

# **Healthcare Management Database**

## **Description of the Database:**

In the context of the healthcare industry, the Healthcare Management Database serves as a central hub for managing patient data and healthcare services. It empowers healthcare providers to deliver high-quality care by providing access to critical patient information, facilitating appointment scheduling, and ensuring the accurate tracking of medical records and prescriptions. Hospital administrators can optimize patient admissions and resources, and insurance providers can efficiently manage patient coverage and claims.

The database plays a crucial role in improving the overall patient experience by streamlining administrative tasks and enhancing the coordination of healthcare services. It ensures data accuracy and accessibility, contributing to the well-being and health of patients and the efficient operation of healthcare organizations. Whether it is a doctor scheduling an appointment, a nurse maintaining medical records, or a pharmacist tracking medication dispensing, the Healthcare Management Database meets the diverse information needs of healthcare professionals, ultimately benefiting patients and the healthcare system.

## **Users of the Database:**

- 1. Healthcare Providers:** Doctors, nurses, and other healthcare professionals rely on this database to streamline patient care, schedule appointments, maintain medical records, and prescribe medications. It supports the efficient delivery of healthcare services and enables healthcare providers to access up-to-date patient data.
- 2. Pharmacists:** Pharmacists use the database to manage pharmaceutical services, including prescription fills. They track medication dispensing to patients, ensuring accurate medication management and accountability.
- 3. Hospital Administrators:** Hospital administrators leverage the database to manage patient admissions, allocate rooms, and coordinate healthcare services. It aids in optimizing the hospital's capacity and resources.
- 4. Insurance Providers:** Insurance companies use the database to manage patient insurance coverage. They can track insurance plans offered, coverage details, and manage claims efficiently.

### **Information Needs the Database Meets:**

- 1. Patient Management:** The database meets the need for comprehensive patient management. It stores patient information, including names, dates of birth, gender, and contact details, enabling healthcare providers to identify and communicate with patients effectively.
- 2. Appointment Scheduling:** Healthcare professionals can schedule appointments with patients efficiently, recording appointment details such as date, time, and the reason for the appointment. This ensures effective patient care and consultation.
- 3. Medical Record Keeping:** The database facilitates the maintenance of patient medical records, including diagnoses, prescribed medications, treatment dates, and medical notes. This data is crucial for tracking a patient's health journey and providing continuous care.
- 4. Prescription Management:** It supports the management of prescriptions by storing data on medication, dosages, frequencies, and start/end dates. This ensures that medications are prescribed accurately and tracked effectively.
- 5. Hospital Information:** Hospital administrators can manage hospital information, including names, locations, capacities, services offered, contact numbers, and websites. This data aids in coordinating patient admissions and healthcare services.
- 6. Nursing Staff Management:** The database contains information about nursing staff, including names, specializations, license numbers, and contact details. This information ensures that the healthcare facility has qualified nursing staff.
- 7. Admission Coordination:** Hospital administrators can use the database to efficiently manage patient admissions, assign rooms, record admission and discharge dates, and track the reasons for discharge.
- 8. Lab Test Management:** The database records information about laboratory tests performed on patients, including test names, dates, results, and additional comments. This is vital for diagnosing and monitoring a patient's health.
- 9. Pharmaceutical Services:** Pharmacists can use the database to manage prescription fills efficiently. It records data such as fill dates, dispensed medications, quantities, and the dispensing pharmacist.
- 10. Insurance Coverage:** Insurance providers can manage insurance coverage for patients, including insurance plans offered, contact details, coverage details, and websites. This data aids in patient coverage and claims management.

### Data Dictionary:

Table Name	Attribute Name	Contents	Data Type	Format	Range	Required	PK/FK	Reference
Patients	PatientID	Unique patient identifier	Integer	Auto-incremented	1 - 2147483647	Yes	PK	
	FirstName	First name of the patient	Varchar		Up to 50 characters	Yes		
	LastName	Last name of the patient	Varchar		Up to 50 characters	Yes		
	DateOfBirth	Date of birth	Date	YYYY-MM-DD	<= Current Date	Yes		
	Gender	Gender of the patient	Char(1)	M(Male), F(Female), O(Other)		Yes		
	ContactNumber	Contact number	Varchar	Numeric with format (XXX) XXX-XXXX	Numeric, 10 digits	Yes		
	InsuracePolicyNum	Insurance policy number of the patient	Varchar	Alphanumeric (INSXXX)	Upto 7 characters	Yes		
Doctors	DoctorID	Unique doctor identifier	Integer	Auto-incremented	1 - 2147483647	Yes	PK	
	FirstName	First name of the doctor	Varchar		Up to 50 characters	Yes		
	LastName	Last name of the patient	Varchar		Up to 50 characters	Yes		

	Specialization	Doctor's specialization	Varchar		Up to 100 characters	Yes		
	ContactNumber	Doctor's contact number	Varchar	Numeric with format (XXX) XXX-XXXX	Numeric, 10 digits	Yes		
	Email	Email address of the doctor	String	XXXXXX@gmail.com	Upto 200 characters	Yes		
	DepartmentID	Department of the doctor	Integer	1-25		Yes		Department
Appointments	AppointmentID	Unique Appointment ID	Integer	Auto-incremented	1 - 2147483647	Yes	PK	
	PatientID	Patient's unique ID	Integer			Yes	FK	Patients
	DoctorID	Doctor's unique ID	Integer			Yes	FK	Doctors
	AppointmentDate	Date of the appointment	Date	YYYY-MM-DD	<= Current Date	Yes		
	AppointmentTime	Time of the appointment	Time	HH:MM:SS		Yes		
	Status	Appointment status	Varchar			Yes		
Department	<b><u>DepartmentID</u></b>	Unique identifier for each department	Integer	Auto-increment	1 - 2147483647	Yes	PK	

