**Project team 9 – Hospital Management System**

**Team Members:**

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**PROJECT PROPOSAL**

**Application Vision:**

*The goal is to develop a database system for hospital which will allow the hospital personnel to book available wards/rooms for the patient, look for the available doctors and book an appointment with the doctor, the available tests/scan information for the patients, test reports for the patients, the ambulance information for emergency cases. We are planning to achieve the following objectives.*

1. *To maintain records of both in-patients and* ***patients*** *who are admitted/discharged from the hospital.*
2. *To maintain records of* ***doctors*** *working at the hospital, their specialization and their schedule.*
3. *It should handle records of various tests conducted in the* ***pathology lab*** *of the hospital.*
4. *It should be able to maintain* ***inventory*** *information of the hospital like available/Required stocks (stock other than medicines like tools-stethoscope, Oxygen cylinders, Water).*
5. *To maintain* ***blood bank*** *information which has information about the donors, blood group of the patients and also the amount of blood available/Required for a particular blood group.*
6. *To maintain the* ***availability of the rooms*** *in the hospital.*
7. *To maintain the emergency* ***ambulance*** *van information, their current location, driver Name, Phone number of the driver.*

**Environment Setup - JSP, mySQL Database, HTML, Eclipse IDE, JDBC mysql Connector:**

The environment setup is done with the help of using JSP with Eclipse IDE for front end, mySQL Database for backend and JDBC mysql as the connectors to connect the front end and back end.

**Initial High Level Requirements:**

**Identifying user roles:**

1. **Patient:** People who seek medical care.
2. **Doctors:** People who look into (serve) patients.
3. **Operator:** Operator is a receptionist, who is the first point of contact for the patients.
4. **Administrator:** Person who has the supreme authority to the application**.**
5. **Inventory Manager:** Person who keeps a track of bothHospital inventory, Medical store inventory.
6. **Emergency Manager:** Person who maintains availability of ambulance for emergencies and also keep track of blood availability at blood banks.
7. **Lab in charge:** Person who maintains the test records of patients**.**

**User Story Description:**

1. As a **doctor,** I want to **view patient appointments for the day.**
2. As a **doctor**, I want to **view the test record of the patients.**
3. As a **doctor**, I want to **view the blood availability at the blood bank.**
4. As a **doctor**, I want to **add a request to the inventory.**
5. As an **operator,** I want to **add an appointment for patients.**
6. As an **operator,** I want to **update an appointment for patients.**
7. As an **operator,** I want to **cancel an appointment for patients.**
8. As an **operator,** I want to **update doctor’s visiting hours.**
9. As an **operator,** I want to **add patient record details.**
10. As an **operator,** I want to **add patient personal details.**
11. As an **operator,** I want to **update patient personal details.**
12. As an **operator,** I want to **book wards for patients.**
13. As an **operator,** I want to **update availability of wards.**
14. As an **administrator,** I want to **add operator record details.**
15. As an **administrator,** I want to **update operator record details.**
16. As an **administrator,** I want to **delete operator record details.**
17. As an **administrator,** I want to **add doctor record details.**
18. As an **administrator,** I want to **update doctor record details.**
19. As an **administrator,** I want to **delete doctor record details.**
20. As an **administrator,** I want to **add inventory manager details.**
21. As an **administrator,** I want to **add emergency manager details.**
22. As an **administrator**, I want to **update employee details.**
23. As an **administrator**, I want to **delete employee details.**
24. As an **administrator,** I want to **add lab in charge details.**
25. As an **inventory manager,** I want to **add an item to the inventory.**
26. As an **inventory manager,** I want to **update the inventory details.**
27. As an **inventory manager,** I want to **delete the inventory details.**
28. As an **emergency manager,** I want to **add emergency case details.**
29. As an **emergency manager,** I want to **add ambulance details.**
30. As an **emergency manager,** I want to **delete emergency case details.**
31. As an **emergency manager,** I want to **update blood quantity of respective blood groups.**
32. As a **lab in charge,** I want to **add test records of patients.**

**Entities:**

1.Patient

2.Operator

2.Doctor

3.Emergency Manager

4.Lab In-charge

5.Test Records

6.Administrator

7.Inventory Manager

**Relationship:**

1. Operator updates Patient records.

2. Operator updates record details of patient.

3. Administrator updates record details of doctor.

4. Administrator updates record details of operator.

5. Lab In-charge updates Test Records of patients.

6. Operator updates doctor’s visiting hours.

**SPRINT 1:**

**Story in order of priority:**

1. As an **administrator,** I want to **add doctor record details.**
2. As an **administrator,** I want to **add operator record details.**
3. As an **operator,** I want to **add patient personal details.**
4. As an **operator,** I want to **update doctor’s visiting hours.**
5. As an **operator,** I want to **schedule appointment for patients.**
6. As an **operator,** I want to **add patient medical record details.**

**Story refinement with notes:**

1. As an **administrator,** I want to **add doctor record details.**

**Notes:**

* User must be logged in/log out as an administrator to use this feature.
* Doctor details should include name, degree, specialization, salary, contact information.
* Only administrator has the rights to update doctor records.

**Updated stories:**

1. As an **administrator,** I want to **log in to use this feature.**
2. As an **administrator,** I want to **add doctor record details.**
3. As an **administrator,** I want to **log out after use.**
4. As an **administrator,** I want to **add operator record details.**

**Notes:**

* User must be logged in/log out as an administrator to use this feature.
* Operator details should include name, salary, contact information.
* Only administrator has the rights to update operator records.

**Updated stories:**

1. As an **administrator,** I want to **log in to use this feature.**
2. As an **administrator,** I want to **add operator record details.**
3. As an **administrator,** I want to **log out after use.**
4. As an **operator,** I want to **add patient personal details.**

**Notes:**

* User must be logged in/log out as an Operator to use this feature.
* Patient details should include name, In/Out patient, contact information, allergies,BloodGroup.

**Updated stories:**

1. As an **operator,** I want to **log in to use this feature.**
2. As an **operator,** I want to **add patient personal record details.**
3. As an **operator,** I want to **log out after use.**
4. As an **operator,** I want to **update doctor’s visiting hours.**

**Notes:**

* User must be logged in/log out as an Operator to use this feature.
* Doctor’s visiting hours should include doctor ID, name,Day, visiting hours.

**Updated stories:**

1. As an **operator,** I want to **log in to use this feature.**
2. As an **operator,** I want to **update doctor’s visiting hours.**
3. As an **operator,** I want to **log out after use.**
4. As an **operator,** I want to **schedule appointment for patients.**

**Notes:**

* User must be logged in/log out as an Operator to use this feature.
* Operator should be able to schedule appointment.
* Only one appointment can be made for a particular time slot for a particular doctor.
* The operator shouldn’t be able to book two slots for the same patient at the same time with two different doctors.
* For a particular patient the operator will be able to book only one slot with a particular doctor for a particular day.He can book two slots with different doctors but not the same doctor.
* An appointment for a particular day can be made as long as it is available.

