

N&N Hospital is facing problems in its data organization. As database analyst, you have to normalize following N&N Hospital data up to **4NF**. Elaborate each step you perform with logic and state clearly any other **VALID** assumption that you make.

Doc no.	Name	Address	Phone	Department Id	Designation	Charges Per hour	Patient No.	Patient Name	CNIC	Phone	Room No.	Room Type	Bed No.
D1	Dr.Nadeem	Abc 123	0333-123, 042-123	Neurology	Professor	5000	P1	Kahlid	12345-1	042-1	R2	Normal	B1
							P5	Ahmed	12345-2	042-2			
							P7	Anum	12345-3	042-3	Nil		Nil
D2	Dr.Nadeem	Kb13	0334-124, 0300-123	Orthopedic	Professor	5000	P4	Mehmood	12345-4	042-4	R2	Normal	B1
							P7	Anum	12345-3	042-3	R4	Two bed	B5
							P9	Khawar	12345-6	042-5			B7
D4	Dr.Erum	Ak123	0321-123	ENT/ Neurology	Astt. Professor	3000	P10	Tanweer	12345-7	042-6	Nil		Nil
D5	Dr.Hafeez	Nd123	0321-124	Skin/ Orthopedic	Astt. Professor	3000	P1	Khalid	12345-1	042-1	R5	Special	B8
							P12	Sohail	12345-9	042-8	Nil		Nil
							P13	Ahmed	12346-0	042-9	R6	Special	B9

## Step 1:

The given table is not in 1NF and according to definition a table is said to be in 1 NF if it satisfies:

- Values of each attribute is atomic. An atomic value is a value that cannot be divided.
- All entries in any column must be of the same kind
- Each column must have a unique name
- No two rows are identical

So, after Normalizing it to 1NF we get the following tables (**ASSUMPTION: Department ID is not single-valued**)

- Doctor\_Info\_table (Primary key: Doc no.)
- Doctor\_department\_table
- Doctor\_phone\_table
- Doctor\_patient\_table

**Table 1: Doctor\_Info\_table**

Doc No	Name	Address	Designation	Charges Per Hour
D1	Dr. Nadeem	ABC 123	Professor	5000
D2	Dr. Nadeem	KB 13	Professor	5000
D3	Dr. Erum	AK 123	Astt. Professor	3000
D4	Dr. Hafeez	ND 123	Astt. Professor	3000

Functional dependency (doc no -> name ,address, designation, charges per hour)

**Table 2: Doctor\_Phone\_table**

Doc No	Phone
D1	0333-123
D1	042-123
D2	0334-124
D2	0300-123
D4	0321-123
D5	0321-124

**Table 3: Doctor\_department\_table**

<u>Doc No</u>	Department Id
D1	Neurology
D2	Orthopaedic
D3	ENT
D3	Neurology
D4	Skin
D4	orthopaedic

**Table 4: Doctor\_patient\_table**

<u>Doc No</u>	<u>Patient No</u>	Patient Name	CNIC	Phone	Room No	Room Type	Bed No
D1	P1	Khalid	12345-1	042-1	R2	Normal	B1
D1	P5	Ahmed	12345-2	042-2	R2	Normal	B1
D1	P7	Anum	12345-3	042-3	NIL		Nil
D2	P4	Mehmood	12345-4	042-4	R2	Normal	B1
D2	P7	Anum	12345-3	042-3	R4	Two bed	B5
D2	P9	Khawar	12345-6	042-5	R4	Two bed	B7
D4	P10	Tanweer	12345-7	042-6	Nil		Nil
D4	P1	Khalid	12345-1	042-1	R5	Special	B8
D5	P12	Sohail	12345-9	042-8	Nil		Nil
D5	P13	Ahmed	12345-0	042-9	R6	Special	B9

Functional dependency 1. (doc no, patient no -> patient name, cnic, phone, room no)

2. (room no-> room type, bed no)

## Step 2:

Normalizing to 2NF

A relation schema R is in second normal form (2NF) if it is in 1 NF and if every non-prime attribute A in R is fully functionally dependent on the primary key.

So, If a table is not in 2 NF, it can be normalized to 2NF By breaking into number of 2 NF tables in which nonprime attributes are associated only with part of primary key On which they are fully dependent.