	DepartmentName	Name of the department	String		Upto 50 characters	Yes		
	Description	Description or purpose of the department	Text		Upto 200 characters	Yes		
	Location	Physical location or address of the department	String		Upto 200 characters	Yes		
	ContactNumber	Phone number to contact the department	String	XXX-XXX-XXXX	Upto 10 digits	Yes		
Prescription	PrescriptionID	Unique Prescription ID	Integer	Auto-incremented	1 - 2147483647	Yes	PK	
	PatientID	Patient's unique ID	Integer		1 – 2147483647	Yes	FK	Patients
	DoctorID	Doctor's unique ID	Varchar	AXXXX	1 - 2147483647	Yes	FK	Doctors
	Diagnosis	Diagnosis made by the doctor	Text			Yes		
	PrescriptionDate	Date when the prescription was issued	Date	YYYY-MM-DD		Yes		

	Notes	Additional notes related to the prescription	Text			No		
Staff	<b><u>StaffID</u></b>	Unique identifier for each staff member	Integer	Auto-Increment	1 - 2147483647	Yes	PK	
	FirstName	First name of the staff member	String		Upto 100 characters	Yes		
	LastName	Last name of the staff member	String		Upto 100 Characters	Yes		
	Position	Job position or title of the staff member	String		Upto 100 characters	Yes		
	DepartmentID	Foreign key referencing the Department table	Integer		1 - 2147483647	Yes	FK	Department
	Salary	Salary of the staff member	Float	XXXXX.XXX	Upto 15 digits	Yes		
Billing	<b><u>BillingID</u></b>	Unique identifier for each billing record	Integer	Auto-Increment	1 - 2147483647	Yes	PK	

	PatientID	Foreign key referencing the Patients table	Integer		1 - 2147483647	Yes	FK	Patient
	TotalAmount	Total amount to be billed	Float	XXXXX.XXX	Upto 15 digits	Yes		
	PaymentStatus	Status of payment (e.g., paid, unpaid)	String		Upto 7 characters	Yes		
	BillingDate	Date when the billing was generated	Date	YYYY-MM-DD		Yes		
	HasInsurance	Indicator if the patient has insurance (Yes/No)	Boolean (Yes/No)		Upto 3 characters	Yes		
	InsuranceProviderID	Foreign key referencing the InsuranceProviders table	Integer		1 - 2147483647	Yes	FK	InsuranceProvider
	PaymentSource	Source of payment (e.g., cash, credit card)	String		Upto 20 characters	Yes		
Admissions	AdmissionID	Unique Admission ID	Integer(10)	Auto-incremented	1 - 2147483647	Yes	PK	

	PatientID	Patient's unique ID	Integer(10)			Yes	FK	Patients
	HospitalID	Hospital's unique ID	Integer			Yes	FK	Hospitals
	NurseID	Nurse's unique ID	Integer			Yes	FK	Nurses
	AdmissionDate	Date of Admission	Date	YYYY-MM-DD	<= Current Date	Yes		
	RoomNumber	Room assigned for patient	Varchar			Yes		
	DischargeDate	Date of discharge	Date	YYYY-MM-DD	<= Current Date	Yes		
LabTests	<b><u>LabTestID</u></b>	Unique Test Identifier	Integer	Auto-incremented	1 - 2147483647	Yes	PK	
	TestName	Name of the Lab Test	Varchar		Up to 100 characters	Yes		
	TestType	Date of the Lab Test	Date	YYYY-MM-DD	<= Current Date	Yes		
	Cost	Test Results	Varchar		Up to 500 characters	Yes		
Pharmacies	PharmacyID	Unique Pharmacy Identifier	Integer	Auto-incremented	1 - 2147483647	Yes	PK	
	PharmacyName	Pharmacy name	Varchar		Up to 100 characters	Yes		



	Location	Pharmacy location	Varchar		Up to 100 characters	Yes		
	ContactNumber	Pharmacy Contact Number	Varchar	Numeric with format (XXX) XXX-XXXX	Numeric, 10 digits	Yes		
	OperatingHours	Pharmacy Operating Hours	Varchar		Up to 100 characters	Yes		
	Email	Email of the pharmacy	Varchar	XXXXXX@gmail.com	Upto 100 characters	Yes		
PrescriptionLabTest	PrescriptionID	Unique Fill Identifier	Integer	Auto-incremented	1 - 2147483647	Yes	PK	
	<u>LabTestID</u>	LabTest unique ID	Integer			Yes	FK	LabTest
	Result	Date of Prescription Fill	Date	YYYY-MM-DD	<= Current Date	Yes		
	TestDate	Dispensed Medication	varchar		Up to 100 characters	Yes		
InsuranceProviders	ProviderID	Unique Provider Identifier	Integer	Auto-incremented	1 - 2147483647	Yes	PK	
	ProviderName	Name of the Provider	Varchar		Up to 100 characters	Yes		
	PlansOffered	Insurance Plans offered	Varchar		Up to 200 characters	Yes		

	ContactNumber	Provider Contact Number	Varchar	Numeric with format (XXX) XXX-XXXX	Numeric, 10 digits	Yes		
	CoverageDetails	Insurance Coverage Details	Varchar		Up to 500 characters	Yes		
	Email	Provider Email	Varchar	Valid Email format		Yes		
Ward	<b><u>WardID</u></b>	Unique identifier for each ward	Integer	Auto-Increment	1 - 2147483647	Yes	PK	
	WardNumber	Number or identifier of the ward	Integer or String	Numeric or alphanumeric	Upto 5 digits	Yes		
	Type	Type or category of the ward (e.g., medical, surgical)	String		Upto 20 characters	Yes		
	Capacity	Maximum capacity of the ward	Integer		Upto 5 digits	Yes		
	Availability	Current availability status of the ward	Boolean or string (Available or occupied)	Boolean or String	Upto 10 characters	Yes		

