Normalization example sample solution

Enrollment (StudentID , courseID , course_Instructor , Student_Name , Student_Degree , Student_ADD , course_Name , Instructor_Name , Instructor_Office , Grade)

StudentSupervisor (StudentID* , specialization , supervisor)

• First Normal Form:

Enrollment relation is not in the first Normal Form because the Attribute Student_Degree is not Atomic.

So we decompose as following:

Enrollment (StudentID , courseID , course_Instructor , course_Name Student_Name , Student_ADD, Instructor_Name , Instructor_Office , Grade)

Student_Degree (StudentID* , courseID*, StudentDegree)

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The resulted relations will be:

Enrollment (StudentID , courseID , course_Instructor , course_Name Student_Name , Student_ADD, Instructor_Name , Instructor_Office , Grade)

Student_Degree (StudentID* , courseID*, StudentDegree)

StudentSupervisor (StudentID* , specialization , supervisor)

• Second Normal Form:

1- First we state the FDs for the Enrollment relation

StudentID , courseID ➔ , Grade √

StudentID ➔ Student_Name , Student_ADD . **X**

courseID ➔ course_Name , course_Instructor , Instructor_Name , Instructor_Office , **X**

Enrollment relation is not in the second normal form because only grade attribute is fully functionally dependent on the primary key. However, Student_Degree and StudentSupervisor relations are both in the second normal form.

2- second we decompose:

Course_grade (StudentID , CourseID , Grade)

Student (StudentID *, Student_Name , Student_ADD)

course (courseID* , course_Name , course_Instructor , Instructor_Name , Instructor_Office)

the resulted relations will be :

Course_grade (StudentID , CourseID , Grade)

Student (StudentID *, Student_Name , Student_ADD)

course (courseID* , course_Name , course_Instructor , Instructor_Name , Instructor_Office ,.)

StudentSupervisor (StudentID* , specialization , supervisor)

Student_Degree (StudentID* , courseID*, Student_Degree)

• Third Normal Form:

Course_garde (StudentID , CourseID , Grade) √

Student (StudentID *, Student Name , Student ADD) √

course (courseID* , course_Name , Instructor_Name , Instructor_Office , course_Instructor.) X

This relation is not in the Third Normal Form because

courseID ➔ course_Instructor

course_Instructor ➔ Instructor_Name , Instructor_Office.

Therefore we decompose the relation into :

Course_ Instructor (courseID , course_Name , course_Instructor*)

Instructor (course_Instructor, Instructor_Name , Instructor_Office)

Student_Degree (StudentID* , courseID*, Student_Degree) √

StudentSupervisor (StudentID* , specialization , supervisor) √

The resulted relations:

Course_garde (StudentID , CourseID , Grade)

Student (StudentID *, Student Name , Student ADD)

Course_ Instructor (courseID , course_Name , course_Instructor*)

Instructor (course_Instructor, Instructor_Name , Instructor_Office)

Student_Degree (StudentID* , courseID*, Student_Degree)

StudentSupervisor (StudentID* , specialization , supervisor)

- **BCNF**

Course_garde (<u>StudentID</u> , <u>CourseID</u> , Grade) √

Student (<u>StudentID</u> *, Student Name , Student ADD) √

Course_ Instructor (<u>courseID</u> , course_Name , course_Instructor) √

Instructor (course_Instructor, Instructor_Name , Instructor_Office) √

Student_Degree (<u>StudentID*</u> , <u>courseID*</u>, <u>Student_Degree</u>) √

StudentSupervisor (<u>StudentID*</u> , <u>specialization</u> , supervisor) **X**

Because:

supervisor➜ specialization

and specialization is a part of the primary key

we decompose the relation into the following:

Student_ specialization (<u>StudentID*</u> , <u>specialization</u>)

Supervisor_ specialization (<u>supervisor</u> ,specialization*)

The resulted relations :

Course_garde (<u>StudentID</u> , <u>CourseID</u> , Grade)

Student (<u>StudentID</u> *, Student Name , Student ADD)

Course_ Instructor (<u>courseID</u> , course_Name , course_Instructor*)

Instructor (<u>course_Instructor</u>, Instructor_Name , Instructor_Office)

Student_Degree (<u>StudentID*</u> , <u>courseID*</u>, <u>Student_Degree</u>)

Student_ specialization (<u>StudentID*</u> , <u>specialization</u>)

Supervisor_ specialization (<u>supervisor</u> ,specialization*)