**For 1NF:**

We have multiple phone numbers and patients associated with doctors, so split the table into 3 parts.

Following are the tables achieved with their contents after 1NF

Doctor details (Table 1): Doc No., Name, Address, Department Id, Designation, charges per hour (PK = Doc No.)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Doc No. | Doc Name | Address | Department Id | Designation | Charge |
| D1 | Dr. Nadeem | Abc 123 | Neurology | Professor | 5000 |
| D2 | Dr. Nadeem | Kb 13 | Orthopedic | Professor | 5000 |
| D4 | Dr. Erum | Ak123 | ENT/Neurology | Asst. Professor | 3000 |
| D5 | Dr. Hafeez | Nd123 | Skin/Orthopedic | Asst. Professor | 3000 |

Doctor Contact Details (Table 2): Doc No., phone (PK = Doc No. + phone)

|  |  |
| --- | --- |
| Doc No. | Phone |
| D1 | 0333-123 |
| D1 | 042-123 |
| D2 | 0334-124 |
| D2 | 0300-123 |
| D3 | 0321-123 |
| D4 | 0321-124 |

Attended patients by doctors (Table 3): Doc No., Patient no., patient name, CNIC, phone, room no., room type, bed no. (PK = Doc No.+ Patient no.)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Doc no. | Patient no. | Patient Name | CNIC | Phone | Room number | | Room Type | Room type |
| 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 | | 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 |
| D3 | P10 | Tanweer | 12345-7 | 042-6 | nil | nil | | Nil |
| D3 | P1 | Khalid | 12345-1 | 042-1 | R5 | Special | | B8 |
| D4 | P12 | Sohail | 12345-9 | 042-8 | nil | Nil | | Nil |
| D4 | P13 | Ahmad | 12345-0 | 042-9 | R6 | Special | | B9 |

**For 2NF:**

In table 3, patient name, CNIC, phone are dependent on the primary key partially (only on Patient no., not on doc no.)

So split the table 3 as

Doctor-patient relation (Table 5): Doc No., Patient no., room no., room type, bed no. (PK = Doc No.+ Patient no.)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Doc no. | Patient no. | Room number | Room Type | Room type |
| D1 | P1 | R2 | Normal | B1 |
| D1 | P5 | R2 | Normal | B1 |
| D1 | P7 | nil | Nil | Nil |
| D2 | P4 | R2 | Normal | B1 |
| D2 | P7 | R4 | Two-bed | B5 |
| D2 | P9 | R4 | Two-bed | B7 |
| D3 | P10 | nil | nil | Nil |
| D3 | P1 | R5 | Special | B8 |
| D4 | P12 | nil | Nil | Nil |
| D4 | P13 | R6 | Special | B9 |

Patient details (Table 6): Patient no., patient name, CNIC, phone (PK = Patient no.)

|  |  |  |  |
| --- | --- | --- | --- |
| Patient No. | Patient name | CNIC | Phone |
| P1 | Khalid | 12345-1 | 042-1 |
| P4 | Mehmood | 12345-4 | 042-4 |
| P5 | Ahmed | 12345-2 | 042-2 |
| P7 | Anum | 12345-3 | 042-3 |
| P9 | Khawar | 12345-6 | 042-5 |
| P10 | Tanwir | 12345-7 | 042-6 |
| P12 | Sohail | 12345-9 | 042-8 |
| P13 | Ahmad | 12345-0 | 042-9 |

**For 3NF:**

In table 1, charges per hour depends on designation of the doctor. According to 3NF, there should not be any transitive dependency (i.e. there should not be any non-key 🡪 non-key dependency)

So split the table 1 as:

DocDetails (Table 7): Doc No., Name, Address, Department Id, Designation (PK = Doc No.)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Doc No. | Doc Name | Address | Department Id | Designation |
| D1 | Dr. Nadeem | Abc 123 | Neurology | Professor |
| D2 | Dr. Nadeem | Kb 13 | Orthopedic | Professor |
| D4 | Dr. Erum | Ak123 | ENT/Neurology | Asst. Professor |
| D5 | Dr. Hafeez | Nd123 | Skin/Orthopedic | Asst. Professor |

