Relational Database Design - Pharmacy

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Design Requirements:

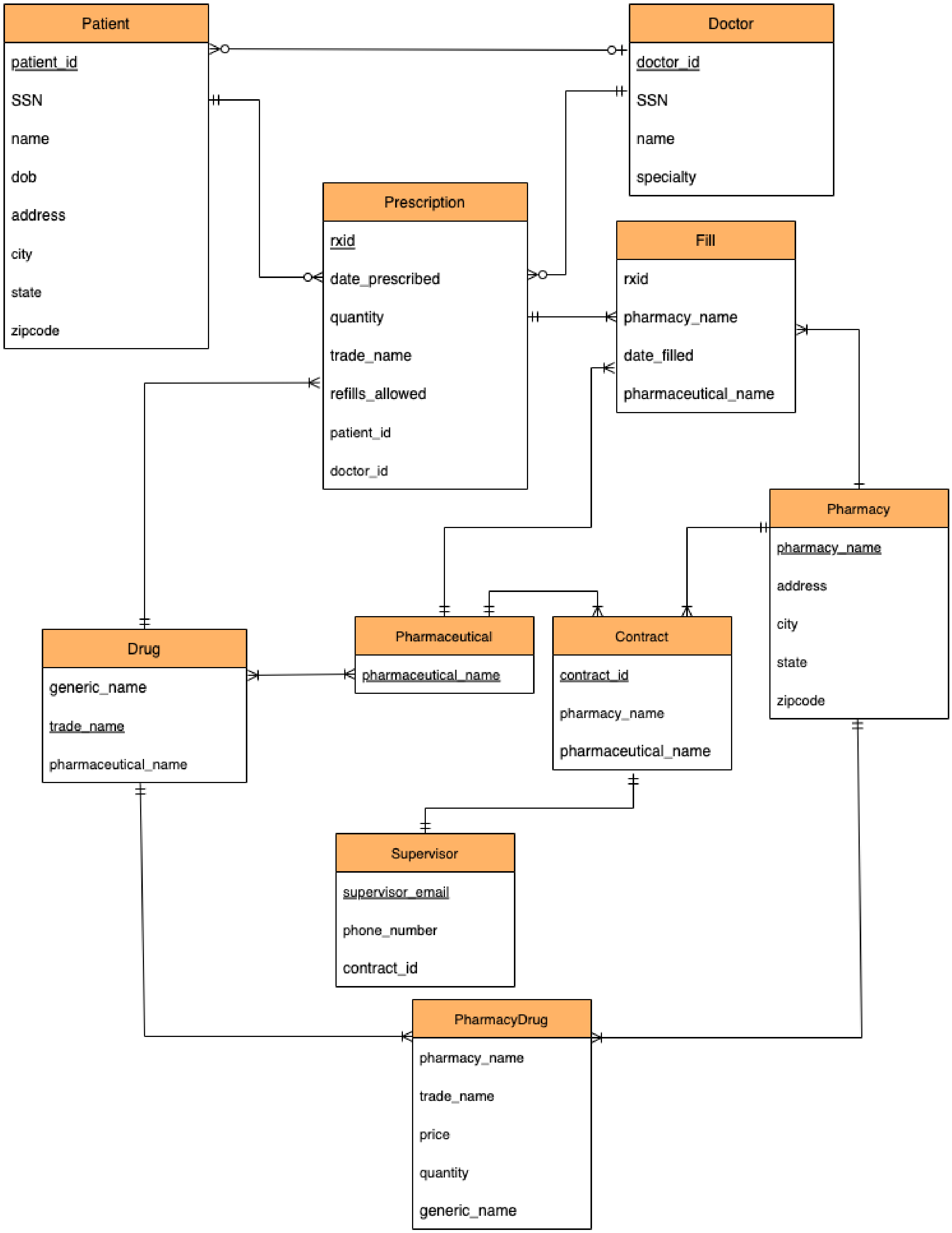
The following will be used to describe a relational database where a patient has one doctor, the doctor can prescribe drugs for the patient. The Doctor can have many patients, and can make many prescriptions for a patient. The pharmacy and pharmaceutical company are linked by a contract which is supervised by a supervisor. The pharmacy has access to its pharmacy drugs and can check the price, quantity, etc. Each prescription has a date and quantity that was prescribed to the patient, if the drug has a generic name then there can be found many pharmacies that provide the drug. Some user stories that help address the database's needs are as follows.

