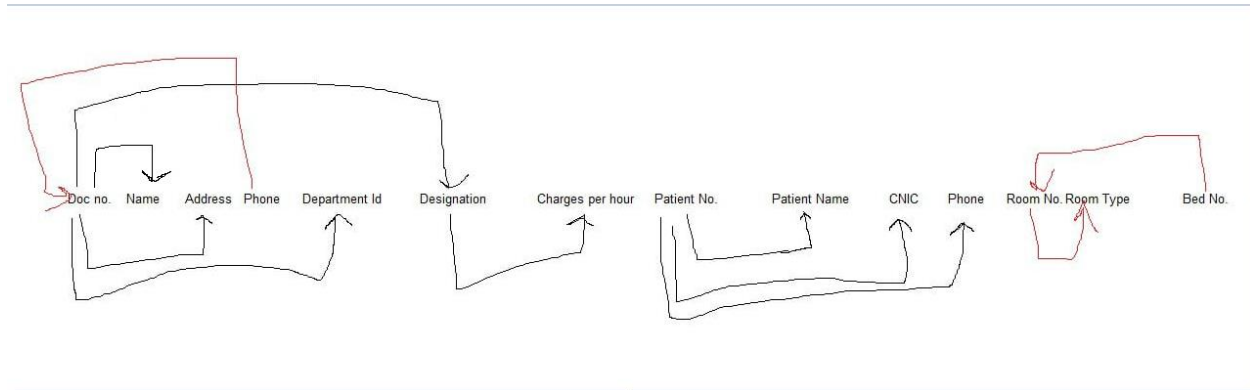


Name: Gaurang Athavale

These are the functional dependencies identified from the table and the data in it.



1NF:

The given table is not in 1NF since there are multiple values in a single row i.e. multivalued fields are **Phone, Patient No., Patient Name, CNIC and Phone**.

Hence, those rows/tuples are split into multiple rows to eliminate the multivalued entries.

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	Neurology	Professor	5000	P1	Khalid	12345-1	042-1	R2	Normal	B1
D1	Dr. Nadeem	Abc 123	042-123	Neurology	Professor	5000	P1	Khalid	12345-1	042-1	R2	Normal	B1
D1	Dr. Nadeem	Abc 123	0333-123	Neurology	Professor	5000	P5	Ahmed	12345-2	042-2	R2	Normal	B1
D1	Dr. Nadeem	Abc 123	042-123	Neurology	Professor	5000	P5	Ahmed	12345-2	042-2	R2	Normal	B1
D1	Dr. Nadeem	Abc 123	0333-123	Neurology	Professor	5000	P7	Anum	12345-3	042-3	Nil		Nil
D1	Dr. Nadeem	Abc 123	042-123	Neurology	Professor	5000	P7	Anum	12345-3	042-3	Nil		Nil
D2	Dr. Nadeem	Kb123	0334-124	Orthopedic	Professor	5000	P4	Mehmood	12345-4	042-4	R2	Normal	B1
D2	Dr. Nadeem	Kb123	0300-123	Orthopedic	Professor	5000	P4	Mehmood	12345-4	042-4	R2	Normal	B1
D2	Dr. Nadeem	Kb123	0334-124	Orthopedic	Professor	5000	P7	Anum	12345-3	042-3	R4	Two Bed	B5
D2	Dr. Nadeem	Kb123	0300-123	Orthopedic	Professor	5000	P7	Anum	12345-3	042-3	R4	Two Bed	B5
D2	Dr. Nadeem	Kb123	0334-124	Orthopedic	Professor	5000	P9	Khawar	12345-6	042-5	R4	Two Bed	B7
D2	Dr. Nadeem	Kb123	0300-123	Orthopedic	Professor	5000	P9	Khawar	12345-6	042-5	R4	Two Bed	B7
D4	Dr. Erum	Ak123	0321-123	ENT/Neurology	Asst. Professor	3000	P10	Tanweer	12345-7	042-6	Nil		Nil
D4	Dr. Erum	Ak123	0321-123	ENT/Neurology	Asst. Professor	3000	P1	Khalid	12345-1	042-1	R5	Special	B8
D5	Dr. Hafeez	Nd123	0321-124	Skin/Orthopedic	Asst. Professor	3000	P12	Sohail	12345-9	042-8	Nil		Nil
D5	Dr. Hafeez	Nd123	0321-124	Skin/Orthopedic	Asst. Professor	3000	P13	Ahmed	12346-0	042-9	R6	Special	B9

2NF:

The key for the above table using the above mentioned functional dependencies is:

Key = {Name Phone PatientNo. BedNo.}

But looking at the functional dependencies we know that the following dependencies are partial dependencies:

Patient No. → Patient Name

Patient No. → CNIC

Patient No. → Phone

Bed No. → Room No.

Phone → Doc No.

As, the key is {Name Phone PatientNo. BedNo.} and any proper subset of the key determining a non-key attribute is a partial dependency, hence the above functional dependencies are partial. Therefore, the table needs to be decomposed i.e. it should be normalised.