**Entity-Relationship Model:**

Entity Name	Relationship	Connectivity	Corresponding Entity
Patients	Receive	1:M	Appointments
	Have	1:M	MedicalRecords
	Have	1:M	Prescriptions
Doctors	Treat	M:N	Patients
	Work At	1:M	Hospitals
Appointments	Schedule	1:M	Patients
	Schedule	1:M	Doctors
	Contain	1:1	MedicalRecords
Hospitals	Admit	1:M	Admissions
	Provide	1:M	LabTests
Admissions	Assign	1:1	Patients
LabTests	Perform	1:M	Patients
	Ordered By	1:M	Doctors
Pharmacies	Fill	1:M	PrescriptionFills
PrescriptionLabTest	Dispensed By	1:M	Pharmacies
	Dispensed To	1:M	Patients
	Dispensed By	1:M	Doctors
InsuranceProviders	Offer	1:M	Patients
	Offer	1:M	Doctors
Nurses	Assigned	1:M	Patients
	works	1:M	Doctors

**Business Rules for the database:**

### **1. Patients and Appointments:**

- Patients can schedule multiple appointments (1:M relationship).
- An appointment must be scheduled for one patient (1:M relationship).

### **2. Patients and Medical Records:**

- Each patient may have multiple medical records (1:M relationship).
- A medical record corresponds to a single patient (1:M relationship).

### **3. Patients and Prescriptions:**

- Patients may have multiple prescriptions (1:M relationship).
- Each prescription is assigned to one patient (1:M relationship).

### **4. Doctors and Patients:**

- Doctors can treat multiple patients (M:N relationship).
- Patients may be treated by multiple doctors (M:N relationship).

### **5. Doctors and Hospitals:**

- Each doctor works at a single hospital (1:M relationship).
- Hospitals may have multiple doctors (1:M relationship).

### **6. Appointments and Patients:**

- Appointments are scheduled for individual patients (1:M relationship).
- Patients may have multiple appointments (1:M relationship).

### **7. Appointments and Doctors:**

- Appointments are scheduled with individual doctors (1:M relationship).
- Doctors may have multiple appointments (1:M relationship).

#### **8. Appointments and Medical Records:**

- Each appointment contains a corresponding medical record (1:1 relationship).
- A medical record is associated with a single appointment (1:1 relationship).

#### **9. Medical Records and Prescriptions:**

- Each medical record contains a corresponding prescription (1:1 relationship).
- A prescription is associated with a single medical record (1:1 relationship).

#### **10. Hospitals and Admissions:**

- Hospitals may admit multiple patients (1:M relationship).
- Each patient is admitted to one hospital (1:M relationship).

#### **11. Hospitals and Lab Tests:**

- Hospitals can provide lab tests (1:M relationship).
- Lab tests are provided by a hospital (1:M relationship).

#### **13. Lab Tests and Doctors:**

- Doctors may perform multiple lab tests (1:M relationship).
- Lab tests are performed by doctors (1:M relationship).

#### **14. Lab Tests and Patients:**

- Lab tests can be ordered for multiple patients (1:M relationship).

- Each lab test corresponds to one patient (1:M relationship).

#### **15. Lab Tests and Doctors:**

- Doctors may order multiple lab tests (1:M relationship).
- Each lab test is ordered by one doctor (1:M relationship).

#### **16. Pharmacies and Prescription Fills:**

- Pharmacies may fill multiple prescription fills (1:M relationship).
- Each prescription fill is dispensed by one pharmacy (1:M relationship).

#### **17. Prescription Fills and Patients:**

- Patients may receive multiple prescription fills (1:M relationship).
- Each prescription fill is dispensed to a single patient (1:M relationship).

#### **18. Prescription Fills and Doctors:**

- Doctors may prescribe medications in multiple prescription fills (1:M relationship).
- Each prescription fill is dispensed by one doctor (1:M relationship).

#### **19. Insurance Providers and Patients:**

- Patients may be covered by multiple insurance providers (1:M relationship).
- Each insurance provider offers coverage to a single patient (1:M relationship).

#### **20. Insurance Providers and Doctors:**

- Doctors may accept multiple insurance providers (1:M relationship).
- Each insurance provider is accepted by one doctor (1:M relationship).

## **Intended Use:**

At its core, the database is designed to facilitate patient management and care coordination. For healthcare providers, it serves as a one-stop repository for vital patient information. From demographic data such as names, dates of birth, and contact details to comprehensive medical histories, the database equips healthcare professionals with a holistic view of each patient. This empowers doctors and nurses to make informed decisions, provide personalized care, and ensure the well-being of their patients. It also streamlines appointment scheduling, making it easier for patients to access care when needed.

The database significantly enhances the management of medical records and prescriptions. Healthcare providers can maintain detailed medical records, recording diagnoses, prescribed medications, treatment dates, and medical notes. This comprehensive view of a patient's health history ensures that care is continuous and consistent. The prescription management feature allows for accurate recording of medication details, dosages, frequencies, and prescription periods. This is essential for medication management, reducing the risk of errors, and ensuring patient safety.

Hospital administrators benefit from efficient patient admissions and resource allocation. The database stores critical information about hospitals, including names, locations, capacities, services offered, and contact numbers. With this data at their fingertips, administrators can optimize patient admissions, assign rooms, and coordinate healthcare services seamlessly. This ensures that patients are admitted to the most suitable facilities, enhancing their overall healthcare experience. It also enables effective resource management within healthcare institutions, ensuring that available resources are allocated judiciously.

Pharmacists play a crucial role in the healthcare ecosystem, and the database supports the efficient management of pharmaceutical services. Pharmacists can use the system to record prescription fills, capturing data such as fill dates, dispensed medications, quantities, and dispensing pharmacists. This feature enhances medication management and accountability, promoting patient safety. With an accurate and organized system for tracking prescription fills, pharmacists can dispense medications with confidence and precision.