- As a patient, I want to be able to see the prescription drugs that are ordered by price based on pharmacy pricings.
- As a patient, I want to get basic information about the drug that was prescribed to me
- As a pharmacy, I want to see the price and quantity that I have of a drug

Methodology:

Some of the challenges we faced when designing our ER diagram was how to implement a relational database that was normalized so we can reduce redundancy and improve data integrity. Another difficulty that we encountered was thinking of the correct relationships that tables have with one another. Another difficulty we faced was to decide which data types we should use for our schema, along with constraints needed so that our relationships are correct with foreign keys and primary keys. We also have to be mindful and think logically how we will drop tables one by one. After implementing the sql table, we sometimes found the relationships are different from the ideal correct table. To implement the correct way from first is really hard and we need to think about the possibilities we are going to change data later. If the table and relationships are not correct, the product is going to be broken easily. Once we get our schema up and running, we have to verify that the inserts we do are correct by mapping foreign keys with respect to the primary key, this can be done with cross validation.

Revised ER Diagram:



Relational Schema:

```
drop table if exists Fill;
drop table if exists Supervisor;
drop table if exists Drug;
drop table if exists PharmacyDrug;
drop table if exists Prescription;
drop table if exists Patient;
drop table if exists Doctor;
drop table if exists Contract;
drop table if exists Pharmacy;
drop table if exists Pharmaceutical;


create table Patient (
   patient_id varchar(15) not null primary key,
   ssn varchar(11) not null,
   name varchar(25) not null,
   dob date not null,
   address varchar(35) not null,
   city varchar(15) not null,
   state varchar(2) not null,
   zipcode numeric(10) not null
);


create table Doctor (
   doctor_id varchar(15) not null primary key,
   ssn varchar(11) not null,
   name varchar(25) not null,
   specialty varchar(25) not null
);


create table Pharmaceutical (
   pharmaceutical_name varchar(25) not null primary key
);


create table Pharmacy (
   pharmacy_name   varchar(25) not null primary key,
   address        varchar(35) not null,
   city                 varchar(15) not null,
   state                varchar(2) not null,
   zipcode        numeric(11) not null
);


create table Contract (
   contract_id varchar(25) not null primary key,
   pharmacy_name varchar(25),
   foreign key (pharmacy_name) references Pharmacy(pharmacy_name),
   pharmaceutical_name varchar(25),
   foreign key (pharmaceutical_name) references Pharmaceutical(pharmaceutical_name)
);


create table Supervisor (
   supervisor_email varchar(255) not null primary key,
   phone_number varchar(15) not null,
   contract_id varchar(25),
   foreign key (contract_id) references Contract(contract_id)
);


create table Drug (
   trade_name varchar(255) primary key,
   generic_name varchar(255),
   pharmaceutical_name varchar(25),
   foreign key (pharmaceutical_name) references Pharmaceutical(pharmaceutical_name)
);


create table PharmacyDrug (
   pharmacy_name varchar(25) not null,
   trade_name varchar(255),
   price decimal(5,2) not null,
   quantity numeric(3) not null,
   foreign key  (pharmacy_name) references pharmacy(pharmacy_name)
);


create table Prescription (
   rxid                 varchar(25) not null primary key,
   date_prescribed      date not null,
   quantity             numeric(4) not null,
   trade_name           varchar(25),
   refills_allowed      number(1) not null,
   patient_id           varchar(15),
   doctor_id varchar(15),
      foreign key (patient_id) references Patient(patient_id),
   foreign key (doctor_id) references Doctor(doctor_id)
            on delete set null
);


create table Fill (
   rxid          varchar(25),
   pharmacy_name varchar(25),
   date_filled date not null,
   pharmaceutical_name  varchar(25),
   constraint rxid1 foreign key (rxid) references Prescription(rxid)
            on delete set null,
   constraint pharmaceutical_name1 foreign key (pharmaceutical_name) references
Pharmaceutical(pharmaceutical_name)
            on delete set null,
   constraint pharmacy1 foreign key (pharmacy_name) references Pharmacy(pharmacy_name)
            on delete set null
);
```

