Group 11 Final Report

Business Description

ZAFE is a business that aims to connect patients and doctors through an application, combining the ease of scheduling virtual appointments like OneMedical after finding doctors in your network as one might with ZocDoc. The company offers this service through a subscription with an annual fee. In exchange, patients can determine whether a doctor will accept their insurance, the necessary expertise for their health concerns, and easily maintain all records in one central location. Details regarding any underlying conditions should be more accessible to each of these medical professionals, enabling them to create a more accurate diagnosis and be aware of any important considerations to make when writing prescriptions.

To help patients better utilize the app, we need to collect information from patients and doctors. We need to collect medical records, contact information, home address, and insurance information for patients. This information will help recommend a doctor to patients. We also need to collect data from doctors, like doctor license, specialty, and hospital of affiliation. After recommending a doctor to a patient, then schedule an appointment time for the patient.

Use Case Outline

Actors include two parties: patients and doctors.

First, there will be patients who must set up an account to use the application. While registering for the account, patients will need to input their first and last name, date of birth, home address, phone number, and email address. Before using the application, the patient must also create a patient record and input their recent medical history or important information such as immunization history, allergies, medications, weight, height, and diagnoses. Additionally, patients can store their insurance information such as the insurance provider, primary holder, group number, and policy number. Through this application, the patient can still contact their doctors even if they cannot be seen right away and request certain forms (ex. Medical form for school).

To treat patients, doctors will need to register by inputting their first and last name, National Provider Identification NumberPI Number(a unique identifier for medical practitioners), phone number, email address, office address, specialization, and hospital affiliation (if applicable). Once the doctors input the requested information, the app will verify their credentials based on the NPI number used to register. Once the system approves their account, the doctors will have access to the patient pool that is interested in meeting them, and patients will be able to select them depending on their needs. From there, they can choose dates and times that work for

both parties to schedule an appointment and establish the primary concern for the appointment.

Entity Relationship Model
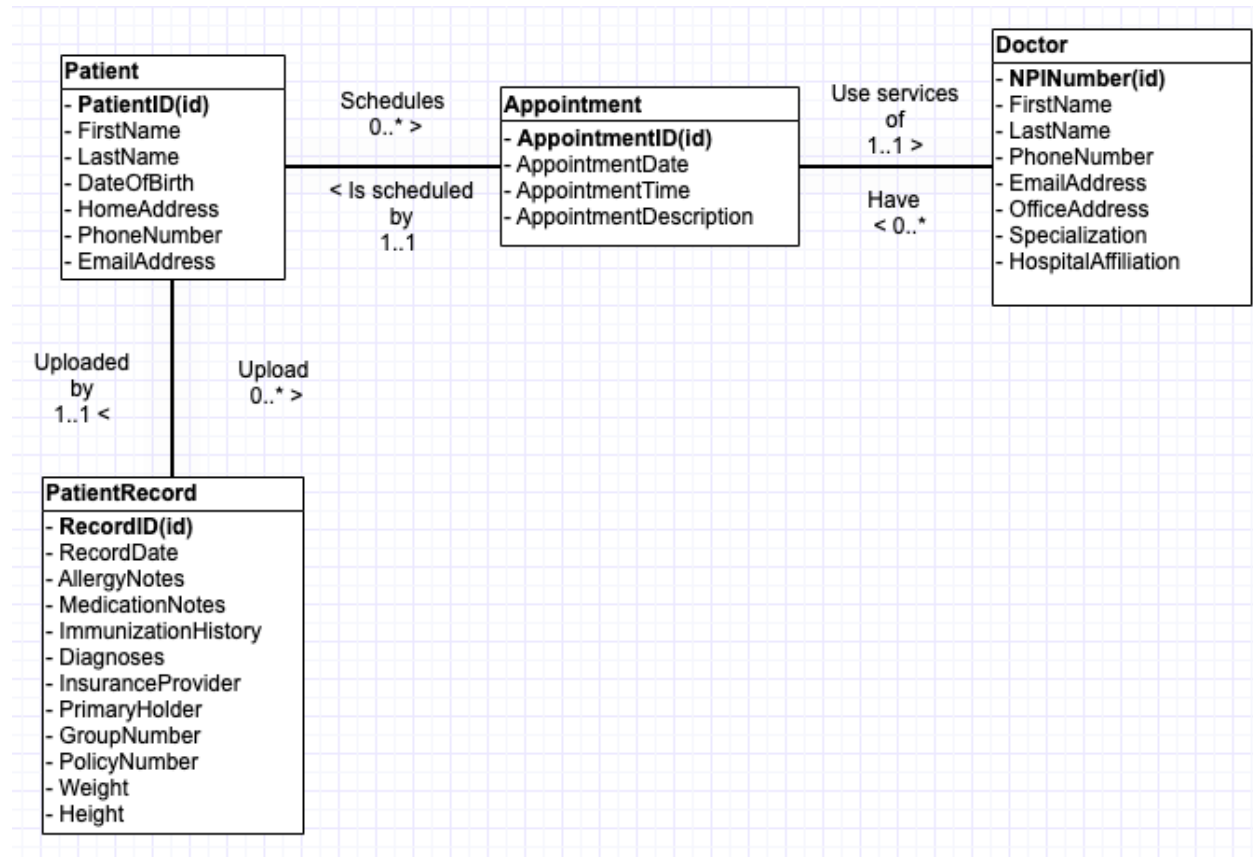
Relational Model