Insurance providers rely on the database to manage patient insurance coverage and claims efficiently. This includes information on insurance plans offered, contact details, coverage details, and websites. By centralizing this information, insurance companies can streamline the management of patient coverage, ensuring that patients have access to the insurance they need. Claims processing becomes more efficient and accurate, enhancing the overall experience for both patients and healthcare providers.

In summary, the intended use of the Healthcare Management Database is to serve as a vital tool for healthcare organizations and professionals. It underpins the seamless delivery of healthcare services, ensuring that patients receive high-quality care and that healthcare providers can access accurate and up-to-date patient data. The database supports the well-being and health of patients by enhancing patient management, appointment scheduling, medical record and prescription management, hospital and resource management, pharmaceutical services, and insurance coverage. It simplifies administrative tasks, optimizes healthcare services, and ensures data accuracy and accessibility in a demanding and dynamic healthcare landscape. Whether it's a doctor diagnosing a patient, a nurse maintaining medical records, a pharmacist dispensing medications, or an insurance provider managing coverage, the Healthcare Management Database meets the diverse needs of healthcare professionals, ultimately benefiting patients and the healthcare system as a whole.



## Hospital Management System part 2

**Relational Schema:**

Patient (**PatientID**, FirstName, LastName, DateOfBirth, Gender, ContactNumber, InsurancePolicyNum)

Doctor (**DoctorID**, FirstName, LastName, Specialization, ContactNumber, Email, DepartmentID)

Appointment (**AppointmentID**, PatientID, DoctorID, AppointmentDate, AppointmentTime, Status)

Department (**DepartmentID**, DepartmentName, Description, Location, ContactNumber)

Staff (**StaffID**, FirstName, LastName, Position, DepartmentID, Salary)

Ward (**WardID**, WardNumber, Type, Capacity, Availability)

Admission (**AdmissionID**, PatientID, WardID, AdmissionDate, DischargeDate, AdmissionReason)

Prescription (**PrescriptionID**, DoctorID, PatientID, Diagnosis, PrescriptionDate, Notes)

Billing (**BillingID**, PatientID, TotalAmount, PaymentStatus, BillingDate, HasInsurance, InsuranceProviderID, PaymentSource)

Pharmacy (**PharmacyID**, PharmacyName, Location, ContactNumber, OperatingHours, Email)

LabTest (**LabTestID**, TestName, TestType, Cost)

InsuranceProvider (**InsuranceProviderID**, ProviderName, CoverageType, CoverageAmount, ContactNumber, Email, InsurancePolicyNum)

PrescriptionLabTest (**PrescriptionID**, **LabTestID**, Result, TestDate)

**Pre normalization:**

The given table captures information about each combination of Appointment and Ward, including details about the associated Patient and Doctor. Currently, the table relies on a composite primary key composed of AppointmentID and WardID. However, there are significant data gaps when relying solely on AppointmentID. To initiate the normalization process, it is necessary to populate null values, eliminating repeating groups and enhancing data completeness.

Appointment ID	Ward ID	WardNumber	Type	Capacity	Availability	PatientID	Doctor ID	Appointment Date	Appointment Time	Status	FirstName	LastName	DateOfBirth	Gender	ContactNumber	Insurance PolicyNumber	Specialization	Email	DepartmentID
1	101	W101	ICU	20	10	1001	2001	11/15/2023	10:00 AM	Scheduled	John	Doe	05/20/1980	M	318-742-2295	INS467	Internal Med	John.d@gmail.com	1
2	102	W102	General	18	8		2002	11/16/2023	2:30 PM	Scheduled							Internal Med		3
3	103	W103	Surgical	14	9		2003	11/17/2023	10:15 AM	Completed							Surgery		2
4	104	W104	ICU	18	9	1004	2004	11/18/2023	12:00 PM	Cancelled	Emily	Davis	07/04/1983	F	317-234-9032	INS184	Internal Med	Emily.d@gmail.com	3
5	105	W105	ICU	20	11	1005	2005	11/18/2023	1:45 PM	Scheduled	Michael	White	01/25/1977	F	314-832-7753	INS083	Internal Med	Michael.w@gmail.com	2
6	106	W106	General	20	14	1006		11/19/2023	10:30 AM	Cancelled	Olivia	Brown	09/30/1990	F	319-123-4567	INS284		Olivia.b@gmail.com	2
7	107	W107	Surgical	18	4	1007		11/19/2023	4:00 PM	Scheduled	James	Wilson	10/22/1981	M	312-345-9876	INS984		James.w@gmail.com	1
8	108	W108	General	14	10	1008	2008	11/19/2023	1:30 PM	Scheduled	Sophia	Miller	12/13/1972	F	315-937-0376	INS269	Surgery	Sophia.m@gmail.com	3

**First Normal Form (1NF):**

In the context of achieving First Normal Form, the process involves rectifying repeating groups and missing values, as well as identifying primary keys and dependencies. In the provided table, the composite primary keys, AppointmentID and WardID, are acknowledged to ensure unique instances, and all associated values are populated, eliminating nulls and repeating groups. However, upon closer inspection, certain partial and transitive dependencies emerge. Specifically, AppointmentID is found to determine the attributes PatientID, DoctorID, AppointmentDate, AppointmentTime, Status, FirstName, LastName, DateOfBirth, Gender, ContactNumber, InsurancePolicyNum, Specialization, Email, and DepartmentID. Simultaneously, WardID is associated with WardNumber, Type, Capacity, and Availability. These dependencies indicate partial relationships. Furthermore, PatientID is shown to determine FirstName, LastName, DateOfBirth, Gender, ContactNumber, and InsurancePolicyNum, while DoctorID is connected to FirstName, LastName, Specialization, ContactNumber, Email, and DepartmentID, highlighting transitive dependencies within the partial dependencies.

