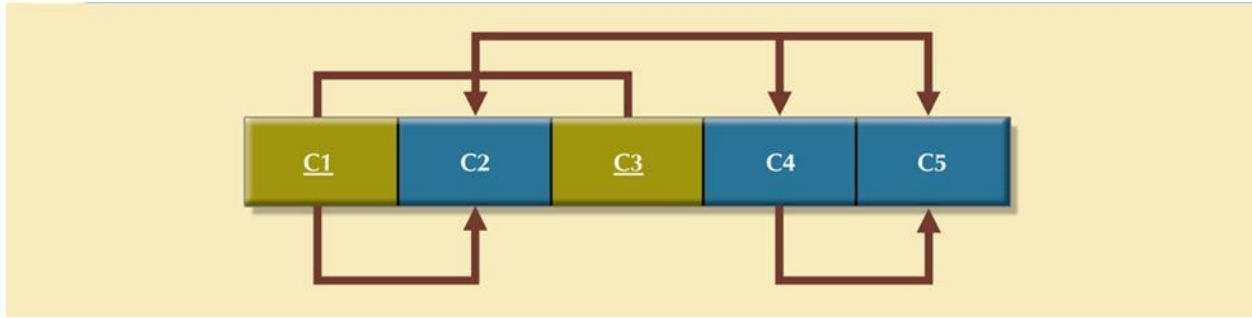


**Question 1 solution:**



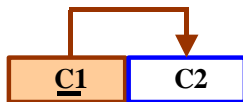
**a. Identify and discuss each of the indicated dependencies.**

$C1 \rightarrow C2$  represents a *partial dependency*, because  $C2$  depends only on  $C1$ , rather than on the entire primary key composed of  $C1$  and  $C3$ .

$C4 \rightarrow C5$  represents a *transitive dependency*, because  $C5$  depends on an attribute ( $C4$ ) that is not part of a primary key.

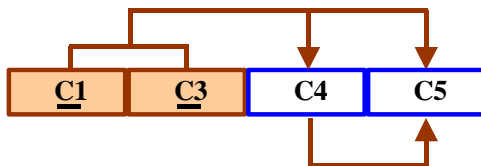
$C1, C3 \rightarrow C2, C4, C5$  represents a set of proper functional dependencies, because  $C2, C4,$  and  $C5$  depend on the primary key composed of  $C1$  and  $C3$ .

**b. Create a database which has all of its tables in 2NF (but not all in 3NF), showing the dependency diagrams for each table.**



**Table 1**

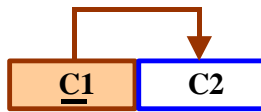
**Primary key:**  $C1$   
**Foreign key:** None  
**Normal form:** 3NF



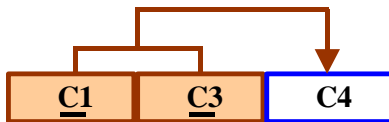
**Table 2**

**Primary key:**  $C1 + C3$   
**Foreign key:**  $C1$  (to Table 1)  
**Normal form:** 2NF, because the table exhibits the transitive dependencies  $C4 \twoheadrightarrow C5$

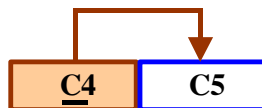
- c. Create a database whose tables are all in 3NF, showing the dependency diagrams for each table.