Patient(**PatientID**(**key**), FirstName, LastName, DateOfBirth, HomeAddress, PhoneNumber, EmailAddress)

PatientRecord(**RecordID**(**key**), RecordDate, AllergyNotes, MedicationNotes, ImmunizationHistory, Diagnoses, InsuranceProvider, PrimaryHolder, GroupNumber, PolicyNumber, Weight, Height, **PatientID**(**fk**))

Appointment(**AppointmentID**(**key**), AppointmentDate, AppointmentTime, AppointmentDescription, **PatientID**(**fk**), **DoctorID**(**fk**))

Doctor(**NPINumber**(**key**), FirstName, LastName, PhoneNumber, EmailAddress, OfficeAddress, Specialization, HospitalAffiliation)

Normalization Proof:
Patient(PatientID(key), FirstName, LastName, DateOfBirth, HomeAddress, PhoneNumber, Email Address**)**
1NF: Yes. It is a given relation
2NF: Yes. No partial key dependencies
3NF: Yes. No transitive dependencies

PatientRecord(**RecordID**(**key**), RecordDate, AllergyNotes, MedicationNotes, ImmunizationHistory, Diagnoses, InsuranceProvider, PrimaryHolder, GroupNumber, PolicyNumber, Weight, Height, **PatientID**(**fk**))
1NF: Yes. It is a given relation
2NF: No. Reason: There are partial dependencies

Insurance(PolicyNumber(key), InsuranceProvider, PrimaryHolder, GroupNumber, **RecordID(fk))**
1NF: Yes. Reason: Subrelation is a relation too.
2NF: Yes. Reason: No partial dependencies.
3NF: Yes. Reason: No transitive dependencies.

PatientRecord(RecordID(key), RecordDate, AllergyNotes, MedicationNotes, ImmunizationHistory, Diagnoses, Weight, Height, Age, **PatientID(fk))**
1NF: Yes. Reason: Subrelation is a relation too.
2NF: Yes. Reason: No partial dependencies.
3NF: Yes. Reason: No transitive dependencies.

Final Answer:
PatientRecord(RecordID(key), RecordDate, AllergyNotes, MedicationNotes, ImmunizationHistory, Diagnoses, Weight, Height, Age, **PatientID(fk))**

Insurance(PolicyNumber(key), InsuranceProvider, PrimaryHolder, GroupNumber, **RecordID(fk))**

Appointment(AppointmentID(key), AppointmentDate, AppointmentTime, AppointmentDescription, **PatientID(fk), DoctorID(fk))**
1NF: Yes. Reason: Subrelation is a relation too.
2NF: Yes. Reason: No partial dependencies.
3NF: Yes. Reason: No transitive dependencies.

Doctor(NPINumber(key), FirstName, LastName, PhoneNumber, EmailAddress, OfficeAddress, Specialization, HospitalAffiliation)

1NF: Yes. Reason: Subrelation is a relation too.
2NF: Yes. Reason: No partial dependencies.
3NF: Yes. Reason: No transitive dependencies.

Normalized Form of Relational Model:

Patient(PatientID(key), FirstName, LastName, DateOfBirth, HomeAddress, PhoneNumber, Email Address)

PatientRecord(RecordID(key), RecordDate, AllergyNotes, MedicationNotes, ImmunizationHistory, Diagnoses, Weight, Height, Age, **PatientID(fk))**

Insurance(PolicyNumber(key), InsuranceProvider, PrimaryHolder, GroupNumber, **RecordID(fk))**

Appointment(AppointmentID(key), AppointmentDate, AppointmentTime, AppointmentDescription, **PatientID(fk), DoctorID(fk))**

Doctor(NPINumber(key), FirstName, LastName, PhoneNumber, EmailAddress, OfficeAddress, Specialization, HospitalAffiliation)

