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M.S. Ramaiah Institute of Technology
(Autonomous Institute, Affiliated to VTU)
Department of Computer Science and Engineering

Course Name: Database Systems

Course Code: CS52

Credits: 3:1:0

UNIT 4 - Tutorial

Term: September – December 2020

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Consider R(A,B,C,D,E,G,H) be a relation schema with set of functional dependencies:

F = {AB□C, B□D, CD□E, CE□GH, G□A}. prove the following

Infer AB□E from F

Infer GB□C from F

Infer CE□A from F

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Compute the minimal Cover

Consider the set F of following functional dependencies on relation $R(ABCDE)$:

$$
\begin{aligned}
AB &\rightarrow C \\
BC &\rightarrow E \\
BD &\rightarrow E \\
C &\rightarrow B \\
D &\rightarrow A
\end{aligned}
$$

Consider the relation REFRIG(MODEL#, YEAR, PRICE, MANUF_PLANT, COLOR), which is abbreviated as REFRIG(M, Y, P, MP, C), and the following set F of functional dependencies: $F = \{M \rightarrow MP, \{M, Y\} \rightarrow P, MP \rightarrow C\}$

a. Evaluate each of the following as a candidate key for REFRIG, giving reasons why it can or cannot be a key: {M}, {M, Y}, {M, C}.
b. Based on the above key determination, state whether the relation REFRIG is in 3NF and in BCNF, giving proper reasons.
c. Consider the decomposition of REFRIG into D = {R1(M, Y, P), R2(M, MP, C)}. Is this decomposition lossless? Show why.

Consider the relation R, which has attributes that hold schedules of courses and sections at a university; R = {CourseNo, SecNo, OfferingDept, Credit–Hours, CourseLevel, InstructorSSN, Semester, Year, Days_Hours, RoomNo, NoOfStudents}. Suppose that the following functional dependencies hold on R:

{CourseNo} → {OfferingDept, CreditHours, CourseLevel}

{CourseNo, SecNo, Semester, Year} → {Days_Hours, RoomNo, NoOfStudents, InstructorSSN}

{RoomNo, Days_Hours, Semester, Year} → {Instructorssn, CourseNo, SecNo}

Try to determine which sets of attributes form keys of R. How would you normalize this relation?

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Solution

The closure of K_1 = {Course_no, Sec_no, Semester, Year} under the functional dependencies is the entire R. This is also the case for K_2 = {Room_no, Days_hours, Semester, Year}, and no other set that doesn't already contain K_1 or K_2 as subsets, so these are the two candidate keys.

Start by decomposing it to 2NF. The only FD that is partial on the left and nonkey on the right is {Course_no} → {Offering_dept, Credit_hours, Course_level}, so decompose on that to:

R_1 = {Course_no, Offering_dept, Credit_hours, Course_level}

R_2 = {Course_no, Sec_no, Instructor_ssn, Semester, Year, Days_hours, Room_no, No_of_students}

Neither of these relations have a nonkey attribute transitively dependent on a key, so this is also in 3NF.

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Thank you