So, after Normalizing it to 2NF we get the following tables :

- Doctor\_Info\_table (Primary key: Doc no.)
- Doctor\_department\_table
- Doctor\_phone\_table
- Doctor\_patient\_table

**Table 1: Doctor\_Info\_table**

<u>Doc No</u>	Name	Address	Designation	Charges Per Hour
---------------	------	---------	-------------	------------------

D1	Dr. Nadeem	ABC 123	Professor	5000
D2	Dr. Nadeem	KB 13	Professor	5000
D3	Dr. Erum	AK 123	Astt. Professor	3000
D4	Dr. Hafeez	ND 123	Astt. Professor	3000

Functional dependency (doc no -> name ,address, designation, charges per hour)

**Table 2: Doctor\_Phone\_table**

<u>Doc No</u>	<u>Phone</u>
D1	0333-123
D1	042-123
D2	0334-124
D2	0300-123
D4	0321-123
D5	0321-124

**Table 3: Doctor\_department\_table**

<u>Doc No</u>	<u>Department Id</u>
D1	Neurology
D2	Orthopaedic
D3	ENT
D3	Neurology
D4	Skin
D4	orthopaedic

**Table 4: Doctor\_patient\_table**

<u>Doc No</u>	<u>Patient No</u>	<u>Patient Name</u>	<u>CNIC</u>	<u>Phone</u>	<u>Room No</u>	<u>Room Type</u>	<u>Bed No</u>
D1	P1	Khalid	12345-1	042-1	R2	Normal	B1
D1	P5	Ahmed	12345-2	042-2	R2	Normal	B1
D1	P7	Anum	12345-3	042-3	NIL		Nil
D2	P4	Mehmood	12345-4	042-4	R2	Normal	B1
D2	P7	Anum	12345-3	042-3	R4	Two bed	B5
D2	P9	Khawar	12345-6	042-5	R4	Two bed	B7
D4	P10	Tanweer	12345-7	042-6	Nil		Nil
D4	P1	Khalid	12345-1	042-1	R5	Special	B8
D5	P12	Sohail	12345-9	042-8	Nil		Nil
D5	P13	Ahmed	12345-0	042-9	R6	Special	B9

Functional dependency 1. (doc no, patient no -> patient name, cnic, phone, room no)

2. (room no-> room type, bed no)

### Step 3:

3Nf: A relation schema R is in third normal form (3NF) if it is in 2NF and no non-prime attribute A in R is transitively dependent on the primary key.

So, if a table is not in 3nf we have to remove transitive dependencies.

So, after Normalizing it to 2NF we get the following tables :

- Doctor\_Info\_table (Primary key: Doc no.)
- Doctor\_department\_table
- Doctor\_phone\_table
- Doctor\_patient\_table
- Room\_table

**Table 1: Doctor\_Info\_table**

<u>Doc No</u>	Name	Address	Designation	Charges Per Hour
D1	Dr. Nadeem	ABC 123	Professor	5000
D2	Dr. Nadeem	KB 13	Professor	5000
D3	Dr. Erum	AK 123	Astt. Professor	3000
D4	Dr. Hafeez	ND 123	Astt. Professor	3000

Functional dependency (doc no -> name ,address, designation, charges per hour)

**Table 2: Doctor\_Phone\_table**

<u>Doc No</u>	<u>Phone</u>
D1	0333-123
D1	042-123
D2	0334-124
D2	0300-123
D4	0321-123
D5	0321-124

**Table 3: Doctor\_department\_table**

<u>Doc No</u>	<u>Department Id</u>
D1	Neurology
D2	Orthopaedic
D3	ENT
D3	Neurology

D4	Skin
D4	orthopaedic

**Table 4: Doctor\_patient\_table**

<u>Doc No</u>	<u>Patient No</u>	Patient Name	CNIC	Phone	Room No
D1	P1	Khalid	12345-1	042-1	R2
D1	P5	Ahmed	12345-2	042-2	R2
D1	P7	Anum	12345-3	042-3	NIL
D2	P4	Mehmood	12345-4	042-4	R2
D2	P7	Anum	12345-3	042-3	R4
D2	P9	Khawar	12345-6	042-5	R4
D4	P10	Tanweer	12345-7	042-6	Nil
D4	P1	Khalid	12345-1	042-1	R5
D5	P12	Sohail	12345-9	042-8	Nil
D5	P13	Ahmed	12345-0	042-9	R6

Functional Dependency (docno, patient no->patient name, cnic, phone, room no)

**Table 5: Room\_table**

<u>Room no</u>	Room Type	<u>Bed no</u>
R2	Normal	B1
R4	Two bed	B5
R4	Two bed	B7
R5	Special	B8
R6	Special	B9

Functional dependency (room no, bed no->room type)