**Table 1**  
**Primary key:** C1  
**Foreign key:** None  
**Normal form:** 3NF

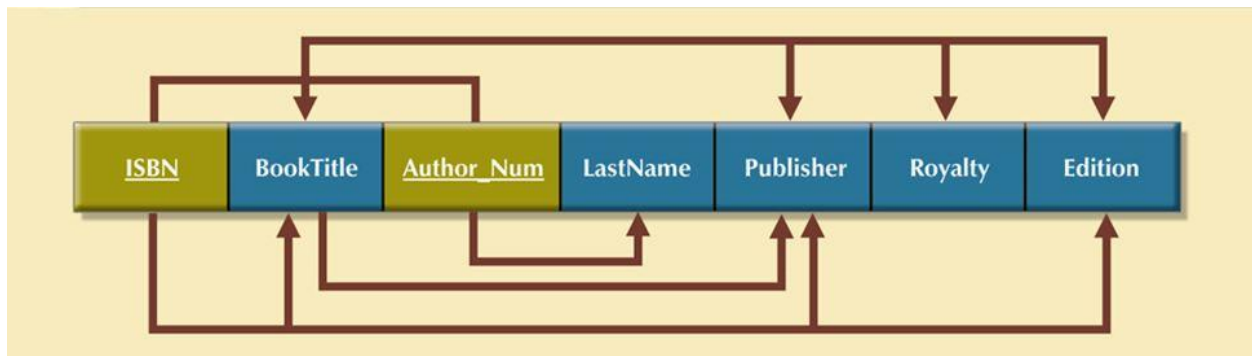


**Table 2**  
**Primary key:** C1 + C3  
**Foreign key:** C1 (to Table 1)  
 C4 (to Table 3)  
**Normal form:** 3NF

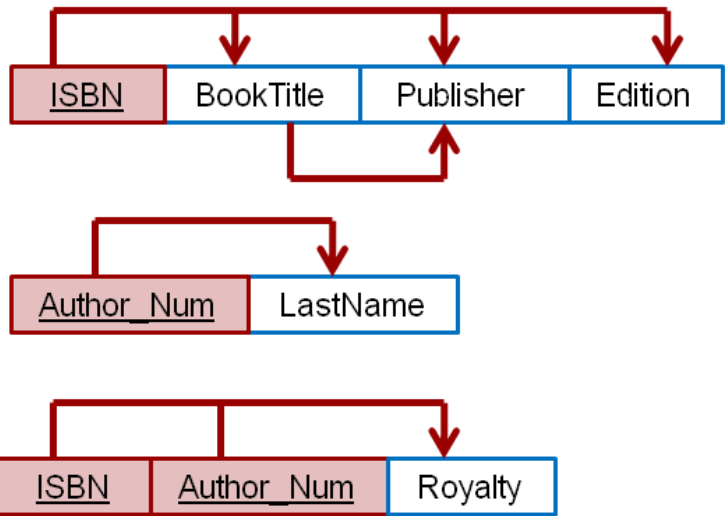


**Table 3**  
**Primary key:** C4  
**Foreign key:** None  
**Normal form:** 3NF

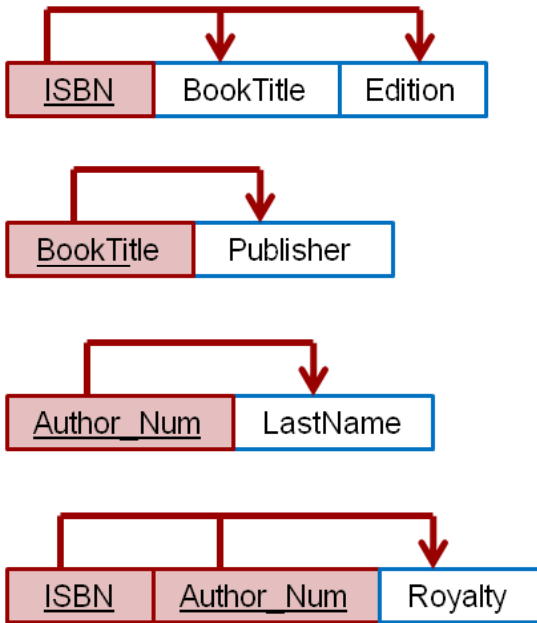
**Question 2 solution:**



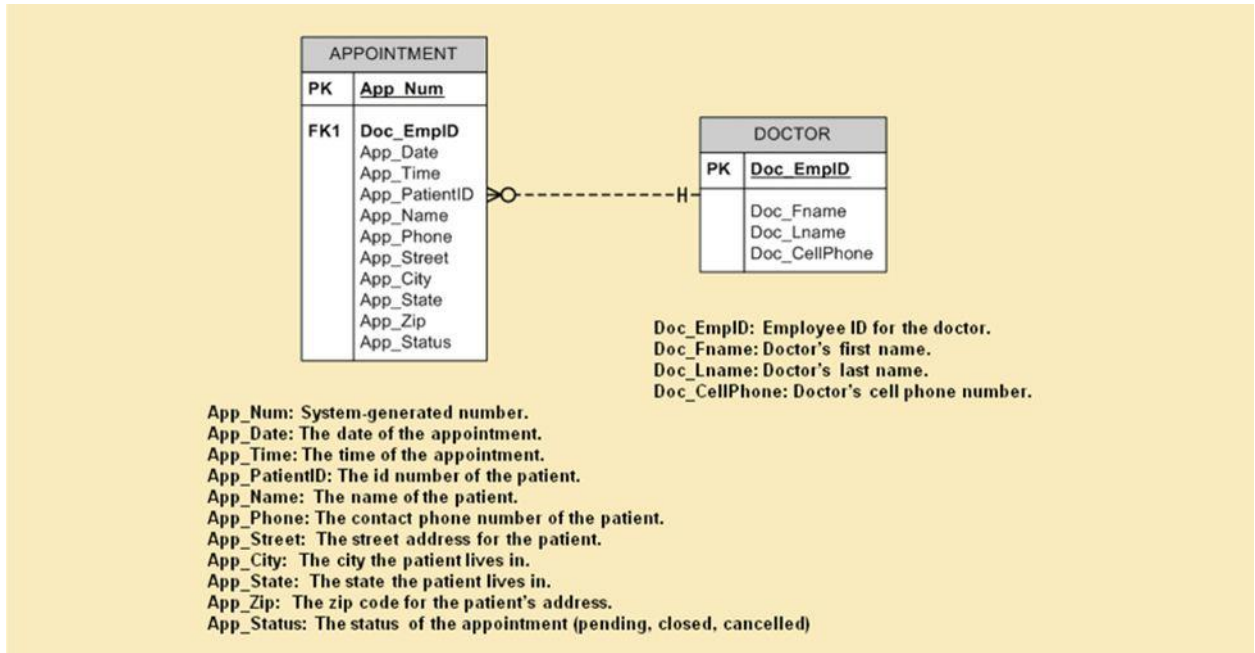
- a. Based on this dependency diagram, create a complete set of tables (in the form of corresponding dependency diagrams) that represent all of the royalty information and that, all together, represent a database that is in 2NF, but not in 3NF.