Charge chart (Table 8): Designation, charges per hour (PK = Designation)

|  |  |
| --- | --- |
| Designation | Charge per hour |
| Professor | 5000 |
| Asst. Professor | 3000 |

Also in table 5, room type is dependent on room number

So split the table 5 as:

Room details (Table 9): room no., room type (PK = room no.)

|  |  |
| --- | --- |
| Room Number | Room Type |
| R2 | Normal |
| R4 | Two-bed |
| R5 | Special |
| R6 | Special |

Doctor-patient relationship (Table 10): Doc No., Patient no., room no., bed no. (PK = Doc No.+ Patient no.)

|  |  |  |  |
| --- | --- | --- | --- |
| Doc no. | Patient no. | Room number | Room type |
| D1 | P1 | R2 | B1 |
| D1 | P5 | R2 | B1 |
| D1 | P7 | nil | Nil |
| D2 | P4 | R2 | B1 |
| D2 | P7 | R4 | B5 |
| D2 | P9 | R4 | B7 |
| D3 | P10 | nil | Nil |
| D3 | P1 | R5 | B8 |
| D4 | P12 | nil | Nil |
| D4 | P13 | R6 | B9 |

All tables now are already in BCNF form, we have tables 2,6,7,8,9,10

**Final tables after normalising are:**

Table 2: Doctor Contact Details

|  |  |
| --- | --- |
| Doc No. | Phone |
| D1 | 0333-123 |
| D1 | 042-123 |
| D2 | 0334-124 |
| D2 | 0300-123 |
| D3 | 0321-123 |
| D4 | 0321-124 |

Table 6: Patient Details

|  |  |  |  |
| --- | --- | --- | --- |
| Patient No. | Patient name | CNIC | Phone |
| P1 | Khalid | 12345-1 | 042-1 |
| P4 | Mehmood | 12345-4 | 042-4 |
| P5 | Ahmed | 12345-2 | 042-2 |
| P7 | Anum | 12345-3 | 042-3 |
| P9 | Khawar | 12345-6 | 042-5 |
| P10 | Tanwir | 12345-7 | 042-6 |
| P12 | Sohail | 12345-9 | 042-8 |
| P13 | Ahmad | 12345-0 | 042-9 |

Table 7: DocDetails

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Doc No. | Doc Name | Address | Department Id | Designation |
| D1 | Dr. Nadeem | Abc 123 | Neurology | Professor |
| D2 | Dr. Nadeem | Kb 13 | Orthopedic | Professor |
| D4 | Dr. Erum | Ak123 | ENT/Neurology | Asst. Professor |
| D5 | Dr. Hafeez | Nd123 | Skin/Orthopedic | Asst. Professor |

Table 8: Charge Chart

|  |  |
| --- | --- |
| Designation | Charge per hour |
| Professor | 5000 |
| Asst. Professor | 3000 |

Table 9: Room details

|  |  |
| --- | --- |
| Room Number | Room Type |
| R2 | Normal |
| R4 | Two-bed |
| R5 | Special |
| R6 | Special |

Table 10: Doctor-patient relationship

|  |  |  |  |
| --- | --- | --- | --- |
| Doc no. | Patient no. | Room number | Room type |
| D1 | P1 | R2 | B1 |
| D1 | P5 | R2 | B1 |
| D1 | P7 | nil | Nil |
| D2 | P4 | R2 | B1 |
| D2 | P7 | R4 | B5 |
| D2 | P9 | R4 | B7 |
| D3 | P10 | nil | Nil |
| D3 | P1 | R5 | B8 |
| D4 | P12 | nil | Nil |
| D4 | P13 | R6 | B9 |