AppointmentID	Ward ID	Ward Number	Type	Capacity	Availability	PatientID	DoctorID	Appointment Date	Appointment Time	Status	FirstName	LastName	DateOfBirth	Gender	ContactNumber	InsurancePolicyNum	Specialization	Email	DepartmentID
1	101	W101	ICU	20	10	1001	2001	11/15/2023	10:00 AM	Scheduled	John	Doe	05/20/1980	M	318-742-2295	INS467	Internal Med	John.d@gmail.com	1
2	102	W102	General	18	8	1001	2002	11/16/2023	2:30 PM	Scheduled	John	Doe	05/20/1980	M	318-742-2295	INS467	Internal Med	John.d@gmail.com	3
3	103	W103	Surgical	14	9	1001	2003	11/17/2023	10:15 AM	Completed	John	Doe	05/20/1980	M	318-742-2295	INS467	Surgery	John.d@gmail.com	2
4	104	W104	ICU	18	9	1004	2004	11/18/2023	12:00 PM	Cancelled	Emily	Davis	07/04/1983	F	317-234-9032	INS184	Internal Med	Emily.d@gmail.com	3
5	105	W105	ICU	20	11	1005	2005	11/18/2023	1:45 PM	Scheduled	Michael	White	01/25/1977	F	314-832-7753	INS083	Internal Med	Michael@gmail.com	2
6	106	W106	General	20	14	1006	2005	11/19/2023	10:30 AM	Cancelled	Olivia	Brown	09/30/1990	F	319-123-4567	INS284	Internal Med	Olivia.b@gmail.com	2
7	107	W107	Surgical	18	4	1007	2005	11/19/2023	4:00 PM	Scheduled	James	Wilson	10/22/1981	M	312-345-9876	INS984	Internal Med	James.w@gmail.com	2
8	108	W108	General	14	10	1008	2008	11/19/2023	1:30 PM	Scheduled	Sophia	Miller	12/13/1972	F	315-937-0376	INS269	Surgery	Sophia.m@gmail.com	3

**1NF Dependency Diagram:**

1NF (**AppointmentID**, **WardID**, WardNumber, Type, Capacity, Availability, PatientID, DoctorID, AppointmentDate, AppointmentTime, Status, FirstName, LastName, DateOfBirth, Gender, ContactNumber, InsurancePolicyNum, Specialization, Email, DepartmentID)

**Partial Dependencies:**

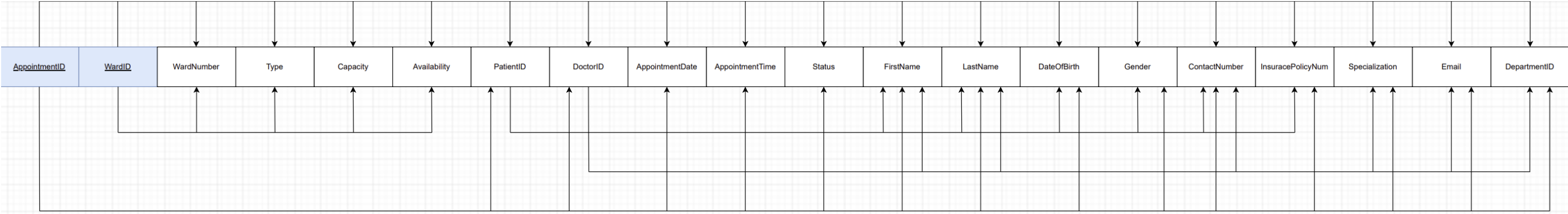
(WardID -> WardNumber, Type, Capacity, Availability)

(AppointmentID -> PatientID, DoctorID, AppointmentDate, AppointmentTime, Status, FirstName, LastName, DateOfBirth, Gender, ContactNumber, InsurancePolicyNum, Specialization, Email, DepartmentID)

**Transitive Dependencies:**

(PatientID -> FirstName, LastName, DateOfBirth, Gender, ContactNumber, InsurancePolicyNum)

(DoctorID -> FirstName, LastName, ContactNumber, Specialization, Email, DepartmentID)



**Second Normal Form (2NF):**

In the context of achieving Second Normal Form, the procedure entails resolving partial dependencies by creating two distinct tables and identifying the corresponding dependent attributes. From the provided information, separate Appointment and Ward tables were created, each with its own set of attributes, and AppointmentID and WardID were designated as the primary keys for their respective entities. Attributes dependent on WardID were incorporated into the Ward table, while those reliant on AppointmentID were integrated into the Appointment table, thereby eliminating partial dependencies. However, certain transitive dependencies persist in the table. Specifically, PatientID determines FirstName, LastName, DateOfBirth, Gender, ContactNumber, and InsurancePolicyNum, while DoctorID determines FirstName, LastName, ContactNumber, Specialization, Email, and DepartmentID. To eliminate these transitive dependencies and adhere to Third Normal Form, further modifications to the table structure are required.

Table: Ward

WardID	WardNumber	Type	Capacity	Availability
101	W101	ICU	20	10
102	W102	General	18	8
103	W103	Surgical	14	9
104	W104	ICU	18	9
105	W105	ICU	20	11
106	W106	General	20	14
107	W107	Surgical	18	4
108	W108	General	14	10

Table: Appointment

AppointmentID	PatientID	DoctorID	AppointmentDate	AppointmentTime	Status	FirstName	LastName	DateOfBirth	Gender	ContactNumber	InsurancePolicyNum	Specialization	Email	DepartmentID
1	1001	2001	11/15/2023	10:00 AM	Scheduled	John	Doe	05/20/1980	M	318-742-2295	INS467	Internal Med	John.d@gmail.com	1
2	1001	2002	11/16/2023	2:30 PM	Scheduled	John	Doe	05/20/1980	M	318-742-2295	INS467	Internal Med	John.d@gmail.com	3
3	1001	2003	11/17/2023	10:15 AM	Completed	John	Doe	05/20/1980	M	318-742-2295	INS467	Surgery	John.d@gmail.com	2
4	1004	2004	11/18/2023	12:00 PM	Cancelled	Emily	Davis	07/04/1983	F	317-234-9032	INS184	Internal Med	Emily.d@gmail.com	3
5	1005	2005	11/18/2023	1:45 PM	Scheduled	Michael	White	01/25/1977	F	314-832-7753	INS083	Internal Med	Michael.w@gmail.com	2
6	1006	2005	11/19/2023	10:30 AM	Cancelled	Olivia	Brown	09/30/1990	F	319-123-4567	INS284	Internal Med	Olivia.b@gmail.com	2