R1:

Doc no. → Name

Doc no. → Address

Doc no. → Department Id

Doc no. → Designation

Designation → Charges per hour

Key = {Doc No.}(i)

Doc no.	Name	Address	Department Id	Designation	Charges per hour
D1	Dr. Nadeem	Abc 123	Neurology	Professor	5000
D2	Dr. Nadeem	Kb123	Orthopedic	Professor	5000
D4	Dr. Erum	Ak123	ENT/Neurology	Asst. Professor	3000
D5	Dr. Hafeez	Nd123	Skin/Orthopedic	Asst. Professor	3000

R2:

Phone → Doc no.

Key = {Phone}

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

R3:

Patient No. → Patient Name

Patient No. → CNIC

Patient No. → Phone

Key = {Patient No.}

Patient No.	Patient Name	CNIC	Phone
P1	Khalid	12345-1	042-1
P5	Ahmed	12345-2	042-2
P7	Anum	12345-3	042-3
P4	Mehmood	12345-4	042-4
P9	Khawar	12345-6	042-5
P10	Tanweer	12345-7	042-6
P12	Sohail	12345-9	042-8
P13	Ahmed	12346-0	042-9

R4:

Room no. → Room Type

Bed No. → Room No.

Key = {Bed No.}(ii)

Room No.	Room Type	Bed No.
R2	Normal	B1
R4	Two Bed	B5
R4	Two Bed	B7
R5	Special	B8
R6	Special	B9
Nil		Nil

3NF:

3NF is a Normal form which is in 2NF and doesn't have transitive dependencies. So, now we have to remove transitive dependencies from the above 4 tables.

Transitive dependency exists if a Non-key attribute determines another non-key attribute.

Following functional dependencies are transitive dependencies:

Designation → Charges per hour because, both Designation and Charges per hour are non-key attributes for R1from (i)

Room No. → Room Type because, both Room No. and Room Type are non-key attributes for R4from (ii)

R2 and R3 are already in 3NF.

Hence, to convert it to 3NF the tables R1 and R4 need to be split/decomposed:

R11:

Doc no. → Name

Doc no. → Address

Doc no. → Department Id

Doc no. → Designation

Key = {Doc no.}

Doc no.	Name	Address	Department Id	Designation
D1	Dr. Nadeem	Abc 123	Neurology	Professor
D2	Dr. Nadeem	Kb123	Orthopedic	Professor
D4	Dr. Erum	Ak123	ENT/Neurology	Asst. Professor
D5	Dr. Hafeez	Nd123	Skin/Orthopedic	Asst. Professor

R12:

Designation → Charges per hour

Key = {Designation}

Designation	Charges per hour
Professor	5000
Asst. Prof	3000

R2:

Phone → Doc no.

Key = {Phone}

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

R3:

Patient No. → Patient Name

Patient No. → CNIC

Patient No. → Phone

Key = {Patient No.}

Patient No.	Patient Name	CNIC	Phone
P1	Khalid	12345-1	042-1
P5	Ahmed	12345-2	042-2
P7	Anum	12345-3	042-3
P4	Mehmood	12345-4	042-4
P9	Khawar	12345-6	042-5
P10	Tanweer	12345-7	042-6
P12	Sohail	12345-9	042-8
P13	Ahmed	12346-0	042-9

R41:

Room No. → Room Type

Key = {Room No.}

Room No.	Room Type
R2	Normal
R4	Two Bed
R5	Special
R6	Special
Nil	Nil

R42:

Bed No → Room No.

Key = {Bed No.}

Bed No.	Room No.
B1	R2
B5	R4
B7	R4
B8	R5
B9	R6
Nil	Nil

BCNF:

The above 3NF tables are already in BCNF since all tables satisfy the BCNF condition i.e. determinant (LHS) should determine all other attributes in the table.

R11:

Doc no. → Name

Doc no. → Address

Doc no. → Department Id

Doc no. → Designation

Key = {Doc no.}

Doc no.	Name	Address	Department Id	Designation
D1	Dr. Nadeem	Abc 123	Neurology	Professor
D2	Dr. Nadeem	Kb123	Orthopedic	Professor
D4	Dr. Erum	Ak123	ENT/Neurology	Asst. Professor
D5	Dr. Hafeez	Nd123	Skin/Orthopedic	Asst. Professor

R12:

Designation → Charges per hour

Key = {Designation}

Designation	Charges per hour
Professor	5000
Asst. Prof	3000

R2:

Phone → Doc no.

Key = {Phone}

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

R3:

Patient No. → Patient Name

Patient No. → CNIC

Patient No. → Phone

Key = {Patient No.}

Patient No.	Patient Name	CNIC	Phone
P1	Khalid	12345-1	042-1
P5	Ahmed	12345-2	042-2
P7	Anum	12345-3	042-3
P4	Mehmood	12345-4	042-4
P9	Khawar	12345-6	042-5
P10	Tanweer	12345-7	042-6
P12	Sohail	12345-9	042-8
P13	Ahmed	12346-0	042-9

R41:

Room No. → Room Type

Key = {Room No.}

Room No.	Room Type
R2	Normal
R4	Two Bed
R5	Special
R6	Special
Nil	Nil

R42:

Bed No → Room No.

Key = {Bed No.}

Bed No.	Room No.
B1	R2
B5	R4
B7	R4
B8	R5
B9	R6
Nil	Nil