

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

There are some situations where BCNF is not dependency preserving

Example:

Relation dept\_advisor(s\_ID, dept\_name, i\_ID)

Functional dependencies  $F = \{s\_ID, dept\_name \rightarrow i\_ID, i\_ID \rightarrow dept\_name\}$

In  $i\_ID \rightarrow dept\_name$ : dept\_name depends on i\_ID, but i\_ID is not a super key

Any other decomposition of dept\_advisor will not include all the attributes in, thus, BCNF cannot be dependency preserving in any case.

**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

<u>TutorID</u>	TutEmail
Tut1	tut1@fhbb.ch
Tut3	tut3@fhbb.ch
Tut5	tut5@fhbb.ch

<u>Topic</u>	Book
GMT	Deumlich
Gln	Zehnder
PhF	Dümmers
AVQ	SwissTopo

<u>UnitID</u>	<u>StudentID</u>	Grade
U1	St1	4.7
U2	St1	5.1
U1	St4	4.3
U5	St2	4.9
U4	St2	5.0

<u>UnitID</u>	Date	TutorID	Topic	Room
U1	23.02.03	Tut1	GMT	629
U2	18.11.02	Tut3	Gln	631
U4	04.07.03	Tut5	AVQ	621
U5	05.05.03	Tut3	PhF	632

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

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

<u>ProjectName</u>	<u>ProjectManager</u>	Position
Project1	Manager1	CTO
Project2	Manager2	CTO2

<u>ProjectName</u>	Budget	TeamSize
Project1	1 kk \$	15
Project2	1.5 kk \$	12

**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

  

<u>Group</u>	Specialty	<u>Specialty</u>	Facutly
g1	s1	s1	f1
g2	s2	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

<u>ProjectID</u>	<u>Department</u>
p1	d1
p2	d2

<u>ProjectID</u>	Curator	TeamSize
p1	e1	100
p2	e2	120

<u>TeamSize</u>	ProjectGroupsNumber
100	5
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.**

1. BCNF
2. Lossless join
3. Dependency preservation

#### **Desirable type: Lossless decomposition**

Lossless decomposition of a relation R into relations R1, R2 such that if we perform natural join of relation R1 and R2, it will return the original relation R

#### **Undesirable type: Lossy decomposition**

It's impossible to return to the original relation R from R1 and R2