Hospital Management System Final Project Report

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CS579 Database Management

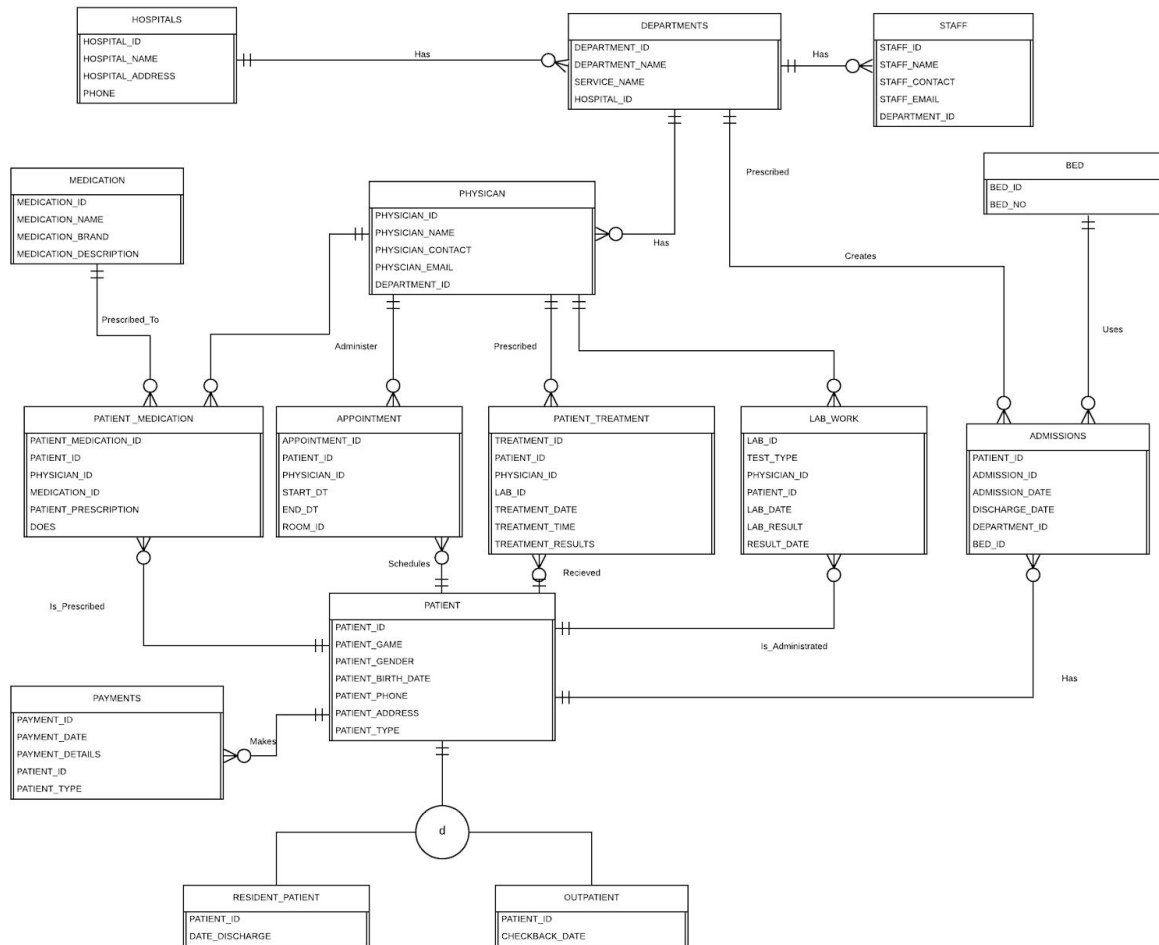Prof. John Russo

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Project Overview

The database schema is designed for the Hospital Management System to maintain hospital and patient information. The database information system will allow for a secure and easy way to store and access information of patients, doctors, rooms, billing and payments, services, and appointments.

The database will also help hospital employees manage different functions and information. It will allow staff admins, staff members, and doctors to add, delete, or query data in the database. The database also stores information important to the patients such as their medical records, treatment and appointments schedule. It also provides and stores data on the patient admissions and discharge date and time.

The schema is part of a larger application with a user interface or frontend that will provide user friendly access to administrative staff. The front end will be a web based application with a login and sign up feature that will prompt the admin to authenticate their credentials. The database will authenticate if the admin credential is valid from the login table. Upon successful authentication, the system will redirect the admin to the main page of the application based on account permission. In the main page, the admin will have different features to manage information such as a dashboard, department, doctors, patients, nurse, billing and payments, room availability, and prescriptions. In the dashboard, the admin will be able to use different features within the Hospital Management System. Admins can add, delete, or edit department, doctor, patient, billing, room availability, and prescription information.

