Second Normal Form

Second Normal Form (2NF)

- Based on the concept of full functional dependency.
- Recall, full functional dependency indicates that if A, B and C are attributes of a relation, and C is fully functionally dependent on the composition of A and B, then C is functionally dependent on A,B but not on any proper subset of A,B.

Second Normal Form (2NF)

- **A table is in second normal form (2NF) if and only if it is in 1NF and every non-key attribute is functionally dependent on the entire primary key and not just on a subset of the primary key (i.e. fully functionally dependent on the primary key).**

1NF to 2NF

- Identify the primary key for the 1NF relation.
- Identify the functional dependencies in the relation.
- If partial dependencies exist on the primary key remove them by placing then in a new relation along with a copy of their determinant.

1NF to 2NF

- The steps involved in transforming a table in first normal form into a set of second normal form tables are as follows:

1. We must separate out the dependent attribute(s) and the determinant into a table of their own. The determinant becomes the primary key of this table.

2. The determinant(s) remains as part of the composite key in the original table.

Example

- Consider the relation EmployeeProject below.

EmployeeProject(PPS, ProjCode, Hours, Name, Title)
Primary key PPS, ProjCode

PPS	ProjCode	Hours	Name	Title
123456789	ABC	32.5	Smith, John	Galaxy
123456789	PQR	7.5	Smith, John	Romeo
333456781	ABC	20	English, Joyce	Galaxy
333456781	XYZ	14	English, Joyce	Alpha
333456781	JKL	6	English, Joyce	Sapphire
345123876	PQR	23	Ryan, Melanie	Romeo
345123876	XYZ	17	Ryan, Melanie	Alpha

EmployeeProject

Example

- PPS, ProjCode → Hours is a *full functional dependency* because neither PPS→ Hours nor ProjCode → Hours.

- However, PPS → Name and ProjCode → Title. The non-key attributes (Name and Title) are partial key dependents.

Example

1. We must separate out the dependent attribute(s) and the determinant into a table of their own. The determinant becomes the primary key of this table.

   Employee(PPS, Name)
   Primary key PPS

   Project(ProjCode, Title)
   Primary key ProjCode

Example

2. The determinant(s) remains as part of the composite key in the original table.

   EmployeeProject(PPS, ProjCode, Hours)

   Primary key PPS, ProjCode

   Foreign key PPS references Employee(PPS)

   Foreign key ProjCode references Project(ProjCode)

Exercise

TempStaffAllocation(staffNo, dCenterNo, name, position, hoursPerWeek)
Primary key staffNo, dCenterNo

TempStaffAllocation

staffNo	dCenterNo	name	position	hoursPerWeek
S4555	D002	Ellen Layman	Assistant	16
S4555	D004	Ellen Layman	Assistant	9
S4612	D002	Dave Sinclair	Assistant	14
S4612	D004	Dave Sinclair	Assistant	10

Exercise

- The relation (TempStaffAllocation) is not in Second Normal Form

  i. Why?

  ii. Explain the steps involved in transforming the relation into Second Normal Form (2NF).

  iii. Transform the relation into a set of Second Normal Form (2NF) relations.