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

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

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

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**

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

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.

Answers

Task 1:

Boyce-Codd Normal form doesn't preserve dependencies in any case since BCNF requires that for any dependency A → B, A should be a super key. In simple words, it means, that for a dependency A → B, A cannot be a non-prime attribute, if B is a prime attribute. Also, there aren't any partial and transitive dependencies which were "broken" in 2NF and 3NF. If these properties don't hold, obtained table won't be in BCNF. The reason for using BCNF in DB design is that since it has no dependencies except that it may have multi-valued dependency which is "broken" in 4NF, it has as few unnecessary data as possible

Task 6:

Design goals for relation databases are the following:

1. **Get rid of redundant values in tuples and all the repetitive information in the table**
2. **Reducing (better avoiding) NULL values in tuples**
3. **Disallow spurious tuples**

Reasoning:

1. **Goal of DB design is to minimize the storage space that DB occupies. Distinct tables like "instructor" and "department" consume less space than "in_dep" relation**
2. **Tables in DB should have as few NULL values as possible since NULL represents values that are inappropriate (invalid), unknown or known but absent for this tuple (table)**
3. **We must dissalow the sitatution when "cartesian product" or "join" operation of 2 relations results into table that has invalid tuples**

Undesirable type of decomposition is lossy when we lose when we cannot successfully reconstruct the table we just decomposed and join it into one table again without losing data or making this data invalid when

combined into tuples of table.

If we can successfully join decomposed table again into one without losing data we deal with lossless decomposition which is desirable

Project _name	Budget	Team_size	Project_ manager
Project 1	$1000	15	Manager 1
Project 2	$1500	12	Manager 2

Task 3:

Project_manager	Position
Manager1	CTO
Manager2	CTO2

Task 4:

Group	Specialty
G1	S1
G2	S2

Specialty	Faculty
S1	F1
S2	F2