E-R Diagrams

HOSPITALS
- HOSPITAL_ID
- HOSPITAL_NAME
- HOSPITAL_ADDRESS
- PHONE

Has

DEPARTMENTS
- DEPARTMENT_ID
- DEPARTMENT_NAME
- SERVICE_NAME
- HOSPITAL_ID

Has

STAFF
- STAFF_ID
- STAFF_NAME
- STAFF_CONTACT
- STAFF_EMAIL
- DEPARTMENT_ID

MEDICATION
- MEDICATION_ID
- MEDICATION_NAME
- MEDICATION_BRAND
- MEDICATION_DESCRIPTION

PHYSICAN
- PHYSICIAN_ID
- PHYSICIAN_NAME
- PHYSICIAN_CONTACT
- PHYSICAN_EMAIL
- DEPARTMENT_ID

Prescribed

BED
- BED_ID
- BED_NO

Has

Creates

Uses

Prescribed_To

Administer

Prescribed

PATIENT_MEDICATION
- PATIENT_MEDICATION_ID
- PATIENT_ID
- PHYSICION_ID
- MEDICATION_ID
- PATIENT_PRESCRIPTION
- DOES

APPOINTMENT
- APPOINTMENT_ID
- PATIENT_ID
- PHYSICION_ID
- START_DT
- END_DT
- ROOM_ID

PATIENT_TREATMENT
- TREATMENT_ID
- PATIENT_ID
- PHYSICION_ID
- LAB_ID
- TREATMENT_DATE
- TREATMENT_TIME
- TREATMENT_RESULTS

LAB_WORK
- LAB_ID
- TEST_TYPE
- PHYSICION_ID
- PATIENT_ID
- LAB_DATE
- LAB_RESULT
- RESULT_DATE

ADMISSIONS
- PATIENT_ID
- ADMISSION_ID
- ADMISSION_DATE
- DISCHARGE_DATE
- DEPARTMENT_ID
- BED_ID

Schedules

Recieved

Is_Prescribed

Is_Administrated

Has

PATIENT
- PATIENT_ID
- PATIENT_GAME
- PATIENT_GENDER
- PATIENT_BIRTH_DATE
- PATIENT_PHONE
- PATIENT_ADDRESS
- PATIENT_TYPE

PAYMENTS
- PAYMENT_ID
- PAYMENT_DATE
- PAYMENT_DETAILS
- PATIENT_ID
- PATIENT_TYPE

Makes

d

RESIDENT_PATIENT
- PATIENT_ID
- DATE_DISCHARGE
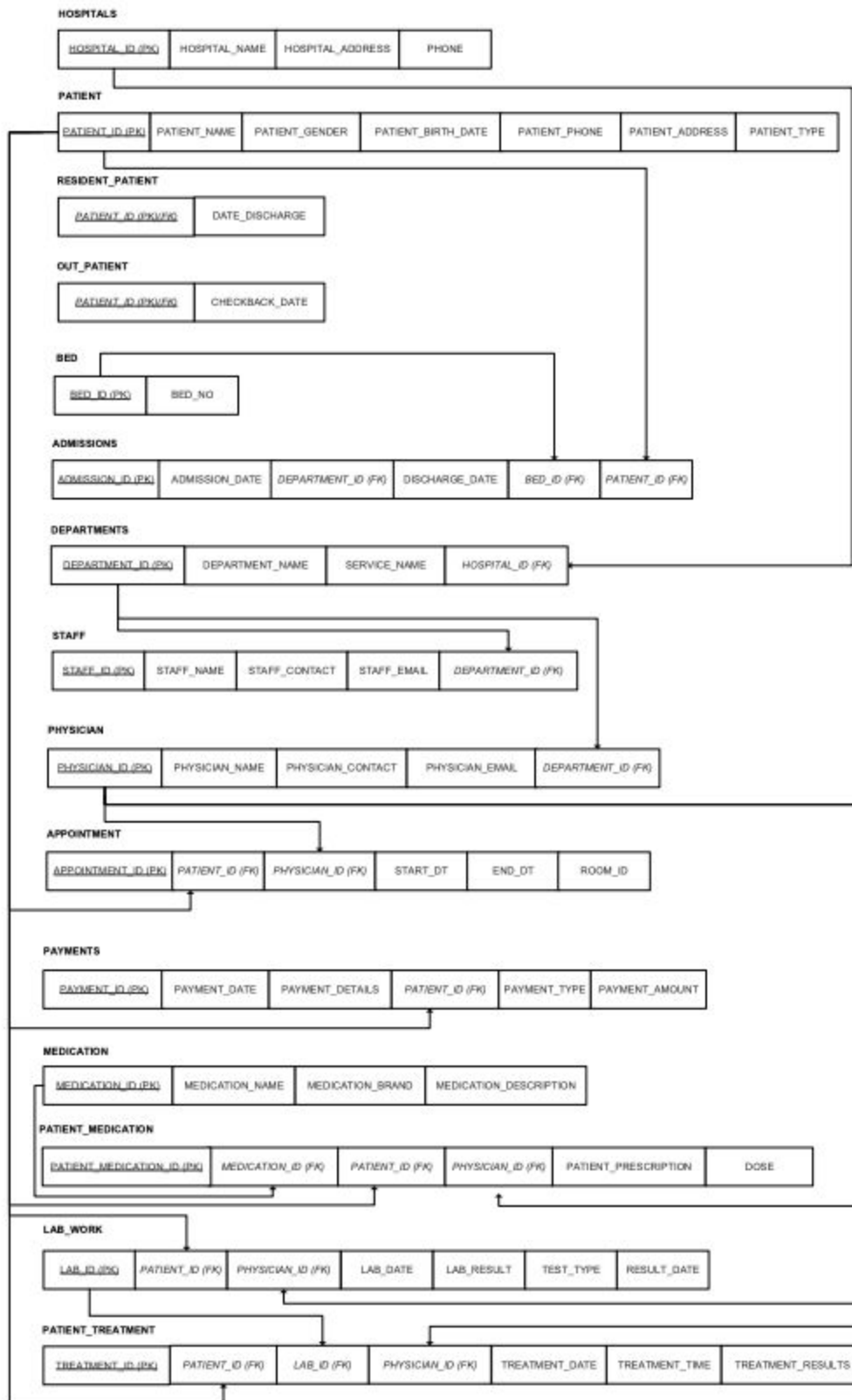
OUTPATIENT
- PATIENT_ID
- CHECKBACK_DATE

