Instituto Tecnológico de Costa Rica
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Escuela de Computación

Bachillerato en Ingeniería en Computación
Curso: Bases de Datos I
IC-4301

Laboratorio #7: Laboratorio de Normalización

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Fecha de Entrega: 11 de mayo del 2019

I Semestre - 2019

1.The following table is susceptible to update anomalies. Provide examples of insertion, deletion, and modification anomalies.

staffNO	dentistName	patientNo	patientName	Appointment date time	surgeryNo
s1011	Tony Smith	p100	Gillian White	12-Aug-03 10:00	s10
s1011	Tony Smith	p105	Jill Bell	13-Aug-03 12:00	s15
s1024	Helen Pearson	p108	Ian MacKay	12-Sept-03 10:00	s10
s1024	Helen Pearson	p108	Ian MacKay	14-Sept-03 10:00	s10
s1032	Robin Plevin	p105	Jill Bell	14-Oct-03 16:30	s15
s1032	Robin Plevin	p110	John Walker	15-Oct-03 18:00	s13

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Insertion Anomaly

If we want to add a new dentist, we must add one with a patient or the info of the appointment.

A dentist or a patient that does not exist can be added.

Deletion Anomaly

When we want to delete a dentist, we will remove an appointment as well.

When we want to delete a patient, an appointment will be removed too.

Update Anomaly

Since there are repeated dentist names, if we want to update one, we must update all of the tuples with the same dentists; otherwise, a wrong dentist name will remain in the other tuples.

If a dentist name is updated, a dentist can have two appointments at the same time.

2. An agency called InstantCover supplies part-time/temporary staff to hotels throughout Scotland. The table lists the time spent by agency staff working at two hotels. The National Insurance Number (NIN) is unique for employee.

NIN	**contractNo**	**hoursPerWeek**	**eName**	**hotelNo**	**hotelLocation**
113567WD	C1024	16	John Smith	H25	Edinburgh
234111XA	C1024	24	Diane Hocine	H25	Edinburgh
712670YD	C1025	28	Sarah White	H4	Glasgow
113567WD	C1025	16	John Smith	H4	Glasgow

Provide examples of insertion, deletion, and modification anomalies.

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Assuming the following dependencies:

NIN → hoursPerWeek, eName

contractNo → hotelNo

hotelNo → hotel Location

Insertion Anomaly

- We cannot add an employee (NIN, hoursPerWeek and eName) unless he or she has been hired by a specific hotel (hotelNo and hotelLocation).
- A hotel (hotelNo and hotelLocation) cannot be added unless there is a contractNo and employee (NIN, hoursPerWeek and eName) associated to it.

Deletion Anomaly

If we delete a hotel, an employee will be lost as well. For example, we can not delete Edinburgh Hotel since we would be losing Diane Hocine as an employee. When in reality the hotel probably does not want to use InstantCover's services anymore, but Diane still works for InstantCover.

Deleting a contractNo would delete an employee, the hotelNo and hotelLocation. For example, deleting C1024 would delete Diane Hocine and Hotel H25 Edinburgh.

Update Anomaly

1. Updating the contractNo (e.g. C1024 to C1026) must be updated twice.
2. Updating eName (e.g. John Smith's eName from John Smith to John Snow) must be updated twice.
3. Updating hotelNo (e.g. Edinburgh's hotelNo H25 to H1) must be updated twice.
4. Updating the hotelLocation (e.g. Edinburgh to Iverness) must be updated twice.

If those are not changed twice, there are going to be problems with data consistency.

3.Choose a key and write the dependencies for the following GRADES relation: GRADES (Student_ID, Course#, Semester#, Grade):

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Primary Key: Student_ID, Course#, Semester#

Student_ID → Course#

Student_ID → Semester#

Student_ID, Course#, Semester# → Grade

4. Choose a key and write the dependencies for the following SOFTWARE relation (assume all of the vendor's products have the same warranty):

SOFTWARE (SoftwareVendor, Product, Release, SystemReq, Price, Warranty)

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Primary Key: SoftwareVendor, Product

SoftwareVendor, Product → Release

SoftwareVendor, Product → SystemReq

SoftwareVendor, Product → Price

SoftwareVendor, Product → Warranty

SoftwareVendor → Warranty

5. Normalize the above SOFTWARE relation into 4NF.

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a. It is in 1NF since there is no redundancy and it is isomorphic to some relation.

b. It is in 2NF since all attributes depend fully and solely on the primary key due to transitivity or not.

c. 3NF: There is transitivity because a product's warranty can be found only using its SoftwareVendor.

This can be fixed like this:

VENDOR (SoftwareVendor, Warranty)

SOFTWARE (SoftwareVendor, Product, Release, SystemReq, Price)

It is in 3NF since all attributes depend not-transitively on the primary key.

Assuming a table like in exercise 8 where Release, SystemReq and Price depend on SoftwareVendor and Product, and not just on Product.

d. It is in BCNF because it satisfies the functional dependency X → Y. We do not need to enter Release, SystemReq, Price or Warranty by themselves, they depend solely on the primary key.

e. It is in 4FN since it is in 3FN or in BCNF (either of both) and does not have non-trivial multivalued dependencies.

6. What normal form is the following relation in (only H,I can act as the key):

STUFF (H, I, J, K, L, M, N, O)

H, I → J, K, L

J → M

K → N

L → O

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The relation is in 1NF and 2NF

1NF: It is isomorphic to some relation.

2NF: All attributes that are not part of the primary key, depend on the primary key.

Due to transitivity, M, N and O depend on the primary key.

3NF: There is transitivity, then it is not on 3NF.

7. What normal form is the following relation in:

MORE_STUFF (D, O, N, T, C, R, Y)

D, O → N, T, C, R, Y

D → N

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The relation is only in 1NF.

1NF: It is isomorphic to some relation.

2NF: N depends on D. Therefore, N can be determined solely on D, and it does not depend fully on D, O (the primary key).

8. Given the following relation and example data:

PartNumber	Description	Supplier	SupplierAddress	Price
10010	20 GB Disk	Seagate	Cuppertino, CA	$100
10010	20 GB Disk	IBM	Armonk, NY	$90
10220	256 MB RAM Card	Kensington	San Mateo, CA	$220
10220	256 MB RAM Card	IBM	Armonk, NY	$290
10220	256 MB RAM Card	Sun Microsystems	Palo Alto, CA	$310
10440	17” LCD Monitor	IBM	Armonk, NY	$2,100

List the functional dependencies and normalize this relation.

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PartNumber → Description

Supplier → SupplierAddress

PartNumber, Supplier → Price

Table 1. Part

PartNumber	Description
10010	20 GB Disk
10220	256 MB RAM Card
10440	17” LCD Monitor

Table 2. Supplier

Supplier	**SupplierAddress**
Seagate	Cuppertino, CA
IBM	Armonk, NY
Kensington	San Mateo, CA
Sun Microsystems	Palo Alto, CA

Table 3. Part_x_Supplier

PartNumber	**Supplier**	**Price**
10010	Seagate	$100
10010	IBM	$90
10220	Kensington	$220
10220	IBM	$290
10220	Sun Microsystems	$310
10440	IBM	$2,100