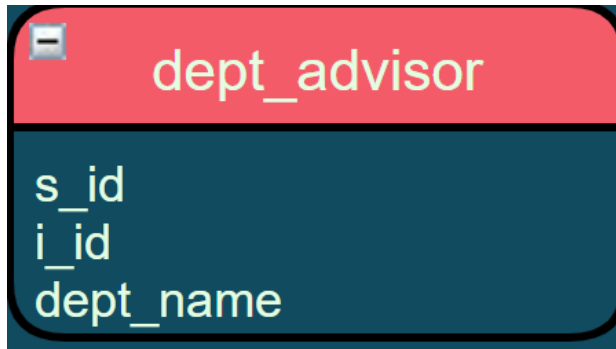


1.

It is not always possible to achieve both BCNF and dependency preservation.



Function dependencies:

$i_id \rightarrow dept_name$

$s_id, dept_name \rightarrow i_id$

Any decomposition will not preserve $s_id, dept_name \rightarrow i_id$ functional dependent.

2.

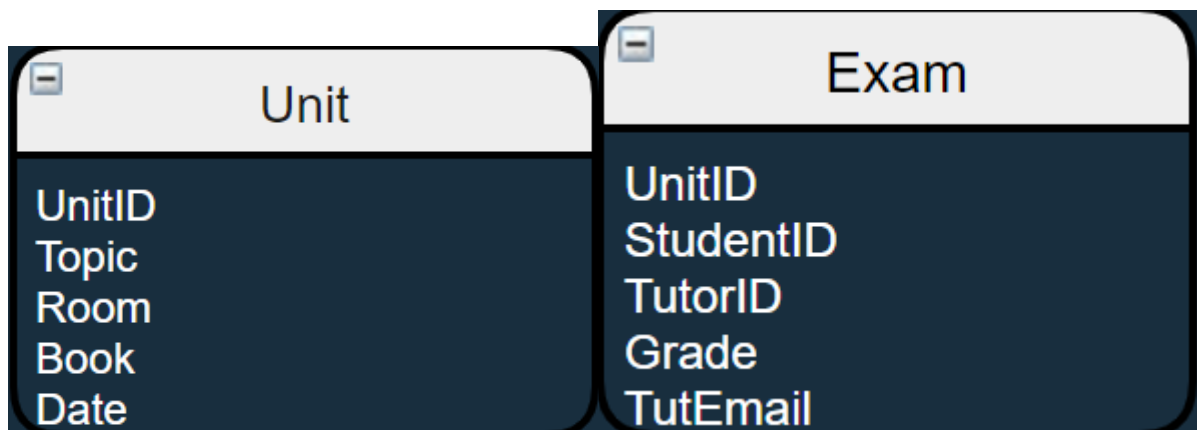
UnitID	StudentID	Date	Tutor ID	Topic	Room	Grade	Book	TutEmail
U1	St1	23.02.03	Tut1	GMT	629	4.7	Deumlich	tut1@fhbb.ch
U2	St1	18.11.02	Tut3	Gln	631	5.1	Zehnder	tut3@fhbb.ch
U1	St4	23.02.03	Tut1	GMT	629	4.3	Deumlich	tut1@fhbb.ch
U5	St2	05.05.03	Tut3	PhF	632	4.9	Dümmli	tut3@fhbb.ch
U4	St2	04.07.03	Tut5	AVQ	621	5.0	SwissTopo	tut5@fhbb.ch

To get this table to 3NF, first we have to convert it to 2NF.

We have primary key (UnitID, StudentID), but Topic, Room, Book, Date only depends on UnitID:

UnitID \rightarrow Topic, Room, Book, Date

That's why we have partial dependency. To fix it we should decompose this table to:

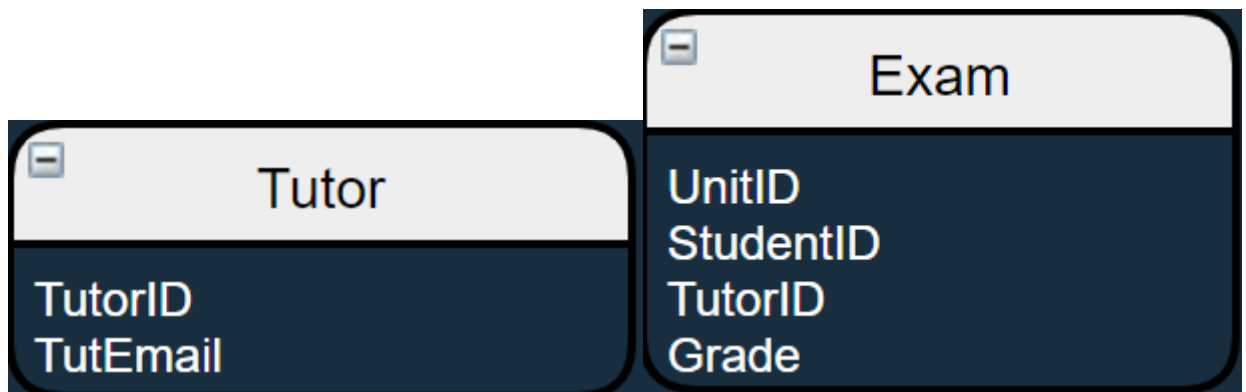


Now our table is in the 2NF.

