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

dept_advisor(s_ID, i_ID, department_name)

i_ID → dept_name

s_ID, dept_name → i_ID

dept_advisor is not in BCNF, because i_ID is not a superkey

Any decomposition of dept_advisor will not include all the attributes in

s_ID, dept_name → i_ID

Example:

(s_ID, i_ID)

(i_ID, dept_name)

Thus, the composition is NOT be dependency preserving.

The functional dependency s_ID, dept_name → i_ID can only be checked by computing the join of the decomposed relations

Advantages of BCNF over 3NF

We can use null values to represent some of the possible meaningful relationships among data items. There is no 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	Dumlmlers	tut3@fhbb.ch
U4	St2	04.07.03	Tut5	AVQ	621	5	SwissTipo	tut5@fhbb.ch

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

Topic	Book
GMT	Deumlich
Gin	Zehnder
Phf	Dummlers
AVG	SwissTopo

UnitID	Date	TutorID	Room	Topic
U1	23.02.03	Tut1	629	GMT
U2	18.11.02	Tut3	631	Gin
U4	04.07.03	Tut5	621	AVG
U5	05.05.03	Tut3	632	PhF

UnitID	StudentID	Grade
U1	St1	4.7
U2	St1	5.1
U1	St4	4.3
U5	St2	4.9
U4	St2	5

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

ProjectName	Projectmanager	Position	Budget	Teamsize
Project1	Manager1	CTO	1kk$	15
Project2	Manager2	CTO2	1.5kk$	12

ProjectName	Projectmanager
Project1	Manager1
Project2	Manager2

ProjectName	Budget	Teamsize	Projectmanager
Project1	1kk$	15	Manager1
Project2	1.5kk$	12	Manager2

Projectmanager	Position
Manager1	CTO
Manager2	CTO2

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

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 → Curator
projectID → TeamSize

teamSize → ProjectGroupNumber

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

ProjectID	Department
p1	d1
p2	d2

ProjectID	TeamSize	Curator
p1	100	e1
p2	120	e2

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.

1) Dependency preserving decomposition.
   This permits the validity of an update to be tested without the need to compute a join of relations in the decomposition.
2) Lossless join decomposition
   By this way we can maintain an accurate relations in our database.
3) Minimization of information repetition
   The smallest possible amount of space is used for storing the information.

Desirable type: **Lossless Decomposition**

By lossless decomposition it becomes feasible to reconstruct the relation R from decomposed tables R1 and R2 by using Joins.

Undesirable type: **Lossy Decomposition**

We cannot reconstruct the original relation