

Document

DocumentID(PK), DeptID(FK), CustomerID(FK), ServiceType, ExpiryDate

First, I propose that we add the issue date as an attribute to Document. This would allow us to easily keep track of when an ID was issued, in the case that a record from the appointment table was deleted.

Document

DocumentID(PK), DeptID(FK), CustomerID(FK), ServiceType, IssueDate, ExpiryDate

First Normal Form

This table is in first normal form as it contains no set valued attributes.

Second Normal Form

A relation R is in 2NF if every non-prime attribute (non CK attribute(s)) of R is fully functionally dependent upon every CK of R.

DeptID, CustomerID, ServiceType, ExpiryDate, and IssueDate are all non-prime attributes, while DocumentID is the only singular prime attribute, in our case the primary key. All attributes in this table are FFD on DocumentID.

So, this table is in Second Normal Form.

Third Normal Form

A relation R is in 3NF if it is in 2NF and has no transitive dependencies.

But, since DocumentID → DeptID, IssueDate and {DeptID, IssueDate} → ExpiryDate, we are left with a transitive dependency. This is because ExpiryDate is a non-prime attribute that is functionally dependent upon the DeptID and IssueDate, both of which are also non-prime attributes.

I propose that to fix this, we alter the document table:

Document

DocumentID(PK), DeptID(FK), CustomerID(FK), ServiceType

And create a new table to track the issue date and expiry date of a specific document:

DocumentExpiry

DocumentID(PK), IssueDate, ExpiryDate

Leaving both the Document table and DocumentExpiry table is 3NF.