QUERIES:

- -- As a patient, I want to be able to see my prescription drug by trade name, price, quantity and pharmacy name ordered by pricings.

```
select pharmacydrug.trade_name, price, pharmacydrug.quantity,
pharmacy.pharmacy_name from pharmacydrug join pharmacy on
pharmacydrug.pharmacy_name=pharmacy.pharmacy_name where
trade_name='Vivelle';
```

- --As a doctor, I want to see a list of all prescribed drugs that were filled by pharmacies, show the doctor_id, trade_name, date_filled and pharmacy_name ordered by date_filled.

```
select d.doctor_id, p.trade_name, f.date_filled, f.pharmacy_name from
```

```
doctor d join prescription p on d.doctor_id=p.doctor_id join fill f on
p.rxid=f.rxid order by f.date_filled;
```

- --As a pharmacy, I want to see the contract_id, pharmaceutical_name, supervisor_email, and trade_name of the drug that we supply for 'Walgreens Pharmacy'

```
select c.contract_id, pharmacydrug.trade_name, s.supervisor_email,
c.pharmacy_name from supervisor s join contract c on
s.contract_id=c.contract_id join pharmacydrug on
c.pharmacy_name=pharmacydrug.pharmacy_name group by
pharmacydrug.trade_name, s.supervisor_email having
pharmacydrug.pharmacy_name='Walgreens Pharmacy';
```

- --As a pharmacy, I want to see number of times that we have filled a prescription of value ‘zx6r3’

```
select f.rxid, f.pharmacy_name, f.date_filled, per.refills_allowed from
fill f join prescription per on f.rxid=per.rxid group by f.date_filled,
per.rxid, f.pharmacy_name, per.refills_allowed having per.rxid = 'zx6r3'
order by f.date_filled;
```

- --Which doctors have been prescribing drugs made by pharmacy company 'CVS Pharmacy'?

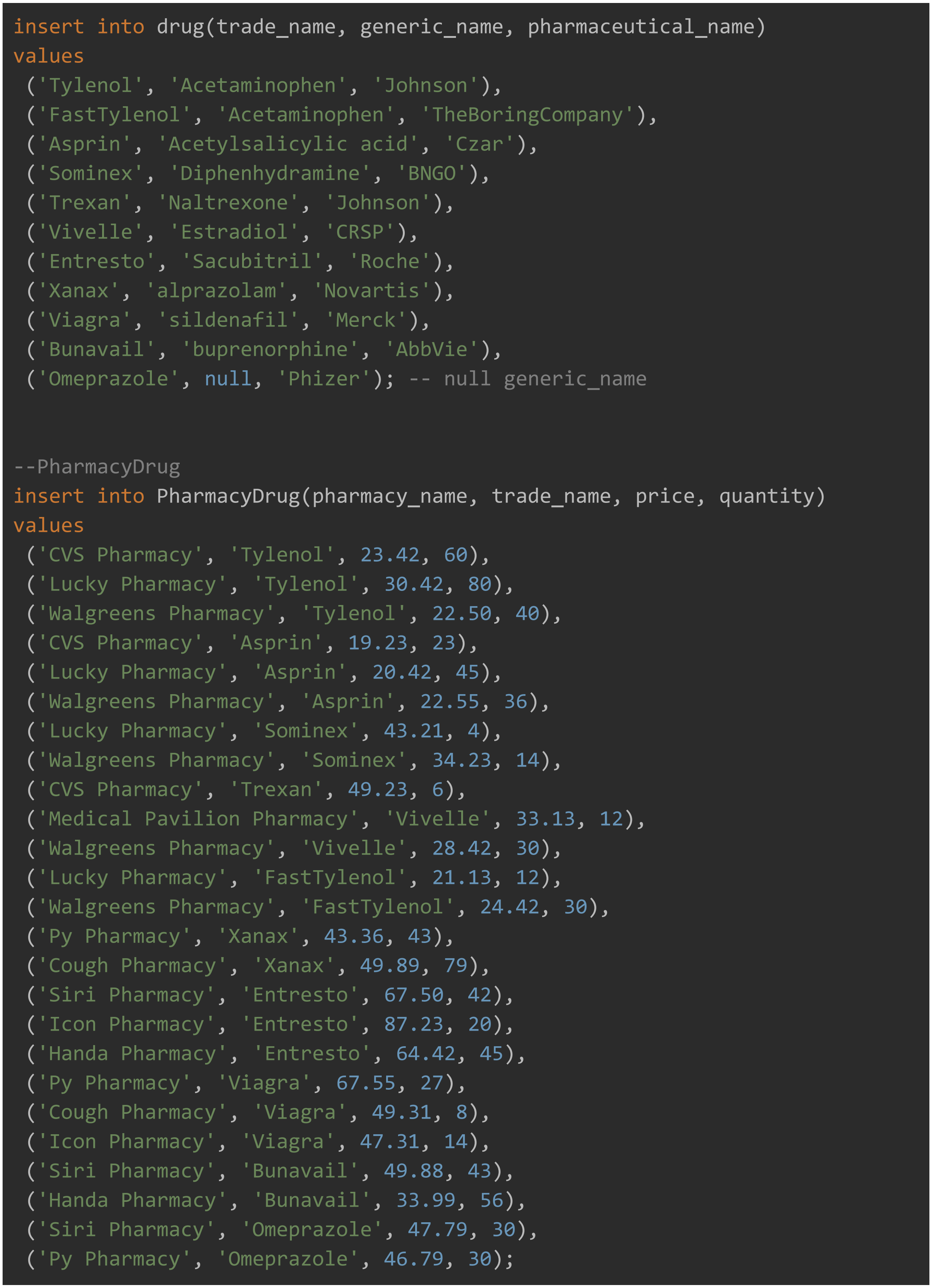
```
select d.doctor_id, count(p.rxid) as prescriptions_made
from doctor d join prescription p on d.doctor_id=p.doctor_id join fill f on
p.rxid=f.rxid join pharmacy ph on ph.pharmacy_name=f.pharmacy_name
group by d.doctor_id, ph.pharmacy_name
having ph.pharmacy_name='CVS Pharmacy';
```