7	1007	2005	11/19/2023	4:00 PM	Scheduled	James	Wilson	10/22/1981	M	312-345-9876	INS984	Internal Med	James.w@gmail.com	2
8	1008	2008	11/19/2023	1:30 PM	Scheduled	Sophia	Miller	12/13/1972	F	315-937-0376	INS269	Surgery	Sophia.m@gmail.com	3

**2NF Dependency Diagram:**

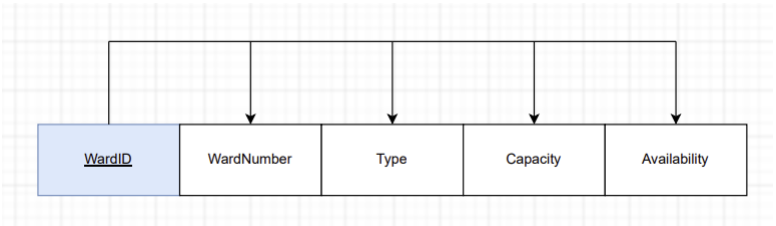
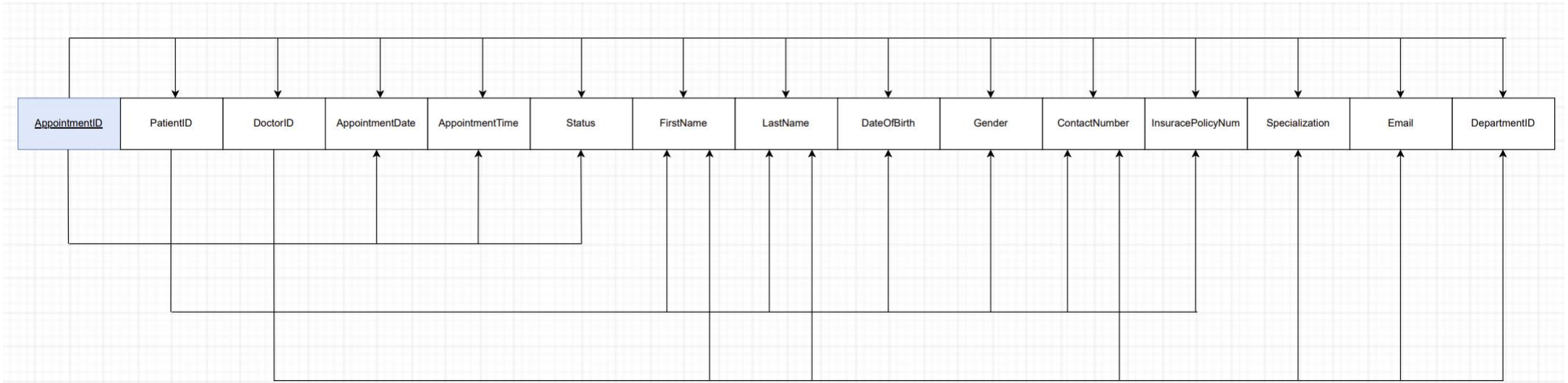
Ward (**WardID**, WardNumber, Type, Capacity, Availability)

Appointment (AppointmentID, PatientID, DoctorID, AppointmentDate, AppointmentTime, Status, FirstName, LastName, DateOfBirth, Gender, ContactNumber, InsurancePolicyNum, Specialization, Email, DepartmentID)

**Transitive dependencies:**

(PatientID -> FirstName, LastName, DateOfBirth, Gender, ContactNumber, InsurancePolicyNum)

(DoctorID -> FirstName, LastName, ContactNumber, Specialization, Email, DepartmentID)



**Third Normal Form (3NF):**

The goal of achieving Third Normal Form is realized by creating new tables, namely Patient and Doctor tables, where AppointmentID, DoctorID, PatientID, and WardID are designated as primary keys for their respective tables. Corresponding attributes have been assigned to each table, effectively eliminating transitive dependencies. As a result, all the mentioned tables are now structured in Third Normal Form, ensuring the removal of redundancy and facilitating an efficient representation of data.

Table: Ward

WardID	WardNumber	Type	Capacity	Availability
101	W101	ICU	20	10
102	W102	General	18	8
103	W103	Surgical	14	9
104	W104	ICU	18	9
105	W105	ICU	20	11
106	W106	General	20	14
107	W107	Surgical	18	4
108	W108	General	14	10

Table: Appointment

AppointmentID	PatientID	DoctorID	AppointmentDate	AppointmentTime	Status
1	1001	2001	11/15/2023	10:00 AM	Scheduled
2	1001	2002	11/16/2023	2:30 PM	Scheduled
3	1001	2003	11/17/2023	10:15 AM	Completed
4	1004	2004	11/18/2023	12:00 PM	Cancelled
5	1005	2005	11/18/2023	1:45 PM	Scheduled
6	1006	2005	11/19/2023	10:30 AM	Cancelled
7	1007	2005	11/19/2023	4:00 PM	Scheduled
8	1008	2008	11/19/2023	1:30 PM	Scheduled

Table: Patient

PatientID	FirstName	LastName	DateOfBirth	Gender	ContactNumber	InsuracePolicyNum
1001	John	Doe	05/20/1980	M	318-742-2295	INS467
1001	John	Doe	05/20/1980	M	318-742-2295	INS467
1001	John	Doe	05/20/1980	M	318-742-2295	INS467
1004	Emily	Davis	07/04/1983	F	317-234-9032	INS184
1005	Michael	White	01/25/1977	F	314-832-7753	INS083
1006	Olivia	Brown	09/30/1990	F	319-123-4567	INS284
1007	James	Wilson	10/22/1981	M	312-345-9876	INS984
1008	Sophia	Miller	12/13/1972	F	315-937-0376	INS269