- b. Now create a new complete set of tables (some of which may be the same as in part (a)) that represent all this royalty information but which are in 3NF. Please be sure to indicate the dependencies.



**Question 3 solution:**

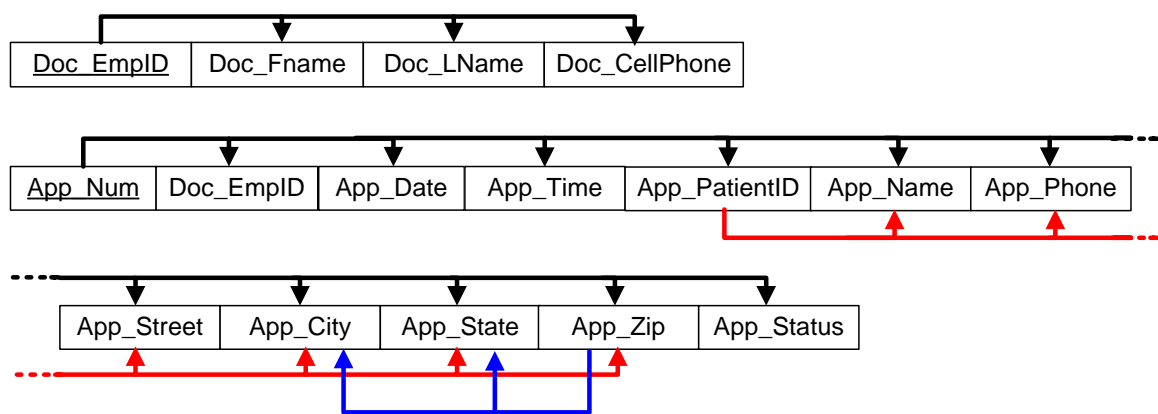


There are no composite keys being used, therefore, by definition, there is not an issue with partial dependencies and the entities are already in 2NF. Based on the descriptions of the attributes, it appears that the patient name, phone number, and address can be determined by the patient id number. Therefore, the following transitive dependency can be determined.