The above E-R diagram demonstrates the entities and relationship for the Hospital Management System Database. The Hospital Management System Database contains fifteen tables. The Hospital table has different Departments. The Departments table has Staff members and Physicians. Patients are admitted to the hospital through departments and can be assigned a bed. Physicians prescribe medication and make appointments to associated patients as well as documenting patients' treatment and lab work. Patients make payments after their visits and patients can be associated as a resident patient or an outpatient.

E-R Diagrams Cont.

The above E-R Diagram demonstrates the attributes and identifier for the Hospital Management

System database.

Normalization (3NF)

HOSPITALS

| HOSPITAL_ID (PK) | HOSPITAL_NAME | HOSPITAL_ADDRESS | PHONE |

PATIENT

| PATIENT_ID (PK) | PATIENT_NAME | PATIENT_GENDER | PATIENT_BIRTH_DATE | PATIENT_PHONE | PATIENT_ADDRESS | PATIENT_TYPE |

RESIDENT_PATIENT

| PATIENT_ID (PK/FK) | DATE_DISCHARGE |

OUT_PATIENT

| PATIENT_ID (PK/FK) | CHECKBACK_DATE |

BED

| BED_ID (PK) | BED_NO |

ADMISSIONS

| ADMISSION_ID (PK) | ADMISSION_DATE | DEPARTMENT_ID (FK) | DISCHARGE_DATE | BED_ID (FK) | PATIENT_ID (FK) |

DEPARTMENTS

| DEPARTMENT_ID (PK) | DEPARTMENT_NAME | SERVICE_NAME | HOSPITAL_ID (FK) |

STAFF

| STAFF_ID (PK) | STAFF_NAME | STAFF_CONTACT | STAFF_EMAIL | DEPARTMENT_ID (FK) |

PHYSICIAN

| PHYSICIAN_ID (PK) | PHYSICIAN_NAME | PHYSICIAN_CONTACT | PHYSICIAN_EMAIL | DEPARTMENT_ID (FK) |

APPOINTMENT

| APPOINTMENT_ID (PK) | PATIENT_ID (FK) | PHYSICIAN_ID (FK) | START_DT | END_DT | ROOM_ID |

PAYMENTS

| PAYMENT_ID (PK) | PAYMENT_DATE | PAYMENT_DETAILS | PATIENT_ID (FK) | PAYMENT_TYPE | PAYMENT_AMOUNT |

MEDICATION

| MEDICATION_ID (PK) | MEDICATION_NAME | MEDICATION_BRAND | MEDICATION_DESCRIPTION |

PATIENT_MEDICATION

| PATIENT_MEDICATION_ID (PK) | MEDICATION_ID (FK) | PATIENT_ID (FK) | PHYSICIAN_ID (FK) | PATIENT_PRESCRIPTION | DOSE |

LAB_WORK

| LAB_ID (PK) | PATIENT_ID (FK) | PHYSICIAN_ID (FK) | LAB_DATE | LAB_RESULT | TEST_TYPE | RESULT_DATE |

PATIENT_TREATMENT

| TREATMENT_ID (PK) | PATIENT_ID (FK) | LAB_ID (FK) | PHYSICIAN_ID (FK) | TREATMENT_DATE | TREATMENT_TIME | TREATMENT_RESULTS |

Metadata

Hospital Table:

TABLE_NAME	COLUMN_NAME	DATA_TYPE	DATA_LENGTH	NULLABLE	CONSTRAINT_NAME	CONSTRAINT_TYPE
HOSPITALS	HOSPITAL_ADDRESS	VARCHAR2	250	No	[NULL]	[NULL]
[NULL]	PHONE	VARCHAR2	25	No	[NULL]	[NULL]
[NULL]	HOSPITAL_NAME	VARCHAR2	150	No	[NULL]	[NULL]
[NULL]	HOSPITAL_ID	VARCHAR2	10	No	[NULL]	PK

Department Table:

TABLE_NAME	COLUMN_NAME	DATA_TYPE	DATA_LENGTH	NULLABLE	CONSTRAINT_NAME	CONSTRAINT_TYPE
DEPARTMENTS	DEPARTMENT_ID	VARCHAR2	10	No	[NULL]	PK
[NULL]	SERVICE_NAME	VARCHAR2	50	Yes	[NULL]	[NULL]
[NULL]	HOSPITAL_ID	VARCHAR2	10	Yes	FK_DEPARTMENTS_HOSPITALS	FK
[NULL]	DEPARTMENT_NAME	VARCHAR2	50	No	[NULL]	[NULL]

Staff Table:

TABLE_NAME	COLUMN_NAME	DATA_TYPE	DATA_LENGTH	NULLABLE	CONSTRAINT_NAME	CONSTRAINT_TYPE
STAFF	DEPARTMENT_ID	VARCHAR2	10	No	FK_STAFF_DEPARTMENTS	FK
[NULL]	STAFF_CONTACT	VARCHAR2	25	No	[NULL]	[NULL]
[NULL]	STAFF_NAME	VARCHAR2	50	No	[NULL]	[NULL]
[NULL]	STAFF_ID	VARCHAR2	10	No	[NULL]	PK
[NULL]	STAFF_EMAIL	VARCHAR2	100	No	[NULL]	[NULL]

Bed Table:

TABLE_NAME	COLUMN_NAME	DATA_TYPE	DATA_LENGTH	NULLABLE	CONSTRAINT_NAME	CONSTRAINT_TYPE
BED	BED_NO	VARCHAR2	10	No	[NULL]	[NULL]
[NULL]	BED_ID	VARCHAR2	10	No	[NULL]	PK

Medication Table:

TABLE_NAME	COLUMN_NAME	DATA_TYPE	DATA_LENGTH	NULLABLE	CONSTRAINT_NAME	CONSTRAINT_TYPE
MEDICATION	MEDICATION_BRAND	VARCHAR2		No	[NULL]	[NULL]
[NULL]	MEDICATION_NAME	VARCHAR2		No	[NULL]	[NULL]
[NULL]	MEDICATION_ID	NUMBER		No	[NULL]	PK
[NULL]	MEDICATION_DESCRIPTIO	VARCHAR2		Yes	[NULL]	[NULL]

Patient Table:

TABLE_NAME	COLUMN_NAME	DATA_TYPE	DATA_LENGTH	NULLABLE	CONSTRAINT_NAME	CONSTRAINT_TYPE
PATIENT	PATIENT_ADDRESS	VARCHAR2	250	Yes	[NULL]	[NULL]
[NULL]	PATIENT_BIRTH_DATE	DATE	7	No	[NULL]	[NULL]
[NULL]	PATIENT_GENDER	CHAR	1	No	[NULL]	[NULL]
[NULL]	PATIENT_TYPE	VARCHAR2	50	No	[NULL]	[NULL]
[NULL]	PATIENT_NAME	VARCHAR2	50	No	[NULL]	[NULL]
[NULL]	PATIENT_PHONE	VARCHAR2	25	No	[NULL]	[NULL]
[NULL]	PATIENT_ID	NUMBER	22	No	[NULL]	PK

Metadata Cont.

Outpatient Table:

TABLE_NAME	COLUMN_NAME	DATA_TYPE	DATA_LENGTH	NULLABLE	CONSTRAINT_NAME	CONSTRAINT_TYPE
OUT_PATIENT	CHECKBACK_DATE	DATE	7	No	[NULL]	PK
[NULL]	PATIENT_ID	NUMBER	22	No	FK_OUTPATIENT_PATIENT	FK
[NULL]	PATIENT_ID	NUMBER	22	No	[NULL]	PK

Resident Patient Table:

TABLE_NAME	COLUMN_NAME	DATA_TYPE	DATA_LENGTH	NULLABLE	CONSTRAINT_NAME	CONSTRAINT_TYPE
RESIDENT_PATIENT	DATE_DISCHARGED	DATE	7	No	[NULL]	PK
[NULL]	PATIENT_ID	NUMBER	22	No	FK_RESIDENTPATIENT_PATIENT	FK
[NULL]	PATIENT_ID	NUMBER	22	No	[NULL]	PK

Physician Table:

TABLE_NAME	COLUMN_NAME	DATA_TYPE	DATA_LENGTH	NULLABLE	CONSTRAINT_NAME	CONSTRAINT_TYPE
PHYSICIAN	DEPARTMENT_ID	VARCHAR2	10	No	FK_PHYSICIAN_DEPARTMENTS	FK
[NULL]	PHYSICIAN_CONTACT	VARCHAR2	25	No	[NULL]	[NULL]
[NULL]	PHYSICIAN_NAME	VARCHAR2	50	No	[NULL]	[NULL]
[NULL]	PHYSICIAN_ID	NUMBER	22	No	[NULL]	PK
[NULL]	PHYSICIAN_EMAIL	VARCHAR2	100	No	[NULL]	[NULL]

Admissions Table:

TABLE_NAME	COLUMN_NAME	DATA_TYPE	DATA_LENGTH	NULLABLE	CONSTRAINT_NAME	CONSTRAINT_TYPE
ADMISSIONS	ADMISSION_DATE	DATE	7	No	[NULL]	[NULL]
[NULL]	ADMISSION_ID	NUMBER	22	No	[NULL]	PK
[NULL]	PATIENT_ID	NUMBER	22	No	FK_ADMISSIONS_PATIENT	FK
[NULL]	DEPARTMENT_ID	VARCHAR2	10	No	FK_ADMISSIONS_DEPARTMENTS	FK
[NULL]	DISCHARGE_DATE	DATE	7	Yes	[NULL]	[NULL]
[NULL]	BED_ID	VARCHAR2	10	No	FK_ADMISSIONS_BED	FK

Appointment Table:

TABLE_NAME	COLUMN_NAME	DATA_TYPE	DATA_LENGTH	NULLABLE	CONSTRAINT_NAME	CONSTRAINT_TYPE
APPOINTMENT	APPOINTMENT_ID	NUMBER	22	No	[NULL]	PK
[NULL]	END_DT	TIMESTAMP(6)	11	Yes	[NULL]	[NULL]
[NULL]	START_DT	TIMESTAMP(6)	11	No	[NULL]	[NULL]
[NULL]	PHYSICIAN_ID	NUMBER	22	No	FK_APPOINTMENT_PHYSICIAN	FK
[NULL]	ROOM_ID	NUMBER	22	No	[NULL]	[NULL]
[NULL]	PATIENT_ID	NUMBER	22	No	FK_APPOINTMENT_PATIENT	FK

Patient Medication Table:

TABLE_NAME	COLUMN_NAME	DATA_TYPE	DATA_LENGTH	NULLABLE	CONSTRAINT_NAME	CONSTRAINT_TYPE
PATIENT_MEDICATION	DOES	VARCHAR2	50	No	[NULL]	[NULL]
[NULL]	MEDICATION_ID	NUMBER	22	No	FK_PATIENTMEDICATION_MEDICATION	FK
[NULL]	PHYSICIAN_ID	NUMBER	22	No	FK_PATIENTMEDICATION_PHYSICIAN	FK
[NULL]	PATIENT_MEDICATION_ID	NUMBER	22	No	[NULL]	PK
[NULL]	PATIENT_PRESCRIPTION	VARCHAR2	100	No	[NULL]	[NULL]
[NULL]	PATIENT_ID	NUMBER	22	No	FK_PATIENTMEDICATION_PATIENT	FK

Metadata Cont.

Lab Work Table:

TABLE_NAME	COLUMN_NAME	DATA_TYPE	DATA_LENGTH	NULLABLE	CONSTRAINT_NAME	CONSTRAINT_TYPE
LAB_WORK	LAB_DATE	DATE	7	No	[NULL]	[NULL]
[NULL]	LAB_ID	VARCHAR2	10	No	[NULL]	PK
[NULL]	LAB_RESULT	VARCHAR2	50	Yes	[NULL]	[NULL]
[NULL]	TEST_TYPE	VARCHAR2	50	No	[NULL]	[NULL]
[NULL]	PHYSICIAN_ID	NUMBER	22	No	FK_LABWORK_PHYSICIAN	FK
[NULL]	RESULT_DATE	DATE	7	Yes	[NULL]	[NULL]
[NULL]	PATIENT_ID	NUMBER	22	No	FK_LABWORK_PATIENT	FK

Patient Treatment Table:

TABLE_NAME	COLUMN_NAME	DATA_TYPE	DATA_LENGTH	NULLABLE	CONSTRAINT_NAME	CONSTRAINT_TYPE
PATIENT_TREATMENT	LAB_ID	VARCHAR2	10	No	FK_PATIENTTREATMENT_LABWORK	FK
[NULL]	PATIENT_ID	NUMBER	22	Yes	FK_PATIENTTREATMENT_PATIENT	FK
[NULL]	PHYSICIAN_ID	NUMBER	22	Yes	FK_PATIENTTREATMENT_PHYSICIAN	FK
[NULL]	TREATMENT_TIME	TIMESTAMP(6)	11	Yes	[NULL]	[NULL]
[NULL]	TREATMENT_ID	NUMBER	22	No	[NULL]	PK
[NULL]	TREATMENT_RESULTS	VARCHAR2	100	Yes	[NULL]	[NULL]
[NULL]	TREATMENT_DATE	DATE	7	Yes	[NULL]	[NULL]

Payments Table:

TABLE_NAME	COLUMN_NAME	DATA_TYPE	DATA_LENGTH	NULLABLE	CONSTRAINT_NAME	CONSTRAINT_TYPE
PAYMENTS	PATIENT_ID	NUMBER	22	No	FK_PAYMENTS_PATIENT	FK
[NULL]	PAYMENT_AMOUNT	NUMBER	22	No	[NULL]	[NULL]
[NULL]	PAYMENT_TYPE	VARCHAR2	50	No	[NULL]	[NULL]
[NULL]	PAYMENT_DETAILS	VARCHAR2	50	No	[NULL]	[NULL]
[NULL]	PAYMENT_ID	NUMBER	22	No	[NULL]	PK
[NULL]	PAYMENT_DATE	DATE	7	No	[NULL]	[NULL]

