Database Management Systems

ICT1212

1NF, 2NF, 3NF
BCNF
4NF, 5NF

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Lecture 9
Part II

What we are discussing

- Remembering Normal Forms
  - 1NF
  - 2NF
  - 3NF
- Discussing
  - BCNF
  - 4NF
  - 5NF

1NF (First Normal Form)

- To be in the First Normal Form a Relation
  - must only have atomic valued attributes(columns)
  - values stored in an attribute(column) must be of the same domain
  - all the attributes(columns) names in a relation must be unique
  - it doesn't matter the order of the data stored in the relation

1NF (First Normal Form) Example

reg_no	name	name	age	c_id
ICT001	Saman	Perera	22	ICT1213 ICT1242
ICT002	Nimal	Silva	Twenty	ICT1223 ICT1232

Is it in 1NF?

2NF (Second Normal Form)

- To be in the Second Normal Form a Relation
  - it must be in the First Normal Form
  - it must not have Partial Dependency

- What is Partial Dependency?
  - an attribute in a relation depends on only a part of the primary key and not on the whole key

2NF (Second Normal Form) Example

reg_no	c_id	name	grade	c_name
ICT001	ICT1213	Saman	A	DBMS
ICT001	ICT1242	Saman	A	MIS

Is it in 1NF?
Is it in 2NF?

3NF (Third Normal Form)

- To be in the Third Normal Form a Relation
  - it must be in the Second Normal Form
  - it must not have Transitive Dependency

- What is Transitive Dependency?
  - a non-prime attribute depends on other non-prime attributes rather than depending upon the prime attributes or primary key

3NF (Third Normal Form) Example

reg_no	name	d_name	d_head
ICT001	Saman	ICT	Dias
ICT002	Kamal	ET	Fernando

Is it in 1NF?

Is it in 2NF?

Is it in 3NF?

Normalization

- We strive to meet two properties of decomposition during the normalization process
- The nonadditive join or lossless join property
  - which guarantees that the spurious tuple generation problem does not occur with respect to the relation schemas created after decomposition
- The dependency preservation property
  - which ensures that each functional dependency is represented in some individual relation resulting after decomposition

- The nonadditive join property is extremely critical and must be achieved at any cost
- whereas the dependency preservation property, although desirable, is sometimes sacrificed,

BCNF (Boyce-Codd Normal Form)

- BCNF is an extension to the third normal form
- To be in the BCNF Normal Form a Relation
  - it must be in the Third Normal Form
  - for any Functional Dependency X → A holds in Relation, then X is a superkey of Relation

BCNF (Boyce-Codd Normal Form) Example

reg_no	course	lecturer
ICT001	DBMS	Perera
ICT001	MIS	Kamal
ICT002	Networking	Piyal
ICT003	Networking	Silva

Is it in 1NF?

Is it in 2NF?

Is it in 3NF?

Is it in BCNF?

4NF (Fourth Normal Form)

- To be in the 4NF Normal Form a Relation
  - it must be in the BCNForm
  - the relation must not have any Multi-valued Dependency

- What is Multi-valued Dependency?
  - For a given dependency $X \rightarrow Y$ in a relation, if for a single value of X, multiple value of Y exists, then the relation may have multi-valued dependency
  - A relation must have at least 03 columns for it to have a multi-valued dependency
  - For a relation R(X,Y,Z), if there is a multi-valued dependency between, X and Y, then Y and Z must be independent of each other

4NF (Fourth Normal Form) Example

reg_no	course	club
ICT001	DBMS	Nature
ICT001	MIS	Art

Is it in 1NF?

Is it in 2NF?

Is it in 3NF?

Is it in BCNF?

Is it in 4NF?

5NF (Fifth Normal Form)

- To be in the 5NF Normal Form a Relation
  - it must be in the Fourth Normal Form
  - the relation must not have any Join Dependency

- What is Join Dependency?
  - If a table can be recreated by joining multiple tables and each of this table have a subset of the attributes of the table, then the table is in Join Dependency.
  - It is a generalization of Multivalued Dependency

5NF (Fifth Normal Form) Example

SUPPLY

Sname	Part_name	Proj_name
Smith	Bolt	ProjX
Smith	Nut	ProjY
Adamsky	Bolt	ProjY
Walton	Nut	ProjZ
Adamsky	Nail	ProjX
Adamsky	Bolt	ProjX
Smith	Bolt	ProjY

Is it in 1NF? Is it in 2NF? Is it in 3NF?

Is it in BCNF? Is it in 4NF?

Is it in 5NF?

5NF (Fifth Normal Form) Example

R_1

Sname	Part_name
Smith	Bolt
Smith	Nut
Adamsky	Bolt
Walton	Nut
Adamsky	Nail

R_2

Sname	Proj_name
Smith	ProjX
Smith	ProjY
Adamsky	ProjY
Walton	ProjZ
Adamsky	ProjX

R_3

Part_name	Proj_name
Bolt	ProjX
Nut	ProjY
Bolt	ProjY
Nut	ProjZ
Nail	ProjX

Questions ???

Thank You

References

- *Chapter 15 : Fundamentals of Database Systems*

  (6th Edition) By Remez Elmasri & Shamkant B. Navathe