- -- Are there any patients who have been getting the same prescription from different doctors each month?

```
select patient.name from patient join prescription on
patient.patient_id=prescription.patient_id group by patient.name having
count(patient.name)>1;
```

InsertTable

```
-- patient
insert into patient(patient_id, ssn, name, dob, address, city, state,
zipcode)
values
 ('123', '000-10-0000', 'Fett Boba', '1977-11-03', '1 FiresprayGunship',
'Santa Cruz', 'CA', 95076),
 ('125', '000-11-0000', 'Solo Dillon', '2000-03-03', '125 ShootingStar Ct',
'Monterey', 'CA', 95077),
 ('127', '123-10-0000', 'Vader Darth', '1966-05-30', '1 DeathStar Wy',
'Elden', 'CO', 1-358973),
 ('129', '000-10-1234', 'Grogu', '2007-02-26', '145 laken Ln', 'Salinas',
'CA', 12334),
 ('131', '100-10-0000', 'Chewbacca', '1977-11-03', '1 MillenniumFalcon',
'Brooklyn', 'NY', 35435),
 ('151', '111-10-2222', 'Chollet Francois', '1984-03-26', '1234 NeuralNet
Ln', 'Monterey', 'CA', 950),
 ('153', '322-11-1245', 'Rodriguez Rick', '1992-09-23', '135 EldenRings
Ct', 'Santa Cruz', 'CA', 95076),
 ('155', '123-10-5342', 'Vader Mark', '1979-07-30', '1 DeathStar Wy',
'Elden', 'CO', 1-358973),
 ('157', '642-06-4678', 'Djarin Din', '1983-05-16', '134 laken Ln',
'Salinas', 'CA', 12334),
 ('159', '103-10-3333', 'Antonio Marco', '1969-01-30', '5313 Recuerdame
St', 'Seaside', 'CA', 12337);


-- doctor
insert into Doctor(doctor_id, ssn, name, specialty)
values
 ('ava1', '000-00-0001', 'Dr. Lane Piteker', 'Anesthesiology'),
 ('ava3', '000-00-0341', 'Dr. Doolittle', 'Pediatrics'),
 ('ava5', '000-00-2357', 'Dr. Romero', 'Dermatology'),
 ('ava7', '000-33-1333', 'Dr. Nguyen', 'Nephrology'),
 ('ava9', '777-23-0001', 'Dr. Processor', 'Pediatrics'),
 ('ava11', '000-02-9840', 'Dr. Din Djarin', 'Pediatrics'),
 ('ava13', '434-23-0341', 'Dr. DoNothing', 'Anesthesiology'),
 ('ava15', '345-21-8867', 'Dr. Ready', 'Anesthesiology'),
 ('ava17', '111-23-2343', 'Dr. Love', 'Nephrology'),
 ('ava19', '090-63-0001', 'Dr. Otter', 'Dermatology');


--Pharmaceutical
insert into Pharmaceutical(pharmaceutical_name)
values
 ('Johnson'),