**Updated stories:**

1. As an **operator,** I want to **log in to use this feature.**
2. As an **operator,** I want to **schedule appointment for patients.**
3. As an **operator,** I want to **log out after use.**
4. As an **operator,** I want to **add patient medical record details.**

**Notes:**

* User must be logged in/log out as an Operator to use this feature.
* Patient details should include name, doctor name, diagnostic description,Date and Time

**Updated stories:**

1. As an **operator,** I want to **log in to use this feature.**
2. As an **operator,** I want to **add patient medical record details.**
3. As an **operator,** I want to **log out after use.**

**SPRINT 1:**

**Updated stories in the order of priority:**

1. As an **administrator,** I want to **log in to use this feature.**
2. As an **administrator,** I want to **add doctor record details.**
3. As an **administrator,** I want to **log out after use.**
4. As an **administrator,** I want to **log in to use this feature.**
5. As an **administrator,** I want to **add operator record details.**
6. As an **administrator,** I want to **log out after use.**
7. As an **operator,** I want to **log in to use this feature.**
8. As an **operator,** I want to **add patient personal record details.**
9. As an **operator,** I want to **log out after use.**
10. As an **operator,** I want to **log in to use this feature.**
11. As an **operator,** I want to **update doctor’s visiting hours.**
12. As an **operator,** I want to **log out after use.**
13. As an **operator,** I want to **log in to use this feature.**
14. As an **operator,** I want to **schedule appointment for patients.**
15. As an **operator,** I want to **log out after use.**
16. As an **operator,** I want to **log in to use this feature.**
17. As an **operator,** I want to **add patient medical record details.**
18. As an **operator,** I want to **log out after use.**

**SPRINT 1 CONCEPTUAL DESIGN:**

**ENTITY:** Patient

**ATTRIBUTES:**

Patient\_ID

Patient\_Name [Composite attribute]

Last\_Name

First\_Name

Age

Sex

Patient\_Type

Address [Composite attribute]

Addr\_line1

Addr\_line2

City

Zip\_code

Email [Multi valued attribute]

Mobile\_Number

Emergency\_Mobile\_Number

**ENTITY:** Employee

**ATTRIBUTES:**

Employee\_ID

Employee\_Name [Composite attribute]

Last\_Name

First\_Name

user\_name

pass

Address [Composite attribute]

Addr\_line1

Addr\_line2

City

Zip\_code

Email [Multi valued attribute]

Mobile\_Number

**ENTITY:** Doctor

**ATTRIBUTES:**

Employee\_ID

Degree

Specialization

in\_time

out\_time

**ENTITY:** Administrator

**ATTRIBUTES:**

Employee\_ID

**ENTITY:** Operator

**ATTRIBUTES:**

Employee\_ID

**Generalization/Specialization:**

Generalization “Employee” has the specializations “Doctor”, “Administrator” and “Operator”.

Doctor and Operator are disjoint with partial participation with Employee.

Doctor and Administrator are overlapping with partial participation with Employee.

Administrator and Operator are disjoint with partial participation with Employee.

**WEAK ENTITY:** Patient\_Records

**IDENTIFYING ENTITY:** Patient

**ATTRIBUTES:**

record\_id

Disease

Comments

Visited\_On

ACTION: **Administrator** adds **doctor**.

ACTION: **Administrator** adds **operator**.

ACTION: **Operator** adds **patient** personal details.

ACTION: **Operator** adds **doctor** visiting hours.

**RELATIONSHIPS:**

Relationship: **Operator** schedules **doctor**’s appointment for **patients**

Descriptive Attributes:

Appointment Number

Appointment Time

Cardinality: Many to Many to Many

Participation:

Operator has partial participation

Doctor has partial participation

Patient has total participation

Relationship: **Operator** adds **patient\_record** based on **doctor** comments.

Cardinality: One to Many to One

Participation:

Operator has partial participation

patient\_record has total participation

Doctor has partial participation

Identifying Relationship: **Patient** has **Patient\_Record.**

Cardinality: One to Many

Participation:

Patient has total participation

Patient\_Record has total participation

**Relational Model:**

TABLE**: Patient**

COLUMNS**:**

patient\_id [Primary Key]

last\_Name

first\_Name

age

sex

patient\_Type

addr\_line1

addr\_line2

city

zip\_code

email\_id\_1

email\_id\_2

mobile\_number

e\_mobile\_number

TABLE**: Employee**

COLUMNS**:**

employee\_id [Primary Key]

user\_name [unique]

pass

last\_Name

first\_Name

addr\_line1

addr\_line2

city

zip\_code

email\_id\_1

email\_id\_2

mobile\_number

TABLE**: Doctor**

COLUMNS**:**

doctor\_id [foreign key; references Employee\_ID of Employee table], [Primary Key]

degree

specialization

in\_time

out\_time

TABLE**: Administrator**

COLUMNS**:**

admin\_id [foreign key; references employee\_id of Employee table], [Primary Key]

TABLE**: Operator**

COLUMNS**:**

operator\_id [foreign key; references employee\_id of Employee table], [Primary Key]

TABLE**:** **Appointment**

COLUMNS:

apt\_no [Primary Key]

operator\_id [foreign key; references operator\_id of Operator table]

patient\_id [foreign key; references patient\_id of Patient table]

doctor\_id [foreign key; references doctor\_id of Doctor table]

apt\_time

*Justification: Using cross reference approach to represent the many to many to many relationship “Operator schedules doctor’s appointment for patients” because this is a ternary relationship. Adding relationship attributes Appointment\_Number and Appointment\_Time as well.*

TABLE: **Patient\_Records**

COLUMNS:

record\_id [Primary Key]

patient\_id [foreign key; references patient\_id of Patient table]

doctor\_id [foreign key; references doctor\_id of Doctor table]

operator\_id [foreign key; references operator\_id of Operator table]

disease

comments

Visited\_On

*Justification: Using foreign key approach to represent the one to many relationship “Operator adds patient\_medical\_record” because it is higher overhead to create a separate table to represent this relationship.*

**Sprint 2 Preparation:**

**Story in order of priority:**

1. As an **operator,** I want to **update patient personal details.**
2. As an **operator,** I want to **update an appointment for patients.**
3. As an **operator,** I want to **cancel an appointment for patients.**
4. As an **administrator,** I want to **update doctor record details.**
5. As an **administrator,** I want to **delete doctor record details.**
6. As an **administrator,** I want to **update operator record details.**
7. As an **administrator,** I want to **delete operator record details.**
8. As an **operator,** I want to **book wards for patients.**
9. As an **operator,** I want to **update availability of wards.**
10. As an **administrator**, I want to **add Inventory Manager records**.
11. As an **inventory manager,** I want to **add an item to the inventory.**
12. As a **doctor**, I want to **add a request to the inventory.**
13. As an **inventory manager,** I want to **update the inventory details.**
14. As an **inventory manager,** I want to **delete the inventory details.**
15. As an **operator,** I want to **update patient personal details.**

**Notes:**

* Operator must be logged in/log out to use this feature.
* Operator must know the particular patient record need to be updated (e.g. patient id, first name, last name, mobile number etc).
* Operator should be able to update existing patient personal details like name, age, sex, address , email id, mobile number.

