

Database Systems
Spring Semester 2018

Assignment #4

Due Date: Before the start of the class (2nd April, 2018)

Instructions:

- Use proper assignment papers for solving your assignment questions. Assignment done on diary pages, register pages, rough pages will not be credited.
- Do not copy the work of your peers. In case cheating is detected, then your case will be referred to DC.

Question 1: Consider a relation $R(A, B, C, D)$ with FD's $A \rightarrow C$, $BC \rightarrow D$, $CD \rightarrow A$, and $AD \rightarrow B$.

- a) What are all the nontrivial FD's that follow from the given FD's? You should restrict yourself to FD's with single attributes on the right side.
- b) What are all the keys of R ?
- c) List any five superkeys for R that are not keys?

Question 2: Show that each of the following are *not* valid rules about FD's by giving relational instance that satisfy the given FD's (following the "if") but not the FD that allegedly follows (after the "then").

- b) If $AB \rightarrow C$ and $A \rightarrow C$, then $B \rightarrow C$.
- c) If $AB \rightarrow C$, then $A \rightarrow C$ or $B \rightarrow C$.

Question 3: Find out whether the following set of functional dependencies for a relation $R(A, B, C, D, E)$ are equivalent or not.

1. $E \rightarrow D$, $ED \rightarrow C$, $B \rightarrow EC$, $B \rightarrow A$, $D \rightarrow A$
2. $E \rightarrow ADC$, $B \rightarrow AE$, $D \rightarrow B$

Question 4: Consider the relation $R(A, B, C, D, E, F, G, H, I)$ and a set of functional dependencies:

$FD's = \{A \rightarrow B, ABCD \rightarrow E, EF \rightarrow GH \text{ and } ACDF \rightarrow EG.\}$

- i. Find Keys for the above relation R ?
- ii. Find a minimal cover for the above set of FDs'?
- iii. Decompose the above relation into 3NF that preserve all the dependencies.

Question 5: Suppose you are given a relation $R(A, B, C, D)$. For each of the following sets of FDs, assuming they are the only dependencies that hold for R , do the following: (a) Identify the candidate key(s) for R . (b) State whether or not the proposed decomposition of R into smaller relations is a good decomposition (lossless, dependency preserving, attribute preserving), and briefly explain why or why not.

- $AB \rightarrow C, C \rightarrow A, C \rightarrow D$; decompose into ACD and BC .
- $A \rightarrow BC, C \rightarrow AD$; decompose into ABC and AD .
- $A \rightarrow B, B \rightarrow C, C \rightarrow D$; decompose into AB and ACD .
- $A \rightarrow B, B \rightarrow C, C \rightarrow D$; decompose into AB, AD and CD .

Question 6:

| | | | |
|--------------|---------|-------------------|-----------------------|
| Shipment ID: | 00-0001 | Shipment Date: | 01/10/2010 |
| Origin: | Boston | Expected Arrival: | 01/14/2010 |
| Destination: | Brazil | | |
| Ship Number: | 39 | Captain: | 002-15 Henry Moore |

| Item Number | Type | Description | Weight | Quantity | TOTALWEIGHT |
|-----------------|------|------------------|--------|----------|-------------|
| 3223 | BM | Concrete Form | 500 | 100 | 50,000 |
| 3297 | BM | Steel Beam | 87 | 2,000 | 174,000 |
| Shipment Total: | | | | | 224,000 |

Figure given above shows a shipping manifest. Your assignment is as follows:

- Identify the functional dependencies between the attributes.
- Draw a relational schema and diagram the functional dependencies in the relation.
- In what normal form is this relation(1NF,2NF,3NF,BCNF,4NF)? Decompose the above relation into a set of 3NF relations.
- Draw a relational schema for your 3NF relations and show the referential integrity constraints.

Question 7:

The following statement is presented to the patient (or patient representative) when the patient is discharged. Assume that each item on the bill has a unique description and that the charge for a particular item may vary from one patient to another.

Using the normalization, develop a set of BCNF relations for the patient billing system shown below.

Draw a relational schema for the BCNF relations you developed. Be sure to show the functional dependencies and referential integrity constraints.



MOUNTAIN VIEW COMMUNITY HOSPITAL
200 Forest Dr.
Mountain View, CO 80638

INVOICE

Mary Baker
200 Oak St.
Mountain View, CO 806338

INVOICE DATE:
ACCOUNT NUMBER:
DUE DATE:

10/24/2010
000976555
11/14/2010

| PATIENT NAME | PATIENT # | DATE ADMITTED | DATE DISCHARGED |
|--------------|-----------|---------------|-----------------|
| Mary Baker | 3249 | 10/15/2010 | 10/18/2010 |

| CODE | DESCRIPTION | TOTAL CHARGE |
|------|--------------|--------------|
| 200 | Room semi-pr | 1,800.00 |
| 205 | Television | 75.00 |
| 307 | X-ray | 150.00 |
| 413 | Lab tests | 200.00 |

TOTAL CHARGES DUE

2,225.00