Expected Results

Example 1: Find all the outstanding appointments for patient Amelia Shepherd on 12/16/2020
Query:
 SELECT d.firstname as DoctorFirstName, d.lastName as DoctorLastName, a.AppointmentTime as Time,
a.appointmentdate as Date, p.FirstName as PatientFirstName, p.lastName as PatientLastName,
p.PhoneNumber as PhoneNumber, p.EmailAddress as EmailAddress
FROM doctor AS d
INNER JOIN appointment AS a
ON d.npinumber = a.npinumber
INNER JOIN patient as p
ON p.patientID = a.patientID
WHERE d.NPINumber = 2385192847 AND appointmentdate = '2020-12-06';
Output:

doctorfirstname	doctorlastname	time	date	patientfirstname	patientlastname	phonenumber	emailaddress
Amelia	Shepherd	0000-01-01T14:30:00Z	2020-12-06T00:00:00Z	Ellis	Grey	5347891283	twotimeaverywinner@gmail.com

Benefit: Through this query, Dr. Shepherd can view all of her appointments on a given day. Perhaps she might like to plan out when she wants to take her lunch break, if she needs to prepare any extra material before a certain appointment or reach out to another doctor for a consultation.

Example 2: Find all the outstanding appointments for patient Bob Anderson
Query:
SELECT p.FirstName as firstName, p.LastName as lastName,
a.appointmentdate as appointmentDate,
a.AppointmentTime as appointmentTime, a.appointmentdescription as for,
d.FirstName as DoctorFirstName,
d.LastName as DoctorLastName
FROM patient AS p
INNER JOIN appointment AS a
ON p.patientid = a.patientid
INNER JOIN doctor as d
ON a.NPINumber = d.NPINumber
WHERE p.lastname = 'Anderson';

Output:

firstname	lastname	appointmentdate	appointmenttime	for	doctorfirstname	doctorlastname
Bob	Anderson	2020-12-05T00:00:00Z	0000-01-01T12:00:00Z	Skin Issue	Jennifer	Daniels
Bob	Anderson	2020-12-06T00:00:00Z	0000-01-01T14:00:00Z	Allergy Testing	Mantis	Tobaggan

Benefit: Through this query, the system can track down any existing appointments for patient Bob Anderson. Additionally, we can figure out the appointment date/ time along with the doctor that is seeing him and what the purpose of the appointments are.

Example 3: Find the insurance info for Bob Anderson in preparation for his 12/15 appointment.
Query:
SELECT p.FirstName as PatientFirstName, p.lastname as PatientLastName,
a.appointmentdate as appointmentdate, pr.medicationnotes as medicationnotes,
i.InsuranceProvider as Provider, i.PolicyNumber as PolicyNumber,
i.GroupNumber as GroupNumber
FROM patient as p
INNER JOIN appointment as a
ON p.patientID = a.patientID
INNER JOIN PatientRecord as pr
ON pr.patientID = a.patientID
INNER JOIN Insurance as i
ON i.recordid = pr.recordid
WHERE a.appointmentdate = '2020-12-05' and p.FirstName = 'Bob' and p.lastname = 'Anderson';
Output:

patientfirstname	patientlastname	appointmentdate	medicationnotes	provider	policynumber	groupnumber
Bob	Anderson	2020-12-05T00:00:00Z	Levothyroxine	Cigna PPO	4689329	905302

Benefit: This query helps doctors filter the insurance information for a particular patient. In order to prepare for the appointment with Bob Anderson, the doctor may want to confirm the insurance information and any medical notes.

Example 4: Find all of the doctors who have seen patients that have Blue Cross insurance.
Query:
SELECT DISTINCT p.patientid, p.firstname as patientfirstname, p.lastname as patientlastname, i.insuranceprovider, d.npinumber, d.firstname, d.lastname, d.hospitalaffiliation, a.appointmentdate, a.appointmenttime
FROM doctor AS d
INNER JOIN appointment AS a
USING (NPINUMBER)
INNER JOIN patientrecord AS pr
USING (patientid)
INNER JOIN patient as p
USING (patientid)
inner join insurance AS i
USING (recordid)
WHERE insuranceprovider = 'Blue Cross HMO';
Output:

patientid	patientfirstname	patientlastname	insuranceprovider	npinumber	firstname	lastname	hospitalaffiliation	appointmentdate	appointmenttime
2	Steven	Jones	Blue Cross HMO	4592573829	Jennifer	Daniels	Mount Sinai	2020-12-05T00:00:00Z	0000-01-01T13:00:00Z
9	Alex	Karev	Blue Cross HMO	3736195732	Meredith	Grey	Grey Sloan Memorial	2020-12-06T00:00:00Z	0000-01-01T14:30:00Z
10	Ellis	Grey	Blue Cross HMO	2385192847	Amelia	Shepherd	Grey Sloan Memorial	2020-12-06T00:00:00Z	0000-01-01T14:30:00Z

Benefit: ZAFE wants to filter out all of the patients that are using Blue Cross to inform them about a ransomware attack that may put their personal information at risk.