

Ans 1.

here phone column name is repeated twice so we will change that to Doc Phone for one of the Phone.  
For above table to be in**1NF** the multiple values present in a single row should not be there , so we create a new row for each multi valued column in above table such columns with multiple values are DocPhone, Department Id, Patient No. Patient Name, CNIC, Phone, Room No. Room Type, Bed No.

So the table that we get after performing 1 NF operations is given below. This table is in 1NF.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Doc No. | Name | Address | DocPhone | Department id | Designation | Charges  Per  hour | patientNo. | Patient  name | CNIC | Phone | Room No. | Room Type | Bed  No. |
| D1 | Dr.Nadeem | Abc123 | 0333-123 | Neurology | professor | 5100 | p1 | kahid | 12345-1 | 042-1 | R2 | Normal | B1 |
| D1 | Dr.Nadeem | Abc123 | 0333-123 | Neurology | professor | 5100 | p5 | Ahmad | 12345-2 | 042-2 | R2 | Normal | B1 |
| D1 | Dr.Nadeem | Abc123 | 0333-123 | Neurology | professor | 5100 | p7 | Anum | 12345-3 | 042-3 | Nill |  | Nill |
| D1 | Dr.Nadeem | Abc123 | 042-123 | Neurology | professor | 5100 | p1 | kahid | 12345-1 | 042-1 | R2 | Normal | B1 |
| D1 | Dr.Nadeem | Abc123 | 042-123 | Neurology | professor | 5100 | p5 | Ahmad | 12345-2 | 042-2 | R2 | Normal | B1 |
| D1 | Dr.Nadeem | Abc123 | 042-123 | Neurology | professor | 5100 | p7 | Anum | 12345-3 | 042-3 | Nill |  | Nill |
| D2 | Dr. Nadeem | Kb13 | 0334-124 | Orthopedic | professor | 5000 | p4 | Mehmood | 12345-4 | 042-4 | R2 | Normal | B1 |
| D2 | Dr. Nadeem | Kb13 | 0334-124 | Orthopedic | professor | 5000 | p7 | Anum | 12345-3 | 042-3 | R4 | TwoBed | B5 |
| D2 | Dr. Nadeem | Kb13 | 0334-124 | Orthopedic | professor | 5000 | p9 | khawar | 12345-6 | 042-5 | R4 | Two bed | B7 |
| D2 | Dr. Nadeem | Kb13 | 0300-123 | Orthopedic | professor | 5000 | p4 | Mehmood | 12345-4 | 042-4 | R2 | Normal | B1 |
| D2 | Dr. Nadeem | Kb13 | 0300-123 | Orthopedic | professor | 5000 | p7 | Anum | 12345-3 | 042-3 | R4 | TwoBed | B5 |
| D2 | Dr. Nadeem | Kb13 | 0300-123 | Orthopedic | professor | 5000 | p9 | khawar | 12345-6 | 042-5 | R4 | Two bed | B7 |
| D4 | Dr. Erum | Ak123 | 0321-123 | ENT | Astt.  Professor | 3000 | p10 | Tanweer | 12345-7 | 042-6 | Nill |  | Nill |
| D4 | Dr. Erum | Ak123 | 0321-123 | Neurology | Astt.  Professor | 3000 | p10 | Tanweer | 12345-7 | 042-6 | Nill |  | Nill |
| D4 | Dr. Erum | Ak123 | 0321-123 | ENT | Astt.  Professor | 3000 | p1 | Khalid | 12345-1 | 042-1 | R5 | Special | B8 |
| D4 | Dr. Erum | Ak123 | 0321-123 | Neurology | Astt.  Professor | 3000 | p1 | Khalid | 12345-1 | 042-1 | R5 | Special | B8 |
| D5 | Dr. Hafeez | Nd123 | 0321-124 | Skin | Astt.  Professor | 3000 | p12 | Sohail | 12345-9 | 042-8 | Nill |  | Nill |
| D5 | Dr. Hafeez | Nd123 | 0321-124 | Orthopedicc | Astt.  Professor | 3000 | p12 | Sohail | 12345-9 | 042-8 | Nill |  | Nill |
| D5 | Dr. Hafeez | Nd123 | 0321-124 | Skin | Astt.  Professor | 3000 | p13 | Ahmed | 12346-0 | 042-9 | R6 | Special | B9 |
| D5 | Dr. Hafeez | Nd123 | 0321-124 | Orthopedicc | Astt.  Professor | 3000 | p13 | Ahmed | 12346-0 | 042-9 | R6 | Special | B9 |

**2NF:**

Assumptions: a patient might be getting shifted so he might have multiple doctors assigned to him with multiple room no.s

here in above table to identify each row we need (docNo, DocPhone, DepartmentId, patientNo., ) these 4 can derive all rest of the columns of table.