Table: Doctor

DoctorID	FirstName	LastName	Specialization	ContactNumber	Email	DepartmentID
2001	Smith	John	Internal Med	+1 123-456-7890	john.smith@gmail.com	1
2002	Johnson	Emily	Internal Med	+1 234-567-8901	emily.johnson@gmail.com	3
2003	Davis	Michael	Surgery	+1 345-678-9012	michael.davis@gmail.com	2
2004	Martinez	Olivia	Internal Med	+1 456-789-0123	olivia.martinez@gmail.com	3
2005	Taylor	Ethan	Internal Med	+1 567-890-1234	ethan.taylor@gmail.com	2
2005	Taylor	Ethan	Internal Med	+1 567-890-1234	ethan.taylor@gmail.com	2
2005	Taylor	Ethan	Internal Med	+1 567-890-1234	ethan.taylor@gmail.com	2
2008	Harris	Lily	Surgery	+1 890-123-4567	lily.harris@gmail.com	3

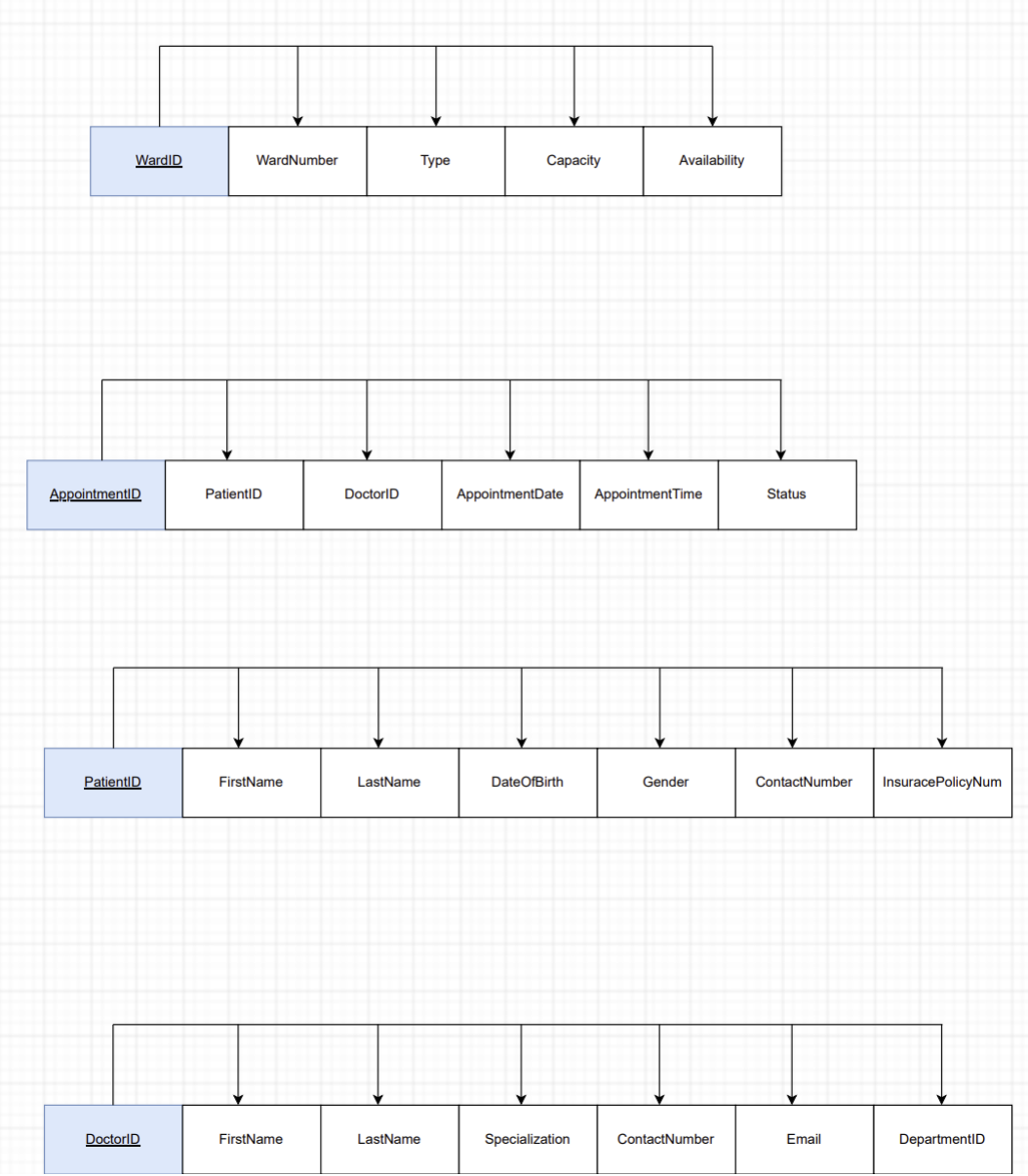
3NF Dependency Diagram:

Ward (**WardID**, WardNumber, Type, Capacity, Availability)