**Updated stories:**

1. As an **operator,** I want to **log in to use this feature.**
2. As an **operator,** I want to **update patient’s personal details.**
3. As an **operator,** I want to **logout after use.**

2) As an **operator,** I want to **update an appointment for patients.**

**Notes:**

* Operator must be logged in/log out to use this feature.
* Operator must know the particular appointment need to be updated (e.g. appointment number, patient id, doctor id etc).
* Operator should be able to update existing appointment details like operator id, patient id, doctor id, appointment time.

**Updated stories:**

1. As an **operator,** I want to **log in to use this feature.**
2. As an **operator,** I want to **update appointment details.**
3. As an **operator,** I want to **logout after use.**

3) As an **operator,** I want to **cancel an appointment for patients.**

**Notes:**

* User must be logged in/log out as an Operator to use this feature.
* Operator should be able to cancel an already scheduled appointment.

**Updated stories:**

1. As an **operator,** I want to **log in to use this feature.**
2. As an **operator,** I want to cancel an **appointment for patients.**
3. As an **operator,** I want to **logout after use.**

4) As an **administrator,** I want to **update doctor record details.**

**Notes:**

* User must be logged in/log out as an administrator to use this feature.
* Doctor details should include name, degree, specialization, salary, contact information.
* Only administrator has the rights to update doctor records.

**Updated stories:**

1. As an **administrator,** I want to **log in to use this feature.**
2. As an **administrator,** I want to **update doctor record details.**
3. As an **administrator,** I want to **log out after use.**

5) As an **administrator,** I want to **delete doctor record details.**

**Notes:**

* User must be logged in/log out as an administrator to use this feature.
* Doctor details include name, degree, specialization, salary, contact information.
* Only administrator has the rights to delete doctor records.

**Updated stories:**

1. As an **administrator,** I want to **log in to use this feature.**
2. As an **administrator,** I want to **delete doctor record details.**
3. As an **administrator,** I want to **log out after use.**

6) As an **administrator,** I want to **update operator record details.**

**Notes:**

* User must be logged in/log out as an administrator to use this feature.
* Operator details include name, degree, salary, contact information.
* Only administrator has the rights to update operator records.

**Updated stories:**

1. As an **administrator,** I want to **log in to use this feature.**
2. As an **administrator,** I want to **update operator record details.**
3. As an **administrator,** I want to **log out after use.**

7) As an **administrator,** I want to **delete operator record details.**

**Notes:**

* User must be logged in/log out as an administrator to use this feature.
* Operator details include name, degree, salary, contact information.
* Only administrator has the rights to delete operator records.

**Updated stories:**

1. As an **administrator,** I want to **log in to use this feature.**
2. As an **administrator,** I want to **delete operator record details.**
3. As an **administrator,** I want to **log out after use.**

**8)**As an **operator,** I want to **allocate ward for patients.**

**Notes:**

* User must be logged in/log out as an operator to use this feature.
* Only operator has the rights to book a ward.
* Operator should enter details like ward number and occupied by while booking the ward

**Updated Stories:**

1. As an **operator,** I want to **log in to use this feature.**
2. As an **operator,** I want to **update ward details while booking the ward for patient.**
3. As an **operator,** I want to **log out after use.**

**9)** As an **operator,** I want to **de-allocate wards.**

**Notes:**

* Operator must be logged in/log out to use this feature.
* Operator must know the particular ward that needs to be updated (e.g. ward number).

**Updated stories:**

1. As an **operator,** I want to **log in to use this feature.**
2. As an **operator,** I want to **update availability of wards.**
3. As an **operator,** I want to **logout after use.**

10) As an **administrator**,I want to **add Inventory Manager records**.

**Notes:**

* User must be logged in/log out as an administrator to use this feature.
* Inventory Manager record should include his personal details.
* Only administrator has the right to add Inventory Manager records.

**Updated stories:**

1. As an **administrator,** I want to **log in to use this feature.**
2. As an **administrator,** I want to **add Inventory Manager record details.**
3. As an **administrator,** I want to **log out after use.**

11) As an **inventory manager,** I want to **add an item to the inventory.**

**Notes:**

* User must be logged in/log out as an inventory manager to use this feature.
* Inventory record should include itemNo, item Name, quantity available, last modified, lastRequestID(request ID for which the item was last requested).
* Only inventory managerhas the rights to add Inventory record details.

**Updated stories:**

1. As an **inventory manager,** I want to **log in to use this feature.**
2. As an **inventory manager,** I want to **add Inventory record details.**
3. As an **inventory manager,** I want to **log out after use.**

12) As a **doctor**, I want to **raise an item request.**

**Notes:**

* User must be logged in/log out as an doctor to use this feature.
* Request record should include RequestID,doctor Name,item Name,Quantity required,Request Status.

**Updated stories:**

1. As a **doctor,** I want to **log in to use this feature.**
2. As a **doctor,** I want to **add a request for the inventory.**
3. As a**doctor,** I want to **log out after use.**

13) As an **inventory manager,** I want to **update the inventory details.**

**Notes:**

* User must be logged in/log out as an inventory manager to use this feature.
* Inventory Manager should be able to update the quantity available while processing an inventory request.
* Only inventory managerhas the right to update Inventory record details.

**Updated stories:**

1. As an **inventory manager,** I want to **log in to use this feature.**
2. As an **inventory manager,** I want to **update Inventory record details.**
3. As an **inventory manager,** I want to **log out after use.**

14) As an **inventory manager,** I want to **delete the inventory details.**

**Notes:**

* User must be logged in/log out as an inventory manager to use this feature.
* Inventory record should be deleted if the available quantity is zero or the inventory which are not required in future.
* Only inventory managerhas the right to delete Inventory record details which are not required in future or for the inventory which has zero stock available.

**Updated stories:**

1. As an **inventory manager,** I want to **log in to use this feature.**
2. As an **inventory manager,** I want to **delete Inventory record details.**
3. As an **inventory manager,** I want to **log out after use.**

**15)** As an **inventory manager,** I want to **update the request status of the requested Inventory.**

**Notes:**

* User must be logged in/log out as an inventory manager to use this feature.
* The inventory manager will mark the request as completed once it is done.
* Only inventory manager has the rights to update the request status.