Example Queries

Query 1. For each department in a hospital display the number of staff members and physicians.

```sql
SELECT
      H.HOSPITAL_NAME,D.DEPARTMENT_NAME
      ,COUNT(S.DEPARTMENT_ID) AS STAFF_COUNT
      ,COUNT(P.DEPARTMENT_ID) AS PHYSICIAN_COUNT
FROM HOSPITALS H
JOIN DEPARTMENTS D ON D.HOSPITAL_ID = H.HOSPITAL_ID
LEFT JOIN STAFF S ON S.DEPARTMENT_ID = D.DEPARTMENT_ID
LEFT JOIN PHYSICIAN P ON P.DEPARTMENT_ID = D.DEPARTMENT_ID
GROUP BY H.HOSPITAL_NAME,D.DEPARTMENT_NAME
ORDER BY H.HOSPITAL_NAME,D.DEPARTMENT_NAME
```

HOSPITAL_NAME	DEPARTMENT_NAME	STAFF_COUNT	PHYSICIAN_COUNT
Boston Children Hospital	Anesthetics	1	1
Boston Children Hospital	Breast Screening	1	1
Boston Children Hospital	Cardiology	1	1
Boston Children Hospital	ER	1	1
Boston Children Hospital	General Surgery	1	0
Boston Children Hospital	Gynecology	1	1
Boston Children Hospital	Neurology	1	1
Boston Children Hospital	Oncology	1	1
Boston Children Hospital	Orthopedics	2	2
Boston Children Hospital	Urology	1	1
Brigham And Women Hospital	Anesthetics	1	1
Brigham And Women Hospital	Breast Screening	1	1
Brigham And Women Hospital	Cardiology	1	1
Brigham And Women Hospital	ER	1	1
Brigham And Women Hospital	General Surgery	1	1
Brigham And Women Hospital	Gynecology	1	1
Brigham And Women Hospital	Neurology	1	1
Brigham And Women Hospital	Oncology	1	1
Brigham And Women Hospital	Orthopedics	1	1
Brigham And Women Hospital	Urology	1	1
Massachusetts General Hospital	Anesthetics	1	1
Massachusetts General Hospital	Breast Screening	2	2

Massachusetts General Hospital	Cardiology	1	1
Massachusetts General Hospital	ER	1	1
Massachusetts General Hospital	General Surgery	1	1
Massachusetts General Hospital	Gynecology	2	2
Massachusetts General Hospital	Neurology	1	1
Massachusetts General Hospital	Oncology	1	1
Massachusetts General Hospital	Orthopedics	1	1
Massachusetts General Hospital	Urology	1	1
Newton-Wellesley Hospital	Anesthetics	2	2
Newton-Wellesley Hospital	Breast Screening	1	0
Newton-Wellesley Hospital	Cardiology	1	0
Newton-Wellesley Hospital	ER	9	9
Newton-Wellesley Hospital	General Surgery	0	1
Newton-Wellesley Hospital	Gynecology	1	1
Newton-Wellesley Hospital	Neurology	1	1
Newton-Wellesley Hospital	Oncology	1	1
Newton-Wellesley Hospital	Orthopedics	2	2
Newton-Wellesley Hospital	Urology	1	1
Tufts Medical Center	Anesthetics	1	1
Tufts Medical Center	Breast Screening	1	1
Tufts Medical Center	Cardiology	2	2
Tufts Medical Center	ER	1	1
Tufts Medical Center	General Surgery	1	1

Tufts Medical Center	Gynecology	2	2
Tufts Medical Center	Neurology	1	1
Tufts Medical Center	Oncology	1	1
Tufts Medical Center	Orthopedics	1	1
Tufts Medical Center	Urology	1	1

Download CSV
50 rows selected.

Query 2. Display the number of admissions in each hospital by month and year.

```sql
SELECT
      H.HOSPITAL_NAME
      ,EXTRACT(YEAR FROM A.ADMISSION_DATE) AS YEAR
      ,EXTRACT(MONTH FROM A.ADMISSION_DATE) AS MONTH
      ,COUNT(A.ADMISSION_ID) AS NUM_OF_ADMISSIONS
FROM HOSPITALS H
JOIN DEPARTMENTS D ON D.HOSPITAL_ID = H.HOSPITAL_ID
JOIN ADMISSIONS A ON A.DEPARTMENT_ID = D.DEPARTMENT_ID
GROUP BY
      H.HOSPITAL_NAME
      ,EXTRACT(YEAR FROM A.ADMISSION_DATE)
      ,EXTRACT(MONTH FROM A.ADMISSION_DATE)
```

HOSPITAL_NAME	YEAR	MONTH	NUM_OF_ADMISSIONS
Massachusetts General Hospital	2020	7	5
Boston Children Hospital	2020	8	1
Newton-Wellesley Hospital	2020	8	2
Boston Children Hospital	2020	7	2
Brigham And Women Hospital	2020	7	2
Newton-Wellesley Hospital	2020	7	9
Massachusetts General Hospital	2020	8	2
Tufts Medical Center	2020	7	1

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8 rows selected.