 ('Czar'),
 ('BNGO'),
 ('CRSP'),
 ('TheBoringCompany'),
 ('Roche'),
 ('Novartis'),
 ('Merck'),
 ('AbbVie'),
 ('Phizer');


--Pharmacy
insert into Pharmacy(pharmacy_name, address, city, state, zipcode)
values
 ('CVS Pharmacy', '145 First St', 'Gilroy', 'CA', 95020),
 ('Walgreens Pharmacy', '178 First St', 'Gilroy', 'CA', 95020),
 ('Kaiser Pharmacy', '483 Emergency Ln', 'Capitola', 'CA', 95064),
 ('Medical Pavilion Pharmacy', '366 Medical Blvd', 'Watsonville', 'CA',
95055),
 ('Lucky Pharmacy', '74 Third St', 'Seaside', 'CA', 95088),
 ('Siri Pharmacy', '145 Tenth St', 'Gilroy', 'CA', 95020),
 ('Icon Pharmacy', '178 Seventh St', 'Salinas', 'CA', 12334),
 ('Handa Pharmacy', '3145 Emergency Ln', 'Capitola', 'CA', 95064),
 ('Cough Pharmacy', '1245 Dog Blvd', 'Watsonville', 'CA', 95055),
 ('Py Pharmacy', '98 Elder St', 'Seaside', 'CA', 95088);


--contract
insert into contract(contract_id, pharmacy_name, pharmaceutical_name)
values
 ('aaa1', 'CVS Pharmacy', 'Johnson'),
 ('aaa2', 'CVS Pharmacy', 'Johnson'),
 ('aaa3', 'Walgreens Pharmacy', 'Czar'),
 ('aaa4', 'Lucky Pharmacy', 'Czar'),
 ('aaa04', 'CVS Pharmacy', 'Czar'),
 ('aaa05', 'Kaiser Pharmacy', 'BNGO'),
 ('aaa03', 'Walgreens Pharmacy', 'BNGO'),
 ('aaa031', 'Lucky Pharmacy', 'BNGO'),
 ('aaa5', 'Medical Pavilion Pharmacy', 'CRSP'),
 ('aaa07', 'Walgreens Pharmacy', 'CRSP'),
 ('aaa6', 'Lucky Pharmacy', 'TheBoringCompany'),
 ('aaa7', 'Walgreens Pharmacy', 'TheBoringCompany'),
 ('aaa21', 'Siri Pharmacy', 'Roche'),
 ('aaa22', 'Icon Pharmacy', 'Roche'),
 ('aaa23', 'Handa Pharmacy', 'Roche'),
 ('aaa24', 'Cough Pharmacy', 'Novartis'),
 ('aaa204', 'Py Pharmacy', 'Novartis'),
 ('aaa205', 'Py Pharmacy', 'Merck'),
 ('aaa203', 'Cough Pharmacy', 'Merck'),
 ('aaa2031', 'Icon Pharmacy', 'Merck'),
 ('aaa25', 'Siri Pharmacy', 'AbbVie'),
 ('aaa207', 'Handa Pharmacy', 'AbbVie'),
 ('aaa26', 'Siri Pharmacy', 'Phizer'),
 ('aaa27', 'Py Pharmacy', 'Phizer');


--Supervisor
insert into Supervisor(supervisor_email, phone_number, contract_id)
values
 ('alma@this.gmail', '(831)711-3545', 'aaa1'),
 ('9er@this.gmail', '(408)715-1245', 'aaa4'),
 ('otter@this