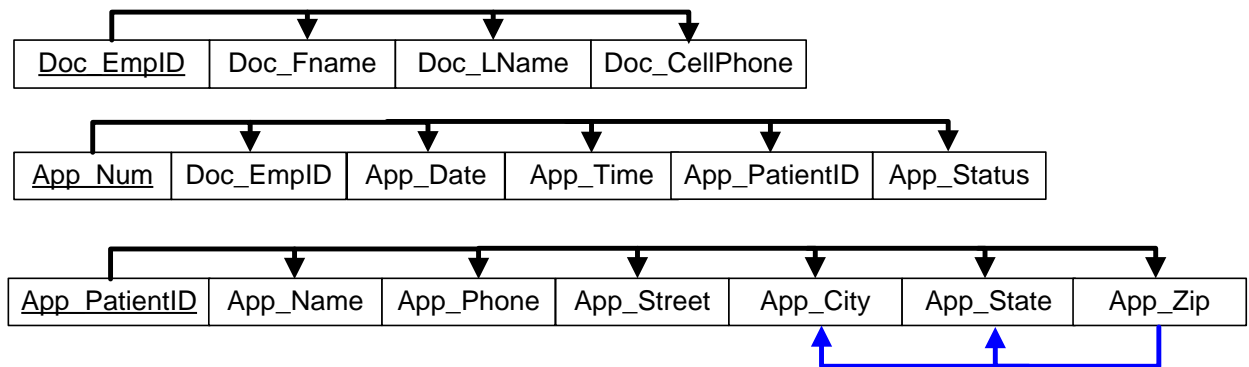
$App\_PatientID \rightarrow (App\_Name, App\_Phone, App\_Street, App\_City, App\_State, App\_Zip)$

As discussed in the chapter, ZIP\_Codes can be used to determine a city and state; therefore, we also have the transitive dependency:

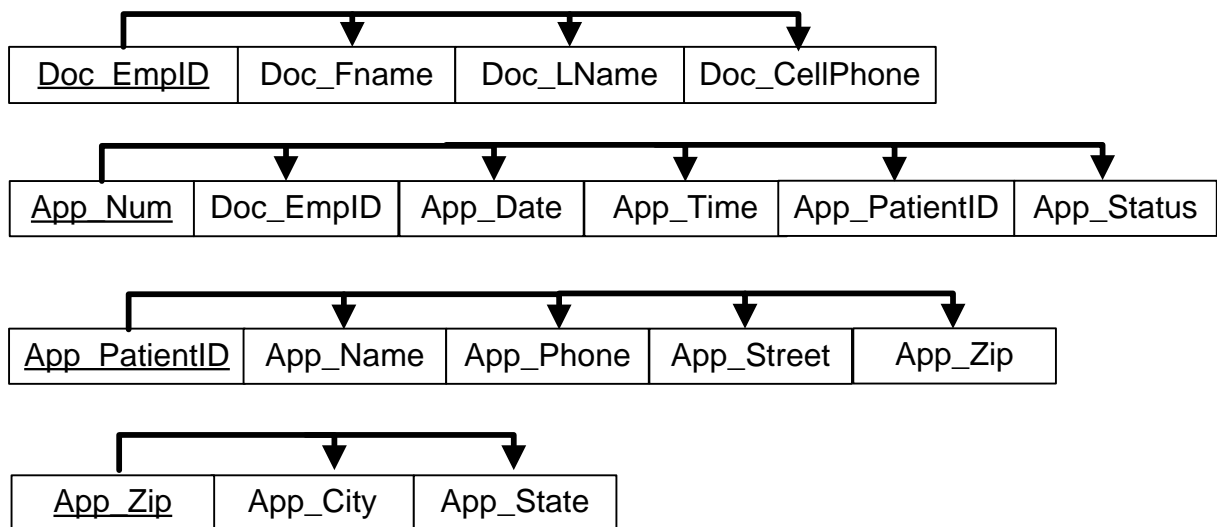
$App\_Zip \rightarrow App\_City, App\_State$



Since the first transitive dependency completely encloses the second transitive dependency, it is appropriate to resolve the first transitive dependency before resolving the second. The following shows the results of resolving the first transitive dependency.



Finally, the second and final transitive dependency can now be resolved as shown in the final dependency diagram below



Note that at this time we have resolved all of the transitive dependencies. Decisions on whether or not to denormalize, and perhaps not remove the final transitive dependency, have yet to be made. Also, the structures have not yet had the benefit of additional design modifications such as achieving proper naming conventions for the attributes in the new tables. However, creating the fully normalized structures is an important set toward making informed decisions about the compromises in the design that we may choose to make.