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

Proof with schema

* R=(A, B, C)

With function dependencies:

* B → C
* A, C →B

R is not in BCNF

* B is not a superkey.

Any decomposition of R will not include all the attributes in

* A, C → B

Thus, the composition is not be dependency preserving

advantages: we may have to use null values to represent some of the possible meaningful relationships among data items. There is the 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](mailto:tut1@fhbb.ch) |
| U2 | St1 | 18.11.02 | Tut3 | GIn | 631 | 5.1 | Zehnder | [tut3@fhbb.ch](mailto:tut3@fhbb.ch) |
| U1 | St4 | 23.02.03 | Tut1 | GMT | 629 | 4.3 | Deumlich | [tut1@fhbb.ch](mailto:tut1@fhbb.ch) |
| U5 | St2 | 05.05.03 | Tut3 | PhF | 632 | 4.9 | Dümmlers | [tut3@fhbb.ch](mailto:tut3@fhbb.ch) |
| U4 | St2 | 04.07.03 | Tut5 | AVQ | 621 | 5.0 | SwissTopo | [tut5@fhbb.ch](mailto:tut5@fhbb.ch) |

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| --- | --- | --- | --- | --- | --- |
| **StudentID** | UnitID | **Date** | **Tutor ID** | **Topic** | **Grade** |
| St1 | U1 | 23.02.03 | Tut1 | GMT | 4.7 |
| St1 | U2 | 18.11.02 | Tut3 | GIn | 5.1 |
| St4 | U1 | 23.02.03 | Tut1 | GMT | 4.3 |
| St2 | U5 | 05.05.03 | Tut3 | PhF | 4.9 |
| St2 | U4 | 04.07.03 | Tut5 | AVQ | 5.0 |

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| Tut3 | [tut3@fhbb.ch](mailto:tut3@fhbb.ch) |
| Tut5 | [tut5@fhbb.ch](mailto:tut5@fhbb.ch) |

|  |  |  |
| --- | --- | --- |
| UnitID | **Topic** | **Room** |
| U1 | GMT | 629 |
| U2 | GIn | 631 |
| U1 | GMT | 629 |
| U5 | PhF | 632 |
| U4 | AVQ | 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** | **Budget** | TeamSize |
| Project1 | 1 kk $ | 15 |
| Project2 | 1.5 kk $ | 12 |

|  |  |
| --- | --- |
| **ProjectName** | **Manager\_ID** |
| Project1 | Manager\_id1 |
| Project2 | Manager\_id2 |

|  |  |  |
| --- | --- | --- |
| **Manager\_ID** | **ProjectManager** | Position |
| Manager\_id1 | Manager1 | CTO |
| Manager\_id2 | 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** |

|  |  |
| --- | --- |
| **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** | **Department** | **Curator** | **TeamSize** | **ProjectGroupsNumber** |
| **p1** | **d1** | **e1** | **100** | **5** |
| **p2** | **d2** | **e2** | **120** | **6** |

|  |  |  |  |
| --- | --- | --- | --- |
| **ID** | **ProjectID** | **Department** | **Curator** |
| **Id1** | **p1** | **d1** | **e1** |
| **Id2** | **p2** | **d2** | **e2** |

|  |  |  |
| --- | --- | --- |
| **ID** | **Team\_id** | **TeamSize** |
| **Id1** | **T1** | **100** |
| **Id2** | **T2** | **120** |

|  |  |
| --- | --- |
| **Team\_id** | **ProjectGroupsNumber** |
| **T1** | **5** |
| **T2** | **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

* lossless-join decompositions
* dependency preserving decompositions
* minimization of repetition of information.

They are desirable so we can maintain an accurate database, check correctness of up- dates quickly, and use the smallest amount of space possible.

Example:

R=(A,B,C)

F = {A → B

B → C}

Key = {A}

R is not in BCNF

Decomposition R1 = (A, B), R2 = (B, C)

• R1 and R2 in BCNF

• Lossless-join decomposition

• Dependency preserving

If we cannot reconstruct the original given relation, lose info and so, this is a lossy decomposition.