Bases de Dados

RELATIONAL MODEL

MAIN EXERCISE

1. REFS relation is an external view containing all the relevant attributes of a bibliographic references' database.

   REFS (T, A, I, C, S#, R, S, E, V, N, PI, PF, Y, M).

   Referencias[1] (Title, Author, Institution, Email, ISSN#, Journal, Acronym, Editor, Volume, Issue, StartPage, EndPage, Year, Month).

An author belongs to an institution I and has an email C; wrote an article with title T, in a journal R, also known by the acronym S, with the international number S#, edited by E; the article appears in the volume V, number N of the journal, published in year Y and month M, from page PI to page PF. The declared functional dependencies are:

$$\mathbf{D}=\{ \; S \rightarrow S\#, R, E$$
$$S\# \rightarrow S$$
$$S, V, N \rightarrow Y, M$$
$$S, V, N, PI \rightarrow T, PF$$
$$A \rightarrow I, C \}$$

An article may have several authors who, in turn, can write several articles.

a) Is X= S# V N A a key of Referencias? Justify.

b) Obtain a decomposition of Referencias in the third normal form with dependency preservation.

c) Compare the decomposition obtained in b) with the initial relation. What are the advantages of the third normal form?

d) On the Revista[2] (S, S#, R, E) relation, the acronym S and the international series number S# are keys and S is the primary key. Through an example, show that, although this relation is in the third normal form, the definition of a primary key is not enough to assure that functional dependencies are not violated. What ability should the DBMS have to assure this?

e) Check if the obtained decomposition is in the Boyce-Codd Normal Form (BCNF).

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[1] References
[2] Journal

MORE EXERCISES

2) Given the relation R(A,B,C,D,E) and the set of dependencies *F*={AB→C, DE→C, B→D}

   a) Find all the keys for R.

   b) Check if the decomposition R_1(A,B,C), R_2(C,D,E), R_3(B,D) assures a lossless join.

   c) Does the conclusion you have reached on b) changes if you add the relation R_4(A,B,E) to the decomposition?

   d) Obtain a decomposition in the third normal form.

   e) Suppose you decompose the relation R(A,B,C,D,E) in relation S(A,B,C) and other relations. If R functional dependencies are F={A→D,BD→E,AC→E,DE→B}, what is the minimal basis for S functional dependencies?

3) Given the relation R(C,S,J,D,P,Q,V) and the set of functional dependencies F={ JP→C, SD→P, J→S}

   a) Find the keys of relation R.

   b) The decomposition R_1(S,D,P), R_2(J,S), R_3(C,J,D,Q,V) is in the third normal form? Justify. If it's not, obtain a third normal form decomposition of R.

   c) See if the functional dependency JP→C is preserved in the decomposition presented in the previous question.

   d) For the same relation R but, for the set of functional dependencies F_1={C→CSJDPQV, JP→C, SD→P, J→S}, obtain a minimal basis for the full set of functional dependencies.

4) Consider the relation R(CPHSAN), where C is the course, P is the teacher, H is the hour, S is the room, A is the student and N is the grade, and the following referential integrity constraints:

   • Each course has a responsible teacher;

   • In a specific hour, only one course can be at a specific room;

   • A teacher can only be at one room in a certain hour;

   • Each student has only one grade for each course;

   • A student can only be at one room in each moment.

   a) Based on the previous integrity constraints, what is the set of functional dependencies?

   b) What is the key of R?

   c) Decompose R into the third normal form.

   d) Check if any of the relations obtained in the previous decomposition is not in BCNF.