**TASK1:** Will the conversion to BCNF be dependency preserving in any case? Proof your statement and give a reasoning for choosing BCNF design.

**Proof:**

We only need to give a counter example: Consider the following schema;

a b c and c-> b

Clearly the above schema is in 3NF, because ab ->c is a superkey 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.

Hence, proved.

**TASK2:** Given table in 1NF, convert to 3NF if PK is UnitID.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UnitID | **Date** | **Tutor ID** | **Topic** | **Room** |
| U1 | 23.02.03 | Tut1 | GMT | 629 |
| U2 | 18.11.02 | Tut3 | GIn | 631 |
| U4 | 04.07.03 | Tut5 | AVQ | 621 |
| U5 | 05.05.03 | Tut3 | PhF | 632 |

|  |  |  |
| --- | --- | --- |
| **StudentID** | UnitID | **Grade** |
| St1 | U1 | 4.7 |
| St1 | U2 | 5.1 |
| St2 | U4 | 5.0 |
| St2 | U5 | 4.9 |
| St4 | U1 | 4.3 |

|  |  |
| --- | --- |
| **Topic** | **Book** |
| GMT | Deumlich |
| GIn | Zehnder |
| PhF | Dümmlers |
| AVQ | SwissTopo |

|  |  |
| --- | --- |
| **Tutor ID** | **TutEmail** |
| Tut1 | [tut1@fhbb.ch](mailto:tut1@fhbb.ch) |
| Tut3 | [tut3@fhbb.ch](mailto:tut3@fhbb.ch) |
| Tut5 | [tut5@fhbb.ch](mailto:tut5@fhbb.ch) |

**TASK3:** Given table in 1NF, convert to 2NF if PK is {ProjectName, ProjectManager} use decomposition:

|  |  |  |  |
| --- | --- | --- | --- |
| **ProjectName** | **ProjectManager** | **Budget** | TeamSize |
| Project1 | Manager1 | 1 kk $ | 15 |
| Project2 | Manager2 | 1.5 kk $ | 12 |

|  |  |
| --- | --- |
| **ProjectManager** | Position |
| Manager1 | CTO |
| Manager2 | CTO2 |

**TASK4:** Given table, convert to 3NF id PK is Group, use decomposition:

|  |  |  |
| --- | --- | --- |
| **Group** | **Faculty** | **Speciality** |
| **g1** | **f1** | **s1** |
| **g2** | **f2** | **s2** |

|  |  |
| --- | --- |
| **Faculty** | **Speciality** |
| **f1** | **s1** |
| **f2** | **s2** |

|  |  |
| --- | --- |
| **Group** | **Speciality** |
| **g1** | **s1** |
| **g2** | **s2** |

**TASK5:** Given table, convert to BCNF if PK is {ProjectID, Department}, use decomposition:

|  |  |  |
| --- | --- | --- |
| **ProjectID** | **Curator** | **TeamSize** |
| **p1** | **e1** | **100** |
| **p2** | **e2** | **120** |

|  |  |
| --- | --- |
| **ProjectID** | **Department** |
| **p1** | **d1** |
| **p2** | **d2** |

|  |  |
| --- | --- |
| **TeamSize** | **ProjectGroupsNumber** |
| **100** | **5** |
| **120** | **6** |

**TASK6:** 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, and minimization ofrepetition 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.