Laboratory work 5

1. It’s not always possible to achieve both BCNF and dependency preservation. If we consider a schema: dept\_advisor(s\_ID, i\_ID, department\_name)

* With function dependencies:

I\_ID 🡪 dept\_name

s\_ID, dept\_name 🡪 i\_ID

* dept\_advisor is not in BCNF
* i\_ID is not a superkey
* Any decomposition of dept\_advisor will not include all the attributes in

s\_ID, dept\_name 🡪 i\_ID

* Thus, the composition is NOT dependency preserving

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

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| UnitID | StudentID | Date | TutorID | 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 | Dummlers | Tut3@fhbb.ch |
| U4 | St2 | 04.07.03 | Tut5 | AVQ | 621 | 5.0 | Swiss lopo | Tut5@fhbb.ch |

2NF Form:

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| UnitID | StudentID | Date | TutorID | Topic | Room | Grade | Book |
| U1 | St1 | 23.02.03 | Tut1 | GMT | 629 | 4.7 | Deumlich |
| U2 | St1 | 18.11.02 | Tut3 | GIn | 631 | 5.1 | Zehnder |
| U1 | St4 | 23.02.03 | Tut1 | GMT | 629 | 4.3 | Deumlich |
| U5 | St2 | 05.05.03 | Tut3 | PhF | 632 | 4.9 | Dummlers |
| U4 | St2 | 04.07.03 | Tut5 | AVQ | 621 | 5.0 | Swiss lopo |

|  |  |
| --- | --- |
| TutorID | TutEmail |
| Tut1 | tut1@fhbb.ch |
| Tut3 | tut3@fhbb.ch |
| Tut5 | tut5@fhbb.ch |

3NF Form:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| UnitID | StudentID | Date | Room | Grade | TopicID | TutorID |
| U1 | St1 | 23.02.03 | 629 | 4.7 | Top1 | Tut1 |
| U2 | St1 | 18.11.02 | 631 | 5.1 | Top2 | Tut3 |
| U1 | St4 | 23.02.03 | 629 | 4.3 | Top1 | Tut1 |
| U5 | St2 | 05.05.03 | 632 | 4.9 | Top3 | Tut3 |
| U4 | St2 | 04.07.03 | 621 | 5.0 | Top4 | Tut5 |

|  |  |  |
| --- | --- | --- |
| TopicID | Topic | Book |
| Top1 | GMT | Deumlich |
| Top2 | GIn | Zehnder |
| Top3 | PhF | Dümmlers |
| Top4 | AVQ | SwissTopo |

|  |  |
| --- | --- |
| TutorID | TutEmail |
| Tut1 | tut1@fhbb.ch |
| Tut3 | tut3@fhbb.ch |
| Tut5 | tut5@fhbb.ch |

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

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ProjectName | ProjectManager | Position | Budget | TeamSize |
| Project1 | Manager1 | СТО | 1 kk $ | 15 |
| Project2 | Manager2 | СТО2 | 1.5 kk $ | 12 |

Solution:

|  |  |
| --- | --- |
| ProjectName | ProjectManager |
| Project1 | Manager1 |
| Project2 | Manager2 |

|  |  |  |
| --- | --- | --- |
| ProjectManager | Position | TeamSize |
| Project1 | СТО | 15 |
| Project2 | СТО2 | 12 |

|  |  |
| --- | --- |
| ProjectName | Budget |
| Project1 | 1 kk $ |
| Project2 | 1.5 kk $ |

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

|  |  |  |
| --- | --- | --- |
| Group | Faculty | Speciality |
| G1 | F1 | S1 |
| G2 | F2 | S2 |
|  |  |  |

|  |  |  |
| --- | --- | --- |
| Group | GroupName | Speciality |
| G1 | Group1 | S1 |
| G2 | Group2 | S2 |

|  |  |
| --- | --- |
| Faculty | FacultyName |
| F1 | FIT |
| F2 | MKM |

|  |  |  |
| --- | --- | --- |
| Speciality | SpecialityName | Faculty |
| S1 | IS | F1 |
| S2 | Mathematical and computer modeling | F2 |

1. Given table, convert to BCNF if PK is {ProjectID, Department}, use decomposition

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ProjectID | Department | Curator | TeamSize | ProjectsGroupNumber |
| P1 | D1 | E1 | 100 | 5 |
| P2 | D2 | E2 | 120 | 6 |

|  |  |
| --- | --- |
| Department | Curator |
| D1 | E1 |
| D2 | E2 |

|  |  |
| --- | --- |
| Department | Curator |
| D1 | E1 |
| D2 | E2 |

|  |  |  |
| --- | --- | --- |
| ProjectID | Curator | TeamID |
| P1 | E1 | T1 |
| P2 | E2 | T2 |

|  |  |  |
| --- | --- | --- |
| TeamID | TeamSize | ProjectsGroupNumber |
| T1 | 100 | 5 |
| T2 | 120 | 6 |

1. Three design goals for relational database: **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.