Query 3. Display the number of appointments for each physician.

```sql
SELECT
        P.PHYSICIAN_NAME
        ,D.DEPARTMENT_NAME
        ,H.HOSPITAL_NAME
        ,COUNT(A.PHYSICIAN_ID) AS NUM_OF_APPOINTMENTS
FROM PHYSICIAN P
JOIN DEPARTMENTS D ON D.DEPARTMENT_ID = P.DEPARTMENT_ID
JOIN HOSPITALS  H ON H.HOSPITAL_ID = D.HOSPITAL_ID
JOIN APPOINTMENT A ON A.PHYSICIAN_ID = P.PHYSICIAN_ID
GROUP BY
        P.PHYSICIAN_NAME,D.DEPARTMENT_NAME,H.HOSPITAL_NAME
ORDER BY P.PHYSICIAN_NAME
```

PHYSICIAN_NAME	DEPARTMENT_NAME	HOSPITAL_NAME	NUM_OF_APPOINTMENTS
Bekki Pinkney	ER	Massachusetts General Hospital	1
Bill Nye	ER	Newton–Wellesley Hospital	2
DMarty Georghiou	Anesthetics	Brigham And Women Hospital	1
Debi Currer	Anesthetics	Boston Children Hospital	1
Dennie Bourdis	General Surgery	Massachusetts General Hospital	1
Derek Shepherd	Anesthetics	Newton–Wellesley Hospital	2
Dwight Greathead	Anesthetics	Massachusetts General Hospital	1
Giordano Crisall	Orthopedics	Newton–Wellesley Hospital	1
Heloise Moxon	Cardiology	Boston Children Hospital	1
Ilka Stud	Urology	Massachusetts General Hospital	1
John Smith	Anesthetics	Newton–Wellesley Hospital	2
John Smith	ER	Tufts Medical Center	1
Karil Shields	Gynecology	Massachusetts General Hospital	1
Keisha Hatchett	ER	Newton–Wellesley Hospital	4
Lydon Colloff	ER	Boston Children Hospital	1
Rodi Coomber	Urology	Newton–Wellesley Hospital	1
Sam Curren	ER	Newton–Wellesley Hospital	2
Stace Emmines	Oncology	Massachusetts General Hospital	1
Vivie Filewood	ER	Brigham And Women Hospital	1
Yetty Kegg	Neurology	Massachusetts General Hospital	1

Download CSV
20 rows selected.

Query 4. Display all payments for a single patient by their ID.

```sql
SELECT
      P.PATIENT_NAME,
      PT.PAYMENT_DATE,
      PT.PAYMENT_AMOUNT,
      PT.PAYMENT_DETAILS,
      PT.PAYMENT_TYPE
FROM PAYMENTS PT
JOIN PATIENT P ON P.PATIENT_ID = PT.PATIENT_ID
WHERE P.PATIENT_ID = 1005
ORDER BY PT.PAYMENT_DATE DESC
```

PATIENT_NAME	PAYMENT_DATE	PAYMENT_AMOUNT	PAYMENT_DETAILS	PAYMENT_TYPE
Sundar Pichai	01-AUG-20	25	Payment for room charges	CASH
Sundar Pichai	01-AUG-20	50	Payment for Covid-19 testing	CASH

Download CSV
2 rows selected.

PATIENT_NAME	PAYMENT_DATE	PAYMENT_AMOUNT	PAYMENT_DETAILS	PAYMENT_TYPE
Sundar Pichai	01-AUG-20	25	Payment for room charges	CASH
Sundar Pichai	01-AUG-20	50	Payment for Covid-19 testing	CASH

Download CSV
2 rows selected.

Query 5. Display all medications and the number of patients to whom that medication was prescribed and average dose.

```sql
SELECT
      M.MEDICATION_NAME,
      COUNT(PM.MEDICATION_ID) AS NUM_OF_PRESCRIBED_PATIENTS
      ,CONCAT(AVG(REGEXP_REPLACE(PM.DOES, '[^0-9]', '')),' Tablets') AS
AVERAGE_DOSE
FROM MEDICATION M
LEFT JOIN PATIENT_MEDICATION PM ON PM.MEDICATION_ID = M.MEDICATION_ID
GROUP BY M.MEDICATION_NAME
ORDER BY M.MEDICATION_NAME
```

MEDICATION_NAME	NUM_OF_PRESCRIBED_PATIENTS	AVERAGE_DOSE
AMOXICILIAN	0	Tablets
AUGMENTIN	0	Tablets
Amphotericin B	0	Tablets
Ascard	1	1 Tablets
IBUPROFEN	0	Tablets
Loprin	1	1 Tablets
Nitromint	1	1 Tablets
Paracetamol	1	2 Tablets
Pulse	2	2 Tablets

Download CSV
9 rows selected.