**Updated Stories:**

1. As an **inventory manager,** I want to **log in to use this feature.**
2. As an **inventory manager,** I want to **update the request status of the requested Inventory.**
3. As an **inventory manager,** I want to **log out after use.**

**SPRINT 2 CONCEPTUAL DESIGN:**

**ENTITY:** Patient

**ATTRIBUTES:**

Patient\_ID

Patient\_Name [Composite attribute]

               Last\_Name

               First\_Name

Patient\_Type

Address [Composite attribute]

               Addr\_line1

               Addr\_line2

               City

               Zip\_code

Email [Multi valued attribute]

Mobile\_Number [Multi valued attribute]

Emergency\_Mobile\_Number [Multi valued attribute]

**ENTITY:** Employee

**ATTRIBUTES:**

Employee\_ID

Employee\_Name [Composite attribute]

               Last\_Name

               First\_Name

User\_Name

Password

Address [Composite attribute]

               Addr\_line1

               Addr\_line2

               City

               Zip\_code

Email [Multi valued attribute]

Mobile\_Number [Multi valued attribute]

**ENTITY:** Doctor

**ATTRIBUTES:**

Employee\_ID

Degree

Specialization

Visiting\_Hours

**ENTITY:** Administrator

**ATTRIBUTES:**

Employee\_ID

**ENTITY:** Operator

**ATTRIBUTES:**

Employee\_ID

**ENTITY:** InventoryManager

**ATTRIBUTES:**

Employee\_ID

**WEAK ENTITY:** Appointment

**IDENTIFYING ENTITY:** Operator and patient

**ATTRIBUTES:**

Appointment\_made\_by\_ID

Appointment\_made\_for\_ID

Appointment\_with\_ID

Appointment\_Date

Appointment\_Time

**WEAK ENTITY:** Patient\_Medical\_Records

**IDENTIFYING ENTITY:** Operator and patient

**ATTRIBUTES:**

Disease

comments

visited\_On

**Entity:** Wards

**Attributes :**

Ward\_id

Ward Type

Capacity

**Entity:** Store\_Details

**Attributes :**

Item\_id

Item\_Name

Quantity

**Entity:** Requests

**Attributes :**

Request\_id

Request\_Name

Quantity

Request\_Description

Request\_status

Action: **operator** updates **patient personal details.**

Action: **administrator** updates **doctor record details.**

Action: **administrator** updates **operator record details.**

Action: **administrator** **adds Inventory Manager records**.

Action: **inventory manager adds an item to the inventory.**

Action: **inventory manager updates the inventory details.**

Action: **inventory manager delete inventory details.**

**RELATIONSHIPS:**

Relationship: **Operator** schedules **doctor**’s appointment for **patients**

Descriptive Attributes:

Appointment Number

Appointment Time

Cardinality: Many to Many to Many

Participation:

Operator has partial participation

Doctor has partial participation

Patient has total participation

Relationship: **Operator** adds **patient\_record** based on **doctor** comments.

Cardinality: One to Many to One

Participation:

Operator has partial participation

patient\_record has total participation

Doctor has partial participation

Identifying Relationship: **Patient** has **Patient\_Record.**

Cardinality: One to Many

Participation:

Patient has total participation

Patient\_Record has total participation

Relationship: **Operator** books **Ward** for **patient**

Cardinality: Many to many to one

Descriptive Attributes:

Bed Number

Participation:

Operator has partial participation

Ward has partial participation

Patient has partial participation

Relationship: **Doctor** raisesa **request**

Cardinality: Many to one

Participation:

Doctor has partial participation

Request has total participation

**Relational Model:**

TABLE**: Patient**

COLUMNS**:**

patient\_id [Primary Key]

last\_Name

first\_Name

age

sex

patient\_Type

addr\_line1

addr\_line2

city

zip\_code

email\_id\_1

email\_id\_2

mobile\_number

e\_mobile\_number

NORMALIZATION: It is in 4NF

TABLE**: Employee**

COLUMNS**:**

employee\_id [Primary Key]

user\_name [unique]

pass

last\_Name

first\_Name

addr\_line1

addr\_line2

city

zip\_code

email\_id\_1

email\_id\_2

mobile\_number

NORMALIZATION: It is in 4NF

TABLE**: Doctor**

COLUMNS**:**

doctor\_id [foreign key; references Employee\_ID of Employee table], [Primary Key]

degree

specialization

in\_time

out\_time

NORMALIZATION: It is in 4NF

TABLE**: Administrator**

COLUMNS**:**

admin\_id [foreign key; references employee\_id of Employee table], [Primary Key]

NORMALIZATION: It is in 4NF

TABLE**: Operator**

COLUMNS**:**

operator\_id [foreign key; references employee\_id of Employee table], [Primary Key]

NORMALIZATION: It is in 4NF

TABLE**:** **Appointment**

COLUMNS:

apt\_no [Primary Key]

operator\_id [foreign key; references operator\_id of Operator table]

patient\_id [foreign key; references patient\_id of Patient table]

doctor\_id [foreign key; references doctor\_id of Doctor table]

apt\_time

NORMALIZATION: It is in 4NF

*Justification: Using cross reference approach to represent the many to many to many relationship “Operator schedules doctor’s appointment for patients” because this is a ternary relationship. Adding relationship attributes Appointment\_Number and Appointment\_Time as well.*

TABLE: **Patient\_Records**

COLUMNS:

record\_id [Primary Key]

patient\_id [foreign key; references patient\_id of Patient table]

doctor\_id [foreign key; references doctor\_id of Doctor table]

operator\_id [foreign key; references operator\_id of Operator table]

disease

comments

Visited\_On

NORMALIZATION: It is in 4NF

*Justification: Using foreign key approach to represent the one to many relationship “Operator adds patient\_medical\_record” because it is higher overhead to create a separate table to represent this relationship.*

TABLE: **Wards**

COLUMNS:

Ward\_ID [Primary Key]

Ward\_Type

Capacity

NORMALIZATION: It is in 4NF

TABLE: **Admitted Patients**

COLUMNS:

Patient\_ID [Primary Key] [foreign key; references patient\_id of Patient table]

Ward\_ID [foreign key; references Ward\_ID of Wards table]

Operator\_ID [foreign key; references employee\_id of Employee table]

Bed\_Number

NORMALIZATION: It is in 4NF

TABLE: **Inventory**

COLUMNS:

Item\_id [Primary Key]

Item\_Name

Quantity

NORMALIZATION: It is in 4NF

TABLE: **Request**

COLUMNS:

Request\_id [Primary Key]

Doctor\_id [foreign key; references doctor\_id of Doctor table]

Item\_name [foreign key; references Item\_name of Store table]

Quantity

Status

NORMALIZATION: It is in 3NF

**SPRINT 3 PREPARATION:**

**Story in order of priority:**

* 1. As a **doctor,** I want to **view patient appointments for the day.**
  2. As an **administrator**, I want **to add lab in charge details.**
  3. As an **administrator**, I want to **add emergency manager details.**
  4. As an **administrator**, I want to **update employee details.**
  5. As an **administrator**, I want to **delete employee details.**
  6. As a **lab in charge,** I want to **add test results of patients.**
  7. As a **doctor**, I want to **view the test result of the patients.**
  8. As an **emergency manager,** I want to **update blood quantity available of respective blood groups.**
  9. As a **doctor**, I want to **view the blood availability at the blood bank.**
  10. As an **emergency manager,** I want to **add emergency case details.**
  11. As an **emergency manager,** I want to **add ambulance details.**
  12. As an **emergency manager,** I want to **delete emergency case details.**

1. As a **doctor,** I want to **view patient appointments for the day.**

**Notes:**

* User must be logged in/logout as a doctor to use this feature.
* The doctor can only view patient appointments for that particular day and can’t edit it.

**Updated Stories:**

1. As a **doctor,** I want to **log in to use this feature.**
2. As a **doctor,** I want to **view patient appointments for the day.**
3. As a **doctor,** I want to **logout after use.**

**2)** As an **administrator**, I want **to add lab in charge details.**

**Notes:**

* User must be logged in/logout as an administrator to use this feature.
* Lab in charge details include name, address, contact information.
* Only administrator has the rights to add lab in charge details.

**Updated stories:**

1. As an **administrator,** I want to **log in to use this feature.**
2. As an **administrator,** I want to **add lab in charge details.**
3. As an **administrator,** I want to **logout after use.**

  3) As an **administrator**, I want to **add emergency manager details.**

**Notes:**

* User must be logged in/logout as an administrator to use this feature.
* Emergency manager details include name, address, contact information.
* Only administrator has the rights to add emergency manager details.

**Updated stories:**

1. As an **administrator,** I want to **log in to use this feature.**
2. As an **administrator,** I want to **add emergency manager details.**
3. As an **administrator,** I want to **logout after use.**

  4) As an **administrator**, I want to **update employee details.**

**Notes:**

* User must be logged in/logout as an administrator to use this feature.
* Employee details includes details (like name, address, contact information) of doctor, operator, emergency manager, inventory manager, lab in charge.
* Only administrator has the rights to update employee details.

**Updated stories:**

1. As an **administrator,** I want to **log in to use this feature.**
2. As an **administrator,** I want to **update employee details.**
3. As an **administrator,** I want to **logout after use.**

  5) As an **administrator**, I want to **delete employee details.**

**Notes:**

* User must be logged in/logout as an administrator to use this feature.
* Employee details includes details (like name, address, contact information) of doctor, operator, emergency manager, inventory manager, lab in charge.
* Only administrator has the rights to delete employee details.

**Updated stories:**

1. As an **administrator,** I want to **log in to use this feature.**
2. As an **administrator,** I want to **delete employee details.**
3. As an **administrator,** I want to **logout after use.**

6) As a **lab in charge,** I want to **add test results of patients.**

**Notes:**

* User must be logged in/logout as an administrator to use this feature.
* Test result of patients will contain details like patient id, test name, test result.
* Only lab in charge has the rights to add test records of patients.

**Updated stories:**

1. As a **lab in charge,** I want to **log in to use this feature.**
2. As a **lab in charge,** I want to **add test records of patients.**
3. As a **lab in charge,** I want to **logout after use.**

**7)** As a **doctor**, I want to **view the test result of the patients.**

**Notes:**

* User must be logged in/logout as a doctor to use this feature.
* The doctor can only view test records of the patients and can’t edit it.

**Updated Stories:**

1. As a **doctor,** I want to **log in to use this feature.**
2. As a **doctor,** I want to **view the test record of the patients.**
3. As a **doctor,** I want to **logout after use.**

8) As an **emergency manager,** I want to **update blood quantity available of respective blood groups.**

**Notes:**

* User must be logged in/logout as an emergency manager to use this feature.
* Blood availability details include quantity of various blood groups.
* Only emergency manager has the rights to update update blood quantity available of respective blood groups.

**Updated stories:**

1. As an **administrator,** I want to **log in to use this feature.**
2. As an **administrator,** I want to **update blood quantity available of respective blood groups.**
3. As an **administrator,** I want to **logout after use.**

9) As a **doctor**, I want to **view the blood availability at the blood bank.**

**Notes:**

* User must be logged in/logout as a doctor to use this feature.
* The doctor can only view the blood availability at the blood banks and can’t edit it.

**Updated Stories:**

1. As a **doctor,** I want to **log in to use this feature.**
2. As a **doctor,** I want to **view the blood availability at the blood bank.**
3. As a **doctor,** I want to **logout after use.**

10) As an **emergency manager,** I want to **add emergency case details.**

**Notes:**

* User must be logged in/logout as an emergency manager to use this feature.
* Emergency case details includes Emergency Case Number, patient name, Address, Date, time, blood group of the patient, ambulance alted.
* Only emergency managerhas the rights to add emergency case details.

**Updated stories:**

1. As an **emergency manager,** I want to **log in to use this feature.**
2. As an **emergency manager,** I want to **add emergency case details.**
3. As an **emergency manager,** I want to **logout after use.**

11) As an **emergency manager,** I want to **add ambulance details.**

**Notes:**

* User must be logged in/logout as an emergency manager to use this feature.
* Ambulance details must include Ambulance Number, driver name, Available/Not Available.
* Only emergency managerhas the rights to allot ambulance for emergency cases.

**Updated stories:**

1. As an **emergency manager,** I want to **log in to use this feature.**
2. As an **emergency manager,** I want to **add ambulance details.**
3. As an **emergency manager,** I want to **logout after use.**

12) As an **emergency manager,** I want to **delete emergency case details.**

**Notes:**

* User must be logged in/logout as an emergency manager to use this feature.
* Only emergency case number is sufficient to delete emergency case details.
* Only emergency managerhas the rights to delete emergency cases details.

**Updated stories:**

1. As an **emergency manager,** I want to **log in to use this feature.**
2. As an **emergency manager,** I want to **delete emergency cases.**
3. As an **emergency manager,** I want to **logout after use.**

**SPRINT 3 PREPARATION:**

**Story in order of priority:**

* 1. As a **doctor,** I want to **view patient appointments for the day.**
  2. As an **administrator**, I want **to add lab in charge details.**
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2. As a **doctor,** I want to **view patient appointments for the day.**
3. As a **doctor,** I want to **logout after use.**

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**Notes:**

* User must be logged in/logout as an administrator to use this feature.
* Lab in charge details include name, address, contact information.
* Only administrator has the rights to add lab in charge details.

