring 2022

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TA: Kyuseo Park

Homework ,5

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|----------------|----------------------|
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Pledge (Must be signed¹ according to UF Honor Code)

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



Student signature

¹Each student is obliged to print out this page, fill in the requested information in a handwritten and readable manner, make the *handwritten* signature, scan this page into PDF, and put this page as the first page of the PDF submission.

Homework 5

Charles
Richardson

- a. Customer Hobbies (is not in 1NF since two of the hobby elements are dists.)

Normalized Customer Hobbies

| Customer Name | Hobbies |
|---------------|----------|
| John | Internet |
| James | Movies |
| James | Musics |
| Lee | Musics |
| Lee | Shopping |
| MJ | Music |
| Jake | Game |

- b. $F = \{ \{ \text{StudentID}, \text{LectureName} \} \rightarrow \text{Score}, \text{LectureName} \rightarrow \text{ClassRoom} \}$

| Findings Candidate Key's | Left Only | Neither | Right Only |
|--------------------------------|-----------|---------|------------|
| StudentID, | | X | Score |
| LectureName | | | ClassRoom |

$$\text{Left} + \text{Neither} = \{ \text{StudentID}, \text{LectureName} \} = F$$

$$F^+ = \{ \text{StudentID}, \text{LectureName}, \text{ClassRoom}, \text{Score} \} = R$$

$\{\text{LectureName} \rightarrow \text{ClassRoom}\}$ is subset of candidate key, not every nonprime key is fully dependent on candidate key.

Attributeless insertion? What if a student is in the class with no grade?

Deletion? What if a student's score is dropped?

Split into two tables \rightarrow Normalized 2NF

| StudentID | LectureName | Score |
|-----------|-------------|-------|
| | | |
| | | |
| | | |
| | | |

| LectureName | ClassRoom |
|-------------|-----------|
| | |
| | |
| | |
| | |

HWS

1. c. One of three requirements must be met (for each FD: $X \rightarrow Y$)
- FDs are trivial \times
 - LHS of FDs are candidate key \times , Candidate key is {StudentID, LectureName, LectureTiming}
 - Every element of $Y - X$ is prime \times , {Score is not prime?}

Normalized 3NF

| | | | | | |
|------------------|----------------|----------------|------------------|--------------------|--------------|
| <u>StudentID</u> | <u>Lecture</u> | <u>Lecture</u> | <u>StudentID</u> | <u>LectureName</u> | <u>Score</u> |
| Name | Tutor | | | | |

| | |
|----------------|------------------|
| <u>Lecture</u> | <u>ClassRoom</u> |
| Name | |

- d) for relation $\{A, B, E\}$, FD's = $\{AB \rightarrow C, B \rightarrow D\}$. Superkey = AB'
- No superkey or candidate key for $\{A, B, E\}$ given

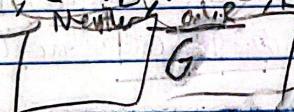
$$\{AB \rightarrow C, B \rightarrow D\}$$

2. a. $R(A, B, C, D, E, F, G)$ 1NF ✓

$$S = \{AB \rightarrow CD, DE \rightarrow F, C \rightarrow E, F \rightarrow C, B \rightarrow G\} = \{AB \rightarrow CDEF\}$$

Find candidate keys
only Nonempty subset

$$AB^t = ABCDEFG = R$$



$(B \rightarrow G)$ is a partial dependency ($B \subseteq AB$)

Normalization
Split table b. FDs

1. $\{B, G\}$ w/ FD $\{B \rightarrow G\}$

2. $\{A, B, C, D, E, F\}$ w/ FD $\{AB \rightarrow DF, DE \rightarrow F, C \rightarrow E, F \rightarrow C\}$

- b. The schemas from the previous question are not in 3NF, none of the FDs are trivial, superkeys, & only one FD is a candidate key of the relation.

c.

2. c. $R(A, B, C, D, E)$

$$F = \{AB \rightarrow CDE, CD \rightarrow ABE, E \rightarrow DS\}$$

1NF - No lists, all indivisible ✓

2NF - Find candidate key:

$$A^+ = AQR, C^+ = CCR, E^+ = DECR$$

$$B^+ = BCR, D^+ = DCR$$

$$+ | AB^+ = ABCDE = R \quad CD^+ = ABCDE = R \rightarrow$$

$$BC^+ = BC \quad DE^+ = DE$$

$$+ | BCE^+ = ABCDE \times \quad BDE^+ = BDE$$

$$ADE^+ = A \quad DE \times$$

| | L | at | Neither | R only | Both |
|--|---|----|---------|--------|-------|
| | | | | | ABCDE |

Candidate keys

AB,
CD

No partial dependences \rightarrow 2NF ✓

3NF - No transitive dependencies ✓

BCNF - $\{E \rightarrow D\}$, E is not a candidate key

Not superkey

The highest normal form is 3NF.

