Databases – Normalization

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Exercises 3

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1 Normal Forms

1.1 Functional dependencies

1. Suppose we have the following relation Enrolled(Ssn, Student_name, Course_num, Course_name). Students have unique Ssn and possibly not unique name. Courses have unique Course_num and possibly not unique title. Each tuple in the relation encodes that one student is enrolled to the given course. What are all of the non-trivial functional dependencies for relation Enrolled.

   (a) $Ssn \rightarrow Student\_name$

   (b) $Ssn \rightarrow Course\_num$, $Course\_num \rightarrow Course\_title$

   (c) $Student\_name \rightarrow Ssn$, $Course\_title \rightarrow Course\_num$

   (d) $Course\_num \rightarrow Ssn$

2. Suppose we have the relation R(A,B,C,D) and the following functional dependencies $AB \rightarrow C$, $AE \rightarrow D$, $D \rightarrow B$,

   Which of the following attribute pairs is a key for R?

   (a) AC

   (b) AB

   (c) AD

   (d) AE

3. Consider a relation R(A,B,C,D,E) and the following set of functional dependencies $F = \{A \rightarrow B, BC \rightarrow D, D \rightarrow E\}$ Which of the following groups of attributes is a key.

   (a) AB

   (b) BC

   (c) AC

4. It's given a relation R(A,B,C,D,E) and the set of functional dependencies $F = \{AB \rightarrow E, C \rightarrow D, E \rightarrow A\}$

   (a) Find all candidate keys.

   (b) Is this relation in BCNF?

1.2 BCNF

1. Suppose it is given a relation R(A,B,C,D,E,F,G) with the following functional dependencies: $A \rightarrow B$, $C \rightarrow AD$, $CE \rightarrow B$, $EF \rightarrow C$

   - Find which groups of attributes are keys of the Relation R

- Find the Boyce-Codd Normal Form (BCNF) decomposition of R. Clarify each step you make in your computation, by showing the relation to which you apply the decomposition and the violation of BCNF that you use during that decomposition step.

2. Consider the following relation of students and projects. Detect what dependencies hold in the table considering given tuples and compute BCNF if the relation is not already in BCNF.

Stud_id	Stud_name	Sex	Proj_code	Phone_num
1	John	M	Proj_X	01732349242
2	Sarah	F	Proj_Y	01781392137
3	Larissa	F	Proj_Z	02890032137
4	Alexander	M	Proj_M	01176010371
1	John	M	Proj_X	04276710009
3	Larissa	F	Proj_Z	02890032137