

**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

Proof with schema

- $R=(A, B, C)$

With function dependencies:

- $B \rightarrow C$
- $A, C \rightarrow B$

R is not in BCNF

- B is not a superkey.

Any decomposition of R will not include all the attributes in

- $A, C \rightarrow B$

Thus, the composition is not be dependency preserving

advantages: we may have to use null values to represent some of the possible meaningful relationships among data items. There is the problem of repetition of information.

**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

StudentID	UnitID	TutorID	Date	Grade
St1	U1	Tut1	23.02.03	4.7
St1	U2	Tut3	18.11.02	5.1
St4	U1	Tut1	23.02.03	4.3
St2	U5	Tut3	05.05.03	4.9
St2	U4	Tut5	04.07.03	5.0

TutorID	TutEmail
Tut1	tut1@fhbb.ch
Tut3	tut3@fhbb.ch
Tut1	tut1@fhbb.ch
Tut3	tut3@fhbb.ch
Tut5	tut5@fhbb.ch

UnitID	Topic	Book	Room
U1	GMT	Deumlich	629
U2	Gln	Zehnder	631
U1	GMT	Deumlich	629
U5	PhF	Dümmers	632
U4	AVQ	SwissTopo	621

**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	Budget	TeamSize
Project1	1 kk \$	15
Project2	1.5 kk \$	12

ProjectName	Manager_ID
Project1	Manager_id1
Project2	Manager_id2

Manager_ID	ProjectManager	Position
Manager_id1	Manager1	CTO
Manager_id2	Manager2	CTO2

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

*Faculties have a number of specialties, each specialty consists of a set of particular groups*

Group	Faculty	Speciality
g1	f1	s1
g2	f2	s2

Group	Speciality
g1	s1
g2	s2

Speciality	Faculty
s1	f1
s2	f2

**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	Department	Curator	Team_id
p1	d1	e1	T1
p2	d2	e2	T2

Team_id	TeamSize	ProjectGroupsNumber
T1	100	5
T2	120	6

**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.**

The three design goals are

- lossless-join decompositions
- dependency preserving decompositions
- minimization of repetition of information.

They are desirable so we can maintain an accurate database, check correctness of updates quickly, and use the smallest amount of space possible.

Example:

$R = (A, B, C)$

$F = \{A \rightarrow B$   
 $B \rightarrow C\}$

Key = {A}

R is not in BCNF

Decomposition  $R_1 = (A, B)$ ,  $R_2 = (B, C)$

- $R_1$  and  $R_2$  in BCNF
- Lossless-join decomposition
- Dependency preserving

If we cannot reconstruct the original given relation, lose info and so, this is a lossy decomposition.