

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

Conversion to BCNF does not always preserve dependency. For example in task 5 attribute "ProjectGroupsNumber" depends on the "TeamSize" attribute, which is not a superkey. And thanks to BCNF we can fix this by decomposition. (You can see more details in task 5). You can eliminate the repetition of one information many times.

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	Dümmmlers	tut3@fhbb.ch
U4	St2	04.07.03	Tut5	AVQ	621	5.0	SwissTopo	tut5@fhbb.ch

3NF:

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

UnitID	Topic	Date
U1	GMT	23.02.03
U2	Gln	18.11.02
U5	PhF	05.05.03
U4	AVQ	04.07.03

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

Topic	Book	TutorID	Room
GMT	Deumlich	Tut1	629
Gln	Zehnder	Tut3	631
PhF	Dümmmlers	Tut3	632
AVQ	SwissTopo	Tut5	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	ProjectManager
Project1	Manager1
Project2	Manager2

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

ProjectManager	Position
Manager1	CTO
Manager2	CTO2

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 → Group

Speciality	Faculty
S1	F1
S2	F2

Group	Speciality
G1	S1
G2	S2

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

ProjectID → teamSize

TeamSize → ProjectGroupsNumber

ProjectID	Department
p1	d1
p2	d2

ProjectID	Curator	TeamSize
P1	E1	100
P2	E2	120

TeamSize	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.

The three design goals are:

1. lossless-join decompositions
2. dependency preserving decompositions

3. 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 of undesirable type is *lossy decomposition*, because we can not obtain initial relation.