d. To normalize split $\{E, D\}$ out of base table w/ the FD $\{E \rightarrow D\}$
Apply 3rd normal form property to $\{AB \rightarrow CDE\}, \{CD \rightarrow ABE\}, \{CE \rightarrow F\}$

| | | | |
|---|---|---|---|
| A | B | C | E |
| | | | |

| | |
|---|---|
| E | D |
| | |

$$FD_S = \{AB \rightarrow CE\} \\ \{CE \rightarrow AB\}$$

$$FD_D = \{E \rightarrow D\}$$

| | A | B | C | D | E | F |
|----------------|---|---|---|---|---|---|
| R ₁ | a | a | a | a | a | a |
| R ₂ | a | a | | a | a | |
| R ₃ | a | | a | a | a | a |
| R ₄ | | a | | a | a | a |

Full Row \rightarrow lossless

b. $R_1 (\underline{ACDE})$ Neither

$$FD_1: E \rightarrow C \\ D \rightarrow AE \\ A \rightarrow B \\ BC \rightarrow D \\ C \rightarrow F$$

$R_2 (\underline{BDF})$

Since R_1 & R_2 have $A \rightarrow B$, $C \rightarrow F$, & $D \rightarrow AE$, the join operation would be lossless.

HWS

3. $\in R_1(ABC)$
 $C \rightarrow A$
 $A \rightarrow C$

Neither
 $C \rightarrow E$
 $E \rightarrow C$

$R_2(ABDE)$
 $AB \rightarrow D$

Not FD preserving. Leaving out $C \rightarrow E$ & $E \rightarrow C$

4. a. $CD \rightarrow BF$ | LHS red.
 $D^+ = ABCDEF \Rightarrow$ Remove $C \rightarrow D \rightarrow BF$.

$AB \rightarrow DE$ | " $B^+ = ABCDEF \Rightarrow$ Remove $A \Rightarrow B \rightarrow DE \Rightarrow B \rightarrow ADE$
 $E \rightarrow CF$
 $B \rightarrow DA$
 $E \rightarrow CF \uparrow$
 $B \rightarrow DA \downarrow$

$D \rightarrow B, D \rightarrow F, B \rightarrow D, B \rightarrow A, B \rightarrow E, E \rightarrow C, E \rightarrow F$

$D^+ = ABCDEF \Rightarrow$ Remove $F \Rightarrow D \rightarrow B$

$B^+ = BCDEF \Rightarrow$ Keep A . $ABEF \Rightarrow$ Removed D

$ABDF \Rightarrow$ Keep E

$E^+ = CE$ or $FE \Rightarrow$ keep C and F

$D \rightarrow B$ $B \rightarrow ADE$, $E \rightarrow CF$

$R_1(B,D)$ $R_2(ABDE)$ $R_3(CEF)$

b.

$R(A,B,C,D,E,F) \times \times$

$S = \{A \rightarrow B, B \rightarrow D, E \rightarrow C, D \rightarrow AE, C \rightarrow F\}$

$A^+ = AB$

$B^+ = B$

$C^+ = C$

$D^+ = AB$

$E^+ = C$

$F^+ = F$

$CD^+ = ABCDEF = R$

Princ = CD

Nonprinc = ABEF

Result:

$D(AB \{A \rightarrow B\} | DA \{D \rightarrow AE\} | BC \{B \rightarrow D\})$
 $- CF \{C \rightarrow F\} | E \{E \rightarrow C\}$

$R(A,B,C,D,E,F)$

$A \rightarrow B$

$D \rightarrow AE$

$B \rightarrow D$

$C \rightarrow F$

$F \rightarrow C$

$ACDEF$

$D \rightarrow AE$

$BC \rightarrow D$

$C \rightarrow F$

$E \rightarrow C$

$ACDEF$

DAE

$D \rightarrow AE$

CDE

$C \rightarrow F$

$E \rightarrow C$

GDF

BCD

$C \rightarrow F$

$BC \rightarrow D$

$C \rightarrow F$

$E \rightarrow C$

CF

C

$E \rightarrow C$

\emptyset

HWS

5. a. Create assertion majority tenured check (select count(*) from Faculty
from Faculty
where tenured=true) >
select count(*)
from Faculty
where tenured=false))

b. Create trigger noRaise
before update of salary on Faculty
for each row

when (:old.salary is not null)

if (:old.salary) > :newSalary then :newSalary = :oldSalary
if (:old.salary) < :newSalary then :newSalary = :oldSalary

End: was more double, so it's not doing that

c. create trigger SyncTables
after update of dname on Department

for each row

declare

dname VARCHAR2 = dname

get selected f.dname from Course C, faculty F

begin where C.dname=dname and

C.fID=F.fID

f.dname=dname

End.