Query 6. For each patient, display the number of times the patient got admitted to a

hospital.

```sql
SELECT
        P.PATIENT_NAME,H.HOSPITAL_NAME
        ,COUNT(A.PATIENT_ID) AS NUM_OF_ADMISSIONS
FROM PATIENT P
LEFT JOIN ADMISSIONS A ON A.PATIENT_ID = P.PATIENT_ID
LEFT JOIN DEPARTMENTS D ON D.DEPARTMENT_ID = A.DEPARTMENT_ID
LEFT JOIN HOSPITALS H ON H.HOSPITAL_ID = D.HOSPITAL_ID
GROUP BY P.PATIENT_NAME,H.HOSPITAL_NAME
ORDER BY P.PATIENT_NAME,H.HOSPITAL_NAME
```

PATIENT_NAME	HOSPITAL_NAME	NUM_OF_ADMISSIONS
Bart Simpson	Massachusetts General Hospital	1
Bill Gates	–	0
Bobby Lee	Newton-Wellesley Hospital	1
Bobby Que	Newton-Wellesley Hospital	1
Bobby Rye	Newton-Wellesley Hospital	1
David Lee	Newton-Wellesley Hospital	1
Homer Simpson	Massachusetts General Hospital	1
Jeff Bezos	Newton-Wellesley Hospital	1
John Cena	Massachusetts General Hospital	1
John Cena	Newton-Wellesley Hospital	1
Johson Rye	Newton-Wellesley Hospital	1
Kaiser Huke	Massachusetts General Hospital	1
Link Kitchinham	Brigham And Women Hospital	1
Lothaire Jakovijevic	Tufts Medical Center	1
Martha Stewart	Newton-Wellesley Hospital	1
Mr Krabs	Massachusetts General Hospital	1
Myron Langtree	Massachusetts General Hospital	1
Petronella Proffer	Brigham And Women Hospital	1
Petronella Proffer	Massachusetts General Hospital	1
Smith Josefowicz	Boston Children Hospital	1
Sponge Bob	Newton-Wellesley Hospital	1

Squid Ward	Newton–Wellesley Hospital	1
Sundar Pichai	Newton–Wellesley Hospital	1
Thor Bratt	Boston Children Hospital	1
Wendie Wyatt	Boston Children Hospital	1

Download CSV
25 rows selected.

Query 7. Display the total payments made by all patients by Month and Year.

```sql
SELECT
        H.HOSPITAL_NAME,
        EXTRACT(YEAR FROM PAYMENT_DATE) AS YEAR,
        EXTRACT(MONTH FROM PAYMENT_DATE) AS MONTH,
        SUM(PAYMENT_AMOUNT) AS PAYMENT_AMOUNT
FROM PAYMENTS PT
JOIN PATIENT P ON P.PATIENT_ID = PT.PATIENT_ID
JOIN ADMISSIONS A ON A.PATIENT_ID = P.PATIENT_ID
JOIN DEPARTMENTS D ON D.DEPARTMENT_ID = A.DEPARTMENT_ID
JOIN HOSPITALS H ON H.HOSPITAL_ID = D.HOSPITAL_ID
GROUP BY
        H.HOSPITAL_NAME,
        EXTRACT(YEAR FROM PAYMENT_DATE),
        EXTRACT(MONTH FROM PAYMENT_DATE)
ORDER BY
        H.HOSPITAL_NAME,
        EXTRACT(YEAR FROM PAYMENT_DATE),
        EXTRACT(MONTH FROM PAYMENT_DATE)
```

HOSPITAL_NAME	YEAR	MONTH	PAYMENT_AMOUNT
Boston Children Hospital	2020	8	1300
Brigham And Women Hospital	2020	8	600
Massachusetts General Hospital	2020	8	1250
Newton-Wellesley Hospital	2020	8	825
Tufts Medical Center	2020	8	1500

Download CSV

5 rows selected.

Query 8. Display all test types from labs and calculate the number of times that test was

conducted on patients.

```
SELECT TEST_TYPE,COUNT(PATIENT_ID) AS NUM_OF_PATIENTS FROM LAB_WORK
GROUP BY TEST_TYPE
ORDER BY TEST_TYPE
```

TEST_TYPE	NUM_OF_PATIENTS
Aids Test	1
Check Up	1
Covid-19 Test	21
Draw Blood	1
IV Test	1

Download CSV
5 rows selected.

Conclusion

The procedure to achieve developing a Hospital Management System database is through a development lifecycle that begins with a concept that models a hospital management system, and then a series of steps that includes logical modeling, normalization, physical modeling, and creating the physical design.

Our team decided to design the schema for a Hospital Management System. The initial steps were to find the entities and figuring out their associations. This was one of the challenging aspects of the project. Additionally, finding the associative entities added more complexity. After developing the logical design, it was easier to implement the physical design. Understanding how to normalize the data helped in the design of database tables and associative entities. Also, inserting mock data is an easy task, but depending on the size of the application, it could be time consuming to add a lot of data to demonstrate the use of an application. It was interesting to see how the queries accessed the data based on the design of the schema.

If our team gets the chance to do this all over again, we would add a lot more data to test and debug the database. We would also expand on other aspects of the project such as expenses, costs incurred and the inventory stock for the hospital. To make this into a more complete application will mean creating and adding more queries to provide more functionality to implement in a full stack application. Also, we would like to make changes to the schema that would allow us to connect to other client applications. This would enable more data to be accessible to patients.

Our initial proposal for this project was to develop a web application with a frontend that connects and access the hospital management system database. However, due to time constraints we were not able to implement a frontend portion. Further development of this application would include a frontend, allowing authentication features, dashboard, and functionality for querying the data stored in the database. In time, the application would be fully developed and connected to serve the patient portal.