Now, here

Doc No,alone can determine Name, Address, Designation, charges per hour

PatientNo alone can determine PatientName, CNIC, Phone,

Bed No. alone can determine Room No, Room Type

So these are the partial dependencies in our table.

So we can split our above table into 4 tables removing these partial dependencies.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Doc No** | **Doc. Phone** | **Department ID** | **PatientNo** | **Bed No** |
| D1 | 0333-123 | Neurology | p1 | B1 |
| D1 | 042-123 | Neurology | p1 | B1 |
| D1 | 0333-123 | Neurology | p5 | B1 |
| D1 | 042-123 | Neurology | p5 | B1 |
| D1 | 0333-123 | Neurology | p7 | Nill |
| D1 | 042-123 | Neurology | p7 | Nill |
| D2 | 0334-124 | orthopedic | p4 | B1 |
| D2 | 0300-123 | orthopedic | p4 | B1 |
| D2 | 0334-124 | orthopedic | p7 | B5 |
| D2 | 0300-123 | orthopedic | p7 | B5 |
| D2 | 0334-124 | orthopedic | p9 | B7 |
| D2 | 0300-123 | orthopedic | p9 | B7 |
| D4 | 0321-123 | ENT | p10 | Nill |
| D4 | 0321-123 | ENT | p1 | B8 |
| D4 | 0321-123 | Neurology | p10 | Nill |
| D4 | 0321-123 | Neurology | p1 | B8 |
| D5 | 0321-124 | Skin | p12 | Nill |
| D5 | 0321-124 | Skin | p13 | B9 |
| D5 | 0321-124 | orthopedic | p12 | Nill |
| D5 | 0321-124 | orthopedic | p13 | B9 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Doc No.** | Name | Address | Designation | Charges  Per  hour |
| D1 | Dr.Nadeem | Abc123 | professor | 5000 |
| D2 | Dr. Nadeem | Kb13 | professor | 5000 |
| D4 | Dr. Erum | Ak123 | Astt.  Professor | 3000 |
| D5 | Dr. Hafeez | Nd123 | Astt.  Professor | 3000 |

|  |  |  |  |
| --- | --- | --- | --- |
| **patientNo.** | Patient  name | CNIC | Phone |
| p1 | kahid | 12345-1 | 042-1 |
| p5 | Ahmad | 12345-2 | 042-2 |
| p4 | Mehmood | 12345-4 | 042-4 |
| p7 | Anum | 12345-3 | 042-3 |
| p9 | khawar | 12345-6 | 042-5 |
| p10 | Tanweer | 12345-7 | 042-6 |
| p12 | Sohail | 12345-9 | 042-8 |
| p13 | Ahmed | 12346-0 | 042-9 |

|  |  |  |
| --- | --- | --- |
| Room No. | Room Type | **Bed**  **No.** |
| R2 | Normal | B1 |
| R4 | TwoBed | B5 |
| R4 | Two bed | B7 |
| R5 | Special | B8 |
| R6 | Special | B9 |

**3NF** : here as we can see looking at room No. we are able to determine room type while room no. is not a part of primary key. Also looking at designation of a doctor we can determine its charges per hour. So these 2 tables can be further split making our database into 3NF.

Also looking at bed no. we can determine the room no. as well. As a bed can be present in one room only.

|  |  |
| --- | --- |
| Room No. | **Bed**  **No.** |
| R2 | B1 |
| R4 | B5 |
| R4 | B7 |
| R5 | B8 |
| R6 | B9 |

|  |  |
| --- | --- |
| **Room No.** | Room Type |
| R2 | Normal |
| R4 | TwoBed |
| R5 | Special |
| R6 | Special |

|  |  |  |  |
| --- | --- | --- | --- |
| **Doc No.** | Name | Address | Designation |
| D1 | Dr.Nadeem | Abc123 | professor |
| D2 | Dr. Nadeem | Kb13 | professor |
| D4 | Dr. Erum | Ak123 | Astt.  Professor |
| D5 | Dr. Hafeez | Nd123 | Astt.  Professor |

|  |  |
| --- | --- |
| **Designation** | Charges  Per  hour |
| professor | 5000 |
| Astt.  Professor | 3000 |

BCNF: its already in BCNF.

Here we have considered dr. Phone no. and department id along with doc. no. and patient no as a primary key from 1 NF onwards but we could have split the table in to a separate table for

**doc** **no and docPhone no**

and

**doc no. and department id**

and then we would have our tables more logically organised with doc no. and patient no. as primary key and bed no. column as a foreign key with that.