

Task 1. Will the conversion to BCNF be dependency preserving in any case? Proof your statement and give a reasoning for choosing BCNF design.

It is not always possible to achieve both BCNF and dependency preservation

Consider a schema:

dept_advisor(s_ID, i_ID, department_name)

With function dependencies:

$i_ID \rightarrow dept_name$

$s_ID, dept_name \rightarrow i_ID$

dept_advisor is not in BCNF

i_ID is not a superkey

Any decomposition of dept_advisor will not include all the attributes in

$s_ID, dept_name \rightarrow i_ID$

Thus, the composition is NOT be dependency preserving

Task 2. Given table in 1NF, convert to 3NF if PK is UnitID:

UnitID	StudentID	Date	Tutor ID	Topic	Room	Grade	Book	TutEmail
U1	St1	23.02.03	Tut1	GMT	629	4.7	Deumlich	tut1@fhbb.ch
U2	St1	18.11.02	Tut3	Gln	631	5.1	Zehnder	tut3@fhbb.ch
U1	St4	23.02.03	Tut1	GMT	629	4.3	Deumlich	tut1@fhbb.ch
U5	St2	05.05.03	Tut3	PhF	632	4.9	Dümmers	tut3@fhbb.ch
U4	St2	04.07.03	Tut5	AVQ	621	5.0	SwissTopo	tut5@fhbb.ch

2NF

UnitID	StudentID	Date	Tutor ID	Topic	Room	Grade	Book
U1	St1	23.02.03	Tut1	GMT	629	4.7	Deumlich
U2	St1	18.11.02	Tut3	Gln	631	5.1	Zehnder
U1	St4	23.02.03	Tut1	GMT	629	4.3	Deumlich
U5	St2	05.05.03	Tut3	PhF	632	4.9	Dümmers

U4	St2	04.07.03	Tut5	AVQ	621	5.0	SwissTopo
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Tutor ID	TutEmail
Tut1	tut1@fhbb.ch
Tut3	tut3@fhbb.ch
Tut3	tut3@fhbb.ch
Tut5	tut5@fhbb.ch

3NF

UnitID	Date	Tutor ID	Topic	Room	Book
U1	23.02.03	Tut1	GMT	629	Deumlich
U2	18.11.02	Tut3	Gln	631	Zehnder
U5	05.05.03	Tut3	PhF	632	Dümmers
U4	04.07.03	Tut5	AVQ	621	SwissTopo

Tutor ID	TutEmail
Tut1	tut1@fhbb.ch
Tut3	tut3@fhbb.ch
Tut5	tut5@fhbb.ch

StudentID	UnitID	Grade
St1	U1	4.7
St1	U2	5.1
St4	U1	4.3
St2	U5	4.9
St2	U4	5.0

Task 3. Given table in 1NF, convert to 2NF if PK is {ProjectName, ProjectManager}, use decomposition:

ProjectName	ProjectManager	Position	Budget	TeamSize
Project1	Manager1	CTO	1 kk \$	15
Project2	Manager2	CTO2	1.5 kk \$	12

ProjectName	Position	Budget
Project1	CTO	1 kk \$
Project2	CTO2	1.5 kk \$

ProjectManager	TeamSize
Manager1	15
Manager2	12

ProjectName	ProjectManager
Project1	Manager1
Project2	Manager2

Task 4. Given table, convert to 3NF if PK is Group, use decomposition:

Faculties have a number of specialities, each speciality consists of a set of particular groups.

Group	Faculty	Speciality
g1	f1	s1
g2	f2	s2

Faculty	Speciality
f1	s1
f2	s2

Speciality	Group
s1	g1
s2	g2

Task 5. Given table, convert to BCNF if PK is {ProjectID, Department}, use decomposition:

Curator depends on projectID and related departments, teamSize directly relates to project and related departments, ProjectGroupsNumber depends on TeamSize.

ProjectID	Department	Curator	TeamSize	ProjectGroupsNumber
p1	d1	e1	100	5
p2	d2	e2	120	6

ProjectID	Curator	TeamSize
p1	e1	100
p2	e2	120

TeamSize	ProjectGroupsNumber
100	5
120	6

ProjectID	Department
p1	d1
p2	d2

Task 6. List the three design goals for relational databases, and explain why each is desirable. Give an example of both desirable and undesirable types of decompositions.

1) Lossless join

The information will not lose from the relation when decomposed. The join would result in the same original relation.

2) Dependency Preservation

It is useful to design the database in a way that constraints can be tested efficiently.

3) Minimization of repetition of information

The key benefit is more efficient storage (less storage required, as only necessary data is stored)

Lossless decomposition

The decompositions $R_1, R_2, R_2 \dots R_n$ for a relation schema R are said to be Lossless if there natural join results the original relation R .

Lossy decomposition

The decompositions $R_1, R_2, R_2 \dots R_n$ for a relation schema R are said to be Lossy if there natural join results into addition of extraneous tuples with the original relation R .