Task 1.

Consider the schema: a b c and c->b that is in 3NF, because ab->c is a super key dependency and from c->b we can see that b-c=b, which is a subset of the primary key (such dependency is also allowed in 3NF). But, the above schema is not in BCNF because c->b is neither super-key nor trivial dependency. So we decompose above schema, keeping it lossless. Only possible lossless decomposition is: ac and cb. (because, their intersection c is primary key for the 2nd table). But clearly the dependency ab->c is lost. Proved.

Task 2.

Unit ID	Student ID	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

Unit ID	Student ID	Grade
U1	St1	4.7
U2	St1	5.1
U1	St4	4.3
U5	St2	4.9
U4	St2	5.0

Tutor ID	TutEmail
Tut1	tut1@fhbb.ch
Tut3	tut3@fhbb.ch
Tut5	tut5@fhbb.ch

Book	Topic
Deumlich	GMT
Zehnder	GIn
Dümmlers	PhF
SwissTopo	AVQ

Unit ID	Date	Tutor ID	Room
U1	23.02.03	Tut1	629
U2	18.11.02	Tut3	631
U5	05.05.03	Tut3	632
U4	04.07.03	Tut5	621

Unit ID	Topic
U1	GMT
U2	GIn
U5	PhF
U4	AVQ

Task 3

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	ProjectManager	Position
Project1	Manager1	CTO
Project2	Manager2	CTO2

Task 4

Faculties have a number of specialities, each speciality consists of a set of particular groups.

Group	Faculty	Specialty
G1	F1	S1
G2	F2	S2

Specialty	Group
S1	G1
S2	G2

Faculty	Specialty
F1	S1
F2	S2

Task 5

Curator depends on projectID and related departments, teamSize directly relates to project and related departments, ProjectGroupsNumber depends on TeamSize

ProjectID	Department	TeamID	Curator
P1	D1	T1	E1
P2	D2	T2	E2

TeamID	TeamSize	ProjectGroupsNumber
T1	100	5
T2	120	6

Task 6

The three design goals are lossless-join decompositions, dependency preserving decompositions, and 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.

Lossless Decomposition(desirable decomposition)
Decomposition is lossless if it is feasible to reconstruct relation R from decomposed tables using Joins. This is the preferred choice. The information will not lose from the relation when decomposed. The join would result in the same original relation.

Example:

EmpInfo (Emp_ID, Emp_Name, Emp_Age, Emp_Location, Dept_ID, Dept_Name)

Decompose the above table into two tables:

EmpDetails (Emp_ID, Emp_Name, Emp_Age, Emp_Location)

DeptDetails (Dept_ID, Emp_ID, Dept_Name)

Now, if we join above two tables we receive the initial table **EmpInfo**. Therefore, the above relation had lossless decomposition i.e. no loss of information.

Lossy Decomposition(undesirable decomposition)

As the name suggests, when a relation is decomposed into two or more relational schemas, the loss of information is unavoidable when the original relation is retrieved.

***Example*:**

EmpInfo (Emp_ID, Emp_Name, Emp_Age, Emp_Location, Dept_ID, Dept_Name)

Decompose the above table into two tables:

EmpDetails (Emp_ID, Emp_Name, Emp_Age, Emp_Location)

DeptDetails (Dept_ID, Dept_Name)

Now, you won't be able to join the above tables, since **Emp_ID** isn't part of the **DeptDetails** relation.

Therefore, the above relation has lossy decomposition.