**Updated stories:**

1. As an **administrator,** I want to **log in to use this feature.**
2. As an **administrator,** I want to **add lab in charge details.**
3. As an **administrator,** I want to **logout after use.**

  3) As an **administrator**, I want to **add emergency manager details.**

**Notes:**

* User must be logged in/logout as an administrator to use this feature.
* Emergency manager details include name, address, contact information.
* Only administrator has the rights to add emergency manager details.

**Updated stories:**

1. As an **administrator,** I want to **log in to use this feature.**
2. As an **administrator,** I want to **add emergency manager details.**
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**Notes:**

* User must be logged in/logout as an administrator to use this feature.
* Employee details includes details (like name, address, contact information) of doctor, operator, emergency manager, inventory manager, lab in charge.
* Only administrator has the rights to update employee details.

**Updated stories:**

1. As an **administrator,** I want to **log in to use this feature.**
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6) As a **lab in charge,** I want to **add test results of patients.**

**Notes:**

* User must be logged in/logout as an administrator to use this feature.
* Test result of patients will contain details like patient id, test name, test result.
* Only lab in charge has the rights to add test records of patients.

**Updated stories:**

1. As a **lab in charge,** I want to **log in to use this feature.**
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**Notes:**

* User must be logged in/logout as a doctor to use this feature.
* The doctor can only view test records of the patients and can’t edit it.

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**Notes:**

* User must be logged in/logout as a doctor to use this feature.
* The doctor can only view the blood availability at the blood banks and can’t edit it.

**Updated Stories:**

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2. As a **doctor,** I want to **view the blood availability at the blood bank.**
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**Notes:**

* User must be logged in/logout as an emergency manager to use this feature.
* Ambulance details must include Ambulance Number, driver name, Available/Not Available.
* Only emergency managerhas the rights to allot ambulance for emergency cases.

**Updated stories:**

1. As an **emergency manager,** I want to **log in to use this feature.**
2. As an **emergency manager,** I want to **add ambulance details.**
3. As an **emergency manager,** I want to **logout after use.**

12) As an **emergency manager,** I want to **delete emergency case details.**

**Notes:**

* User must be logged in/logout as an emergency manager to use this feature.
* Only emergency case number is sufficient to delete emergency case details.
* Only emergency managerhas the rights to delete emergency cases details.

**Updated stories:**

1. As an **emergency manager,** I want to **log in to use this feature.**
2. As an **emergency manager,** I want to **delete emergency cases.**
3. As an **emergency manager,** I want to **logout after use.**

**SPRINT 3 CONCEPTUAL DESIGN:**

**ENTITY:** Patient

**ATTRIBUTES:**

Patient\_ID

Patient\_Name [Composite attribute]

               Last\_Name

               First\_Name

Age

Sex

Patient\_Type

Address [Composite attribute]

               Addr\_line1

               Addr\_line2

               City

               Zip\_code

Email [Multi valued attribute]

Mobile\_Number

Emergency\_Mobile\_Number

**ENTITY:** Employee

**ATTRIBUTES:**

Employee\_ID

Employee\_Name [Composite attribute]

               Last\_Name

               First\_Name

user\_name

pass

Address [Composite attribute]

               Addr\_line1

               Addr\_line2

               City

               Zip\_code

Email [Multi valued attribute]

Mobile\_Number

**ENTITY:** Doctor

**ATTRIBUTES:**

Employee\_ID

Degree

Specialization

in\_time

out\_time

**ENTITY:** Administrator

**ATTRIBUTES:**

Employee\_ID

**ENTITY:** Operator

**ATTRIBUTES:**

Employee\_ID

**ENTITY:** InventoryManager

**ATTRIBUTES:**

Employee\_ID

**ENTITY:** EmergencyManager

**ATTRIBUTES:**

Employee\_ID

**ENTITY:** Lab InCharge

**ATTRIBUTES:**

Employee\_ID

Laboratory

**Generalization/Specialization:**

Generalization “Employee” has the specializations “Doctor”, “Administrator” and “Operator”.

Doctor and Operator are disjoint with partial participation with Employee.

Doctor and Administrator are overlapping with partial participation with Employee.

Administrator and Operator are disjoint with partial participation with Employee.

**WEAK ENTITY:** Patient\_Records

**IDENTIFYING ENTITY:** Patient

**ATTRIBUTES:**

record\_id

Disease

Comments

CreatedOn

**Entity:** Wards

**Attributes :**

Ward\_id

Ward Type

Capacity

**Entity:** Store\_Details

**Attributes :**

Item\_Name

Quantity

**Entity:** Requests

**Attributes :**

Request\_id

Request\_Name

Quantity

Request\_status

**Entity :** BloodGroup

Attributes :

Blood\_Group\_Name

Quantity

**Entity :** Emergency\_Case\_Details :

Attributes :

Case\_id

Name

Address [Composite attribute]

               Addr\_line1

               Addr\_line2

               City

               Zip\_code

Mobile\_Number

**Entity :** Ambulance

Attributes :

Amb\_No.

Driver\_Name [Composite attribute]

Last\_name

First\_name

**Entity**: Inventory

Attributes:

Item\_Name

Quantity

Description

ACTION: **Administrator** adds **doctor**.

ACTION: **Administrator** adds **operator**.

ACTION: **Operator** adds **patient** personal details.

ACTION: **Operator** adds **doctor** visiting hours.

ACTION: **Operator** updates **patient personal details.**

ACTION: **Administrator** updates **doctor record details.**

ACTION: **Administrator** updates **operator record details.**

ACTION: **Administrator** adds **Inventory Manager records**.

ACTION: **Inventory manager** addsan **item to the inventory.**

ACTION: **Inventory manager** updatesthe **inventory details.**

ACTION: **Inventory manager** delete **inventory details.**

ACTION: **Doctor** views **patient appointments for the day.**

ACTION: A**dministrator** adds **lab in charge details.**

ACTION: **Administrator** adds **emergency manager details.**

ACTION: **Administrator** updates **employee details.**

ACTION: A**dministrator** deletes **employee details.**

ACTION: D**octor** views **the test result of the patients.**

ACTION: E**mergency manager** updates **blood quantity available of respective blood groups.**

ACTION: D**octor** views **the blood availability at the blood bank.**

ACTION: E**mergency manager** adds **ambulance details.**

ACTION: E**mergency manager** updates **ambulance details.**

ACTION: E**mergency manager** deletes **ambulance details.**

**RELATIONSHIPS:**

Relationship: **Operator** schedules **doctor**’s appointment for **patients**

Descriptive Attributes:

            Appointment Number

            Appointment Time

Cardinality:  Many to Many to Many

Participation:

            Operator has partial participation

            Doctor has partial participation

            Patient has total participation

Relationship: **Operator** adds **patient\_record** based on **doctor** comments.

