B.Sc (Hons) in Information Technology

IT2040 -Database Management Systems

Year 2, Semester 1

Tutorial 03

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Learning outcomes:

- Identify characteristics of functional dependencies
- Define the term schema refinement and its properties
- Compute keys of a relation based on given functional dependencies
- Decompose tables to obtain better schemas by using Normal Forms.

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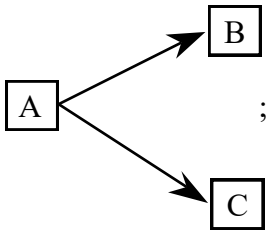
1. Consider the relation X(A,B,C,) is:



; An occurrence of the table is:

A	B	C
a_1	b_1	c_1
a_2	b_2	c_1
a_3	b_2	c_2
a_4	b_2	c_2

The left hand side of the above diagram illustrates the functional dependencies.

i. Suppose a fifth row, starting with a_2 as the value of A, were to be added. What must be the value of attribute B?
ii. What must be the value of attribute C?
iii. Why would the fifth row be illegal?
iv. Can attribute A contain duplicate values?
v. Is attribute A a candidate key?

2. What is meant by the term Schema Refinement?
3. Briefly explain the two properties considered in decomposition during Normalization.
4. Consider the following functional dependencies for a relation R (A, B, C, D, E, F)
   F= {A→*C,* C→D, D→B, E→F}
   Find all keys of R.
5. Consider the following functional dependencies for a relation R(A,B,C,D,E,F),
   F = {AB→C , D C →A E , E →F*}*
   Find all the keys of R.
6. Consider a relation R= (A,B,C,D,) with the following functional dependencies:
   F= {CE →D,D → B,C → A }
   a. Find all candidate keys in R
   b. Which normal for is R in?
   c. If the relation is not in BCNF, convert it to a set of relations in BCNF through decomposition

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7. Consider a relation R (A, B, C, D, E), with the following set of functional dependencies over R:

   F = {A → BC, BC → E, E → DA }

   a. Find all the keys in R.
   b. Is R in BCNF? If R is not in BCNF, convert it to a set of BCNF relations

8. Consider the following functional dependencies for a relation R(A,B,C,D,E),

   F = {AB→C , A B →D, D→A , B C →D , B C →E}

   c. Find all the keys of R.
   d. Is R in BCNF? Give reasons for your conclusion. If R is not in BCNF, convert it to a set of BCNF relations

9. Consider a relation R=(A,B,C,D,E) with the following functional dependencies:

   F= {BC→ADE, D→B}

   a. Find all candidate keys in R
   b. Which normal for is R in?
   c. If the relation is not in BCNF, convert it to a set of relations in BCNF through decomposition