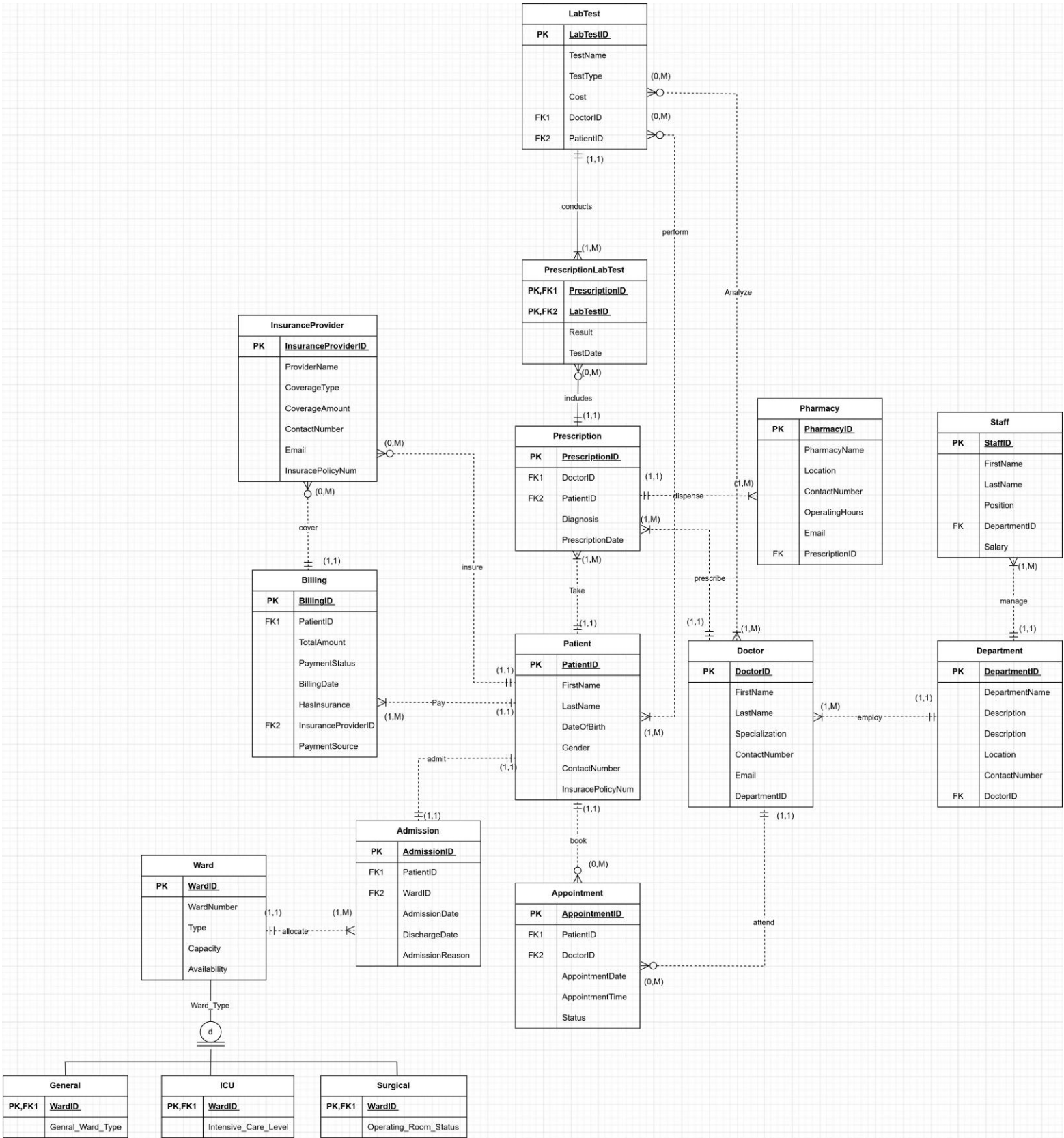
Patient (**PatientID**, FirstName, LastName, DateOfBirth, Gender, ContactNumber, InsurancePolicyNum)

Doctor (**DoctorID**, FirstName, LastName, Specialization, ContactNumber, Email, DepartmentID)

Appointment (**AppointmentID**, PatientID, DoctorID, AppointmentDate, AppointmentTime, Status)



Entity Relationship Diagram:





**Queries**

**1. Query that pulls data from one table:**

How many patients have insurance coverage, and what are their insurance policy numbers?

**Query:**

SELECT PatientID, FirstName, LastName, InsurancePolicyNum

FROM Patient

WHERE InsurancePolicyNum IS NOT NULL;

PatientID	FirstName	LastName	InsurancePolicyNum
1001	John	Doe	INS467
1002	John	Doe	
1003	John	Doe	
1004	Emily	Davis	INS184
1005	Michael	White	INS083
1006	Olivia	Brown	INS284
1007	James	Wilson	INS984
1008	Sophia	Miller	INS269

**2. Query that pulls data from two tables:**

What are the details of appointments scheduled for patients with a specific insurance provider?

**Query:**

SELECT A.AppointmentID, P.PatientID, P.FirstName, P.LastName, A.AppointmentDate, A.AppointmentTime, A.Status

FROM Appointment A

JOIN Patient P ON A.PatientID = P.PatientID

JOIN InsuranceProvider IP ON P.InsurancePolicyNum = IP.InsurancePolicyNum

WHERE IP.ProviderName = 'HealthGuard Insurance';

AppointmentID	PatientID	FirstName	LastName	AppointmentDate	AppointmentTime	Status
1	1001	John	Doe	2023-11-15	10:00 AM	Scheduled
2	1001	John	Doe	2023-11-16	2:30 PM	Scheduled
3	1001	John	Doe	2023-11-17	10:15 AM	Completed

**3. Query that includes a subquery:**

Which patients were admitted to the ICU ward, and what were their admission reasons?

**Query:**

SELECT A.AdmissionID, P.PatientID, P.FirstName, P.LastName, A.AdmissionDate, A.AdmissionReason

FROM Admission A

JOIN Patient P ON A.PatientID = P.PatientID

WHERE A.WardID IN (SELECT WardID FROM Ward WHERE Type = 'ICU');

AdmissionID	PatientID	FirstName	LastName	AdmissionDate	AdmissionReason
501	1001	John	Doe	2023-11-15	Routine Checkup
504	1004	Emily	Davis	2023-11-18	Maternity-Childbirth
505	1005	Michael	White	2023-11-18	Orthopedic Procedure