    Cardinality: One to Many to One

Participation:

           Operator has partial participation

           patient\_record has total participation

           Doctor has partial participation

Identifying Relationship: **Patient** has **Patient\_Record.**

Cardinality: One to Many

Participation:

           Patient has total participation

           Patient\_Record has total participation

   Relationship: **Operator** books **Ward** for **patient**

   Cardinality: Many to many to one

   Descriptive Attributes:

            Bed Number

   Participation:

          Operator has partial participation

Ward has partial participation

Patient has partial participation

    Relationship: **Doctor** raisesa **request**

    Cardinality: Many to one

    Participation:

Doctor has partial participation

Request has total participation

Relationship: **Lab in charge** adds **test results** of **patients.**

Cardinality: one to many to one

Descriptive Attributes:

Test Name

Test Result

Test taken on

    Participation:

Lab in charge has partial participation

Test results has total participation

Patient has partial participation

Relationship: **Emergency manager** adds **emergency case details**

Cardinality: one to many

    Participation:

Emergency manager has partial participation

Emergency case details has total participation

**Relational Model:**

TABLE**: Patient**

COLUMNS**:**

patient\_id [Primary Key]

last\_Name

first\_Name

sex

patient\_Type

addr\_line1

addr\_line2

city

zip\_code

email\_id\_1 [unique]

email\_id\_2 [unique]

mobile\_number [unique]

e\_mobile\_number [unique]

Highest normalization level: 2NF

Justification (if below 4NF): This table is not in 3NF because there is a transitive functional dependency between city and zip\_code. But we decided to keep the table in 2NF because we are not interested in storing the city and zip code of patients who are not part of the database.

Indexes:

Index #: clustered

Columns: patient\_id

Justification: The attribute patient\_id is unique to each row. When there is a single primary key, a table is automatically sorted based on it. This implies that the key is clustered.

Index #: non-clustered

Columns: mobile\_number

Justification: The attribute mobile\_number is unique. The information is sorted by the primary key; thus, it is not sorted by mobile\_number and hence it is non-clustered.

TABLE**: Employee**

COLUMNS**:**

employee\_id [Primary Key]

user\_name [unique]

pass

last\_Name

first\_Name

addr\_line1

addr\_line2

city

zip\_code

email\_id\_1 [unique]

email\_id\_2 [unique]

mobile\_number [unique]

Highest normalization level: 2NF

Justification (if below 4NF): This table is not in 3NF because there is a transitive functional dependency between city and zip code. But we decided to keep the table in 2NF because we are not interested in storing the city and zip code of employee’s who are not part of the database.

Indexes:

Index #: clustered

Columns: employee\_id

Justification: The attribute employee\_id is unique to each row. When there is a single primary key, a table is automatically sorted based on it. This implies that the key is clustered.

Index #: non-clustered

Columns: user\_name

Justification: The attribute user\_name is unique. The information is sorted by the primary key; thus, it is not sorted by user\_name and hence it is non-clustered.

TABLE**: Doctor**

COLUMNS**:**

doctor\_id [foreign key; references Employee\_ID of Employee table], [Primary Key]

degree

specialization

in\_time

out\_time

Highest normalization level: 4NF

Justification (if below 4NF): NA

Indexes:

Index #: clustered

Columns: doctor\_id

Justification: The attribute doctor\_id is unique to each row. When there is a single primary key, a table is automatically sorted based on it. This implies that the key is clustered.

TABLE**: Administrator**

COLUMNS**:**

admin\_id [foreign key; references employee\_id of Employee table], [Primary Key]

Highest normalization level: 4NF

Justification (if below 4NF): NA

Indexes:

Index #: clustered

Columns: admin\_id

Justification: The attribute admin\_id is unique to each row. When there is a single primary key, a table is automatically sorted based on it. This implies that the key is clustered.

TABLE**: Operator**

COLUMNS**:**

operator\_id [foreign key; references employee\_id of Employee table], [Primary Key]

Highest normalization level: 4NF

Justification (if below 4NF): NA

Indexes:

Index #: clustered

Columns: operator\_id

Justification: The attribute operator\_id is unique to each row. When there is a single primary key, a table is automatically sorted based on it. This implies that the key is clustered.

TABLE**:** **Appointment**

COLUMNS:

apt\_no [Primary Key]

operator\_id [foreign key; references operator\_id of Operator table]

patient\_id [foreign key; references patient\_id of Patient table]

doctor\_id [foreign key; references doctor\_id of Doctor table]

apt\_time

*Justification: Using cross reference approach to represent the many to many to many relationship “Operator schedules doctor’s appointment for patients” because this is a ternary relationship. Adding relationship attributes Appointment\_Number and Appointment\_Time as well.*

Highest normalization level: 4NF

Justification (if below 4NF): NA

Indexes:

Index #: clustered

Columns: apt\_no

Justification: The attribute apt\_no is unique to each row. When there is a single primary key, a table is automatically sorted based on it. This implies that the key is clustered.

Index #: non-clustered

Columns: doctor\_id

Justification: Created an index on doctor-id since many individuals are interested in knowing the patients scheduled under a doctor.

TABLE: **Patient\_Records**

COLUMNS:

record\_id [Primary Key]

patient\_id [foreign key; references patient\_id of Patient table]

doctor\_id [foreign key; references doctor\_id of Doctor table]

operator\_id [foreign key; references operator\_id of Operator table]

disease

comments

Created\_on

*Justification: Using foreign key approach to represent the one to many relationship “Operator adds patient\_medical\_record” because it is higher overhead to create a separate table to represent this relationship.*

Highest normalization level: 4NF

Justification (if below 4NF): NA

Indexes:

Index #: clustered

Columns: record\_id

Justification: The attribute record\_id is unique to each row. When there is a single primary key, a table is automatically sorted based on it. This implies that the key is clustered.

Index #: non-clustered

Columns: patient\_id, Created\_on,doctor\_id

Justification:

The query the table to get the patient record details like patient name and the doctor they visited and mostly people try to look for the recent reports therefore creating composite non-clustered index.

TABLE: **Wards**

COLUMNS:

Ward\_ID [Primary Key]

Ward\_Type

Capacity

Highest normalization level: 4NF

Justification (if below 4NF): NA

Indexes:

Index #: clustered

Columns: ward\_id

Justification: The attribute ward\_id is unique to each row. When there is a single primary key, a table is automatically sorted based on it. This implies that the key is clustered.

