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The process of minimizing data redundancy uses a series of steps. It is called normal forms and is called normalization. The total normalization process includes 8 normal forms.

1. First Normal Form (1NF)
2. Second Normal Form (2NF)
3. Third Normal Form (3NF)
4. Boyce-Codd Normal Form (BCNF)
5. Fourth Normal Form (4NF)
6. Fifth Normal Form (5NF)
7. Domain/Key Normal Form(DKNF)
8. Sixth Normal Form(6NF)

PID	Proj Name	EmpID	Ename	Job	Charge/Hour	Hours Worked
P101	College Maintenance	1001	A	Sr. Programmer	500	3
P101	College Maintenance	1007	K	DBA	750	2
P101	College Maintenance	1003	M	Jr. Programmer	300	5
P102	Hospital Maintenance	1001	A	Sr. Programmer	500	5
P102	Hospital Maintenance	1005	S	DBA	750	3
P102	Hospital Maintenance	1003	M	Jr. Programmer	300	5
P102	Hospital Maintenance	1009	R	Jr. Programmer	300	4

First Normal Form (1NF)

A relation is said to be in the first normal form if and only if a primary key is defined for the relation and all non-key attributes are dependent on key attributes. The attributes that are part of the primary key are called key attributes and all the remaining attributes are called non-key attributes. As an example, observe the following relation that contains information regarding various projects and employees working in those projects.

primary key on a single column since every column can contain
define a primary key on the combination of PID and EMPID Columns. NOW by giving the values of

on PID and EMPID columns.

(PID, EMPID) -> Pname, Ename, Job, Charge/Hour, Hours Worked

Second Normal Form (2NF)

A relation is said to be in 2NF if and only if the relation is in first normal form and no partial dependencies exist in the relation. If a primary key is defined on more than one attribute and a non-key attribute is completely dependent on only one key attribute then that dependency is called a partial dependency. The preceding table, after conversion to 1NF, contains a PID and EMPID combination as the primary key. But to get PNAME there is no need to provide the EMPID. Hence PNAME is partially dependent on key attributes. In the same way, to get ENAME, JOB, CHARGE/HOUR and HOURS WORKED, there is no need to provide the PID. Hence these attributes are also partially dependent on key attributes. The preceding relation is not in 2NF.

To convert the preceding relation to 2NF, we need to divide the table as follows.

(PID)	Pname
(EMPID)	Ename, Job, Charge/Hour
(PID, EMPID)	Hours Worked

Now all three relations are said to be in 2NF, since they don't contain partial dependencies.

Third Normal Form (3NF)

A relation is said to be in 3NF, if and only if the relation is in 2NF and no transient dependencies exist in the relation. If a non-key attribute depends on another non-key attribute, then that dependency is called a transient dependency. In the preceding three tables obtained by converting the table of 1NF to 2NF, the second table contains a CHARGE/HOUR column that was actually dependent on JOB but not on EMPID. To convert this table that was not in 3NF to 3NF, we need to divide the table as follows.

(PID)	Pname
(EMPID)	Ename, Job
(JOB)	Charge/Hour
(PID, EMPID)	Hours Worked

Now all the four tables are in 3NF, since they don't contain transient dependencies.

increase. When no tables increase, the database performance v
 combine the data from more than one table. This is the reason why database designers are

De-Normalization

Converting the tables from their current normal form to their previous normal form is called de-normalization.

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