We can see that TutEmail depends only on the TutorID, but TutorID and TutEmail are non-prime attributes:

TutorID \rightarrow TutEmail

This is Transitive Dependence, we have to get rid of it to get our table in 3NF, also we can do it by decomposing our table:



Now our table in 3NF

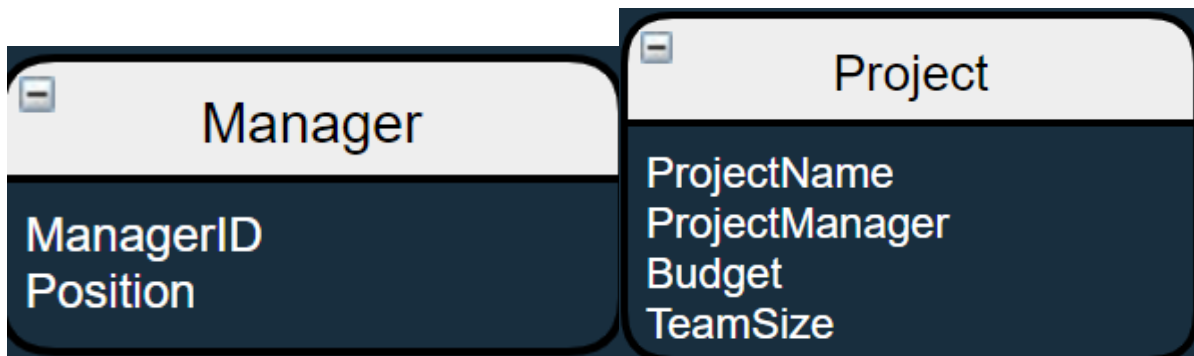
3.

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

We have primary key (ProjectName, ProjectManager). Attribute Position depends on only ProjectManager:

ProjectManager → Position

This is partial dependency, we have to delete it by decomposition:



Now our table in 2NF.

4.

Group	Faculty	Speciality
g1	f1	s1
g2	f2	s2

To get our table to 3NF we have to delete the Transitive Dependence. Speciality depends on the Faculty:

Faculty \rightarrow Speciality

Decomposing gives us:

GroupFac	SpecFac
Group Faculty	Speciality Faculty

5.

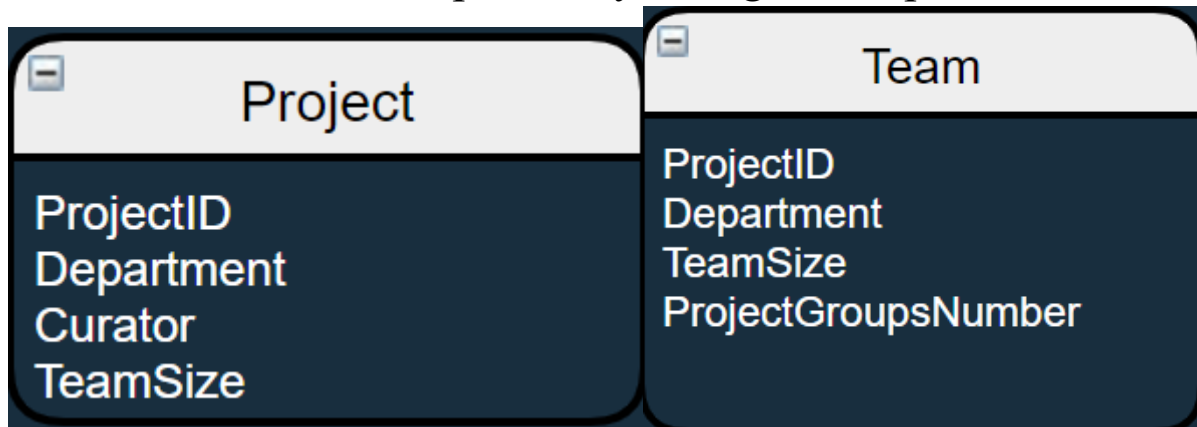
ProjectID	Department	Curator	TeamSize	ProjectGroupsNumber
p1	d1	e1	100	5
p2	d2	e2	120	6

We have this functional dependencies:

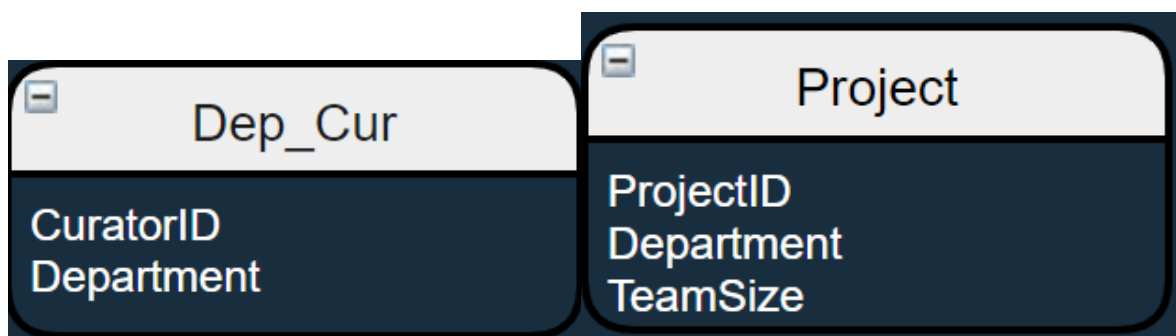
1) TeamSize \rightarrow ProjectGroupsNumber

2) Curator \rightarrow Department

1. TeamSize isn't prime attribute, that's why it is not satisfies 3NF, it's Transitive Dependency, using decomposition:



2. Because Department is prime attribute, it's not allowed in BCNF, decomposition gives us:



Now our table in BCNF.