TABLE: **Admitted Patients**

COLUMNS:

Patient\_ID [Primary Key] [foreign key; references patient\_id of Patient table]

Ward\_ID [foreign key; references Ward\_ID of Wards table]

Operator\_ID [foreign key; references employee\_id of Employee table]

Bed\_Number

*Justification: Using cross reference approach to represent the many to many to many relationship “Operator books Ward for patient” because this is a ternary relationship. Adding relationship attributes Bed\_Number as well.*

Highest normalization level: 4NF

Justification (if below 4NF): NA

Indexes:

Index #: clustered

Columns: patient\_id

Justification: The attribute patient\_id is unique to each row. When there is a single primary key, a table is automatically sorted based on it. This implies that the key is clustered.

TABLE: **Inventory**

COLUMNS:

Item\_Name [Primary Key]

Quantity

Description

Highest normalization level: 4NF

Justification (if below 4NF): NA

Indexes:

Index #: clustered

Columns: item\_name

Justification: The attribute item\_name is unique to each row. When there is a single primary key, a table is automatically sorted based on it. This implies that the key is clustered.

TABLE: **Request**

COLUMNS:

Request\_id [Primary Key]

Doctor\_id [foreign key; references doctor\_id of Doctor table]

Item\_name [foreign key; references Item\_name of Store table]

Quantity

Status

*Justification: Using foreign key approach to represent the many to one relationship “Doctor raises a request” because it is higher overhead to create a separate table to represent this relationship.*

Highest normalization level: 4NF

Justification (if below 4NF): NA

Indexes:

Index #: clustered

Columns: Request\_id

Justification: The attribute Request\_id is unique to each row. When there is a single primary key, a table is automatically sorted based on it. This implies that the key is clustered.

Index #: non-clustered

Columns: Doctor\_id ,Request\_id

Justification:

The composite index helps in sorting it out by ordering the doctor\_id and their requests.

TABLE**: Lab in charge**

COLUMNS**:**

labincharge\_id [foreign key; references employee\_id of Employee table], [Primary Key]

laboratory

Highest normalization level: 4NF

Justification (if below 4NF): NA

Indexes:

Index #: clustered

Columns: labincharge\_id

Justification: The attribute labincharge\_id is unique to each row. When there is a single primary key, a table is automatically sorted based on it. This implies that the key is clustered.

TABLE**: Inventory Manager**

COLUMNS**:**

inv\_manager\_id [foreign key; references employee\_id of Employee table], [Primary Key]

Highest normalization level: 4NF

Justification (if below 4NF): NA

Indexes:

Index #: clustered

Columns: inv\_manager\_id

Justification: The attribute inv\_manager\_id is unique to each row. When there is a single primary key, a table is automatically sorted based on it. This implies that the key is clustered.

TABLE**: Emergency Manager**

COLUMNS**:**

emergencymanager\_id [foreign key; references employee\_id of Employee table], [Primary Key]

Highest normalization level: 4NF

Justification (if below 4NF): NA

Indexes:

Index #: clustered

Columns: emergencymanager\_id

Justification: The attribute emergencymanager\_id is unique to each row. When there is a single primary key, a table is automatically sorted based on it. This implies that the key is clustered.

TABLE**: Blood Group**

COLUMNS**:**

blood\_group\_name [Primary Key]

quantity

Highest normalization level: 4NF

Justification (if below 4NF): NA

Indexes:

Index #: clustered

Columns: blood\_group\_name

Justification: The attribute blood\_group\_name is unique to each row. When there is a single primary key, a table is automatically sorted based on it. This implies that the key is clustered.

TABLE**: Ambulance**

COLUMNS**:**

ambulance\_no [Primary Key]

driver\_first\_name

driver\_last\_name

Highest normalization level: 4NF

Justification (if below 4NF): NA

Indexes:

Index #: clustered

Columns: ambulance\_no

Justification: The attribute ambulance\_no is unique to each row. When there is a single primary key, a table is automatically sorted based on it. This implies that the key is clustered.

TABLE**: Emergency case details**

COLUMNS**:**

case\_id [Primary Key]

emergencymanager\_id [foreign key; references emergencymanager\_id of Emergency manager table]

last\_Name

first\_Name

addr\_line1

addr\_line2

city

zip\_code

mobile\_number [unique]

*Justification: Using foreign key approach to represent the one to many relationship “Emergency manager adds emergency case details” because it is higher overhead to create a separate table to represent this relationship.*

Highest normalization level: 2NF

Justification (if below 4NF): This table is not in 3NF because there is a transitive functional dependency between city and zip code. But we decided to keep the table in 2NF because we are not interested in storing the city and zip code of emergency cases who are not part of the database.

Indexes:

Index #: clustered

Columns: case\_id

Justification: The attribute case\_id is unique to each row. When there is a single primary key, a table is automatically sorted based on it. This implies that the key is clustered.

Index #: non-clustered

Columns: mobile\_number

Justification: The attribute mobile\_number is unique. The information is sorted by the primary key, thus it is not sorted by mobile\_number and hence it is non clustered.

TABLE**: Patient test results**

COLUMNS**:**

Test\_ID[Primary Key]

Patient\_ID [foreign key; references patient\_id of Patient table]

labincharge\_id [foreign key; references labincharge\_id of Lab in charge table]

Test\_Name

Test\_Result

Test\_taken\_on

*Justification: Using cross reference approach to represent the one to many to one relationship “Lab in charge adds test results of patients” because this is a ternary relationship. Adding relationship attributes Bed\_Number as well.*

Highest normalization level: 4NF

Justification (if below 4NF): NA

Indexes:

Index #: clustered

Columns: Test\_ID

Justification: The attribute Test\_ID is unique to each row. When there is a single primary key, a table is automatically sorted based on it. This implies that the key is clustered.

Index #: non-clustered

Columns: Patient\_id

Justification:

To identify the tests taken by patients we have a non-clustered index.

**Stored programs**

**Stored procedure**: deleteEmployeeDetail

Parameters: user\_name, IN

Goal: The corresponding employee\_id for the entered user\_name will be fetched from employee table. Then it will check whether the employee\_id belongs to a doctor, operator, lab in charge, emergency manager or inventory manager by checking in the corresponding tables and the particular employee record will be deleted from the corresponding table.

**Trigger**: before insert on appointment table

Goal: While scheduling appointments for patients, the appointment time should be given in future. If an operator tries to schedule an appointment in the past, then this trigger will not allow to book appointment in the past. If not, a structured output is returned using error handing.

**Trigger**: before insert on inventory table

Goal: If a doctor tries to place a request on the inventory, then the trigger gets initiated on insert to check whether the quantity is greater than zero. If not, a structured output is returned using error handing.