CPSC 304 - Tutorial 5 FDs, Keys, Normal Forms

Tristan Rice, 25886145, q7w9a

Consider the following relation scheme and FDs.

StudentInfo(StudNo, StudName, Major, Advisor, CourseNo, Ctitle, InstrucName, InstrucLocn, Grade)

given the following functional dependencies:

1. StudNo → StudName
2. CourseNo → Ctitle,InstrucName
3. InstrucName → InstrucLocn
4. StudNo,CourseNo,Major → Grade
5. StudNo,Major → Advisor
6. Advisor → Major

Now, answer the following questions.

(a) Give an instance of StudentInfo (i.e., a relation) that illustrates insertion, deletion, and update anomalies.

StudNo	StudName	Major	Advisor	CourseNo	Ctitle	InstrucName	InstrucLocn	Grade
1	Bob	CS	Jill	MH123	Pasta	Greg	O312	89
2	Phil	CS	Carie	MH123	Pasta	Greg	O312	89
3	Miranda	CS	Steve	MH123	Pasta	Greg	O312	89

- Update anomaly: What if we want to change the instructor for CourseNo MH123?
- Insert anomaly: What if we want to say that instructor Jerome has an InstrucLocn of O231?
- Deletional anomaly: If we remove all students from MH123, we lose all information about MH123 and instructor Greg.

(b) Find all keys and prove that you have found them all.

StudNo has to be included in all keys since it's required to find StudName, and nothing returns it. CourseNo is required to find Ctitle and Grade, and nothing returns it.

Partial key (combines 1, 2, 3): StudNo, CourseNo → StudName, Ctitle, InstrucName, InstrucLocn

4, 5 require Major and provides Advisor. 6 requires Advisor and provides Major.

Thus the two keys are: * StudNo, CourseNo, Major * StudNo, CourseNo, Advisor

(c) Find a minimal cover for this set of FDs.

1. StudNo → StudName
2. CourseNo → Ctitle
3. CourseNo → InstrucName
4. InstrucName → InstrucLocn
5. StudNo,CourseNo,Major → Grade
6. StudNo,Major → Advisor
7. Advisor → Major

(d) Obtain a lossless-join BCNF decomposition of StudentInfo.

StudentInfo(StudNo, StudName)

CourseInfo(CourseNo, Ctitle, InstrucName)

InstructorInfo(InstrucName, InstrucLocn)

Grade(StudNo, CourseNo, Major, Grade)

StudentAdvisor(StudNo, Advisor)

AdvisorMajor(Advisor, Major)

(e) Obtain a lossless-join dependency-preserving 3NF decomposition of StudentInfo by making use of the BCNF decomposition in (d).

StudentInfo(StudNo, StudName)

CourseInfo(CourseNo, Ctitle, InstrucName)

InstructorInfo(InstrucName, InstrucLocn)

Grade(StudNo, CourseNo, Major, Grade)

StudentAdvisor(StudNo, Advisor, Major)

(f) Obtain a lossless-join dependency-preserving 3NF decomposition of StudentInfo via synthesis by making use of your minimal cover in (c). Comment on the differences, if any, between your answers to (e) and (f).

R1(StudNo, StudName)

R2(CourseNo, Ctitle)

R3(CourseNo, InstrucName)

R4(InstrucName, InstrucLocn)

R5(StudNo, CourseNo, Major, Grade)

R6(StudNo, Major, Advisor)

R7(Advisor, Major)

The synthesis has more relations then the decomposition, because the decomposition reduces to relations that satisfy 3NF. However, those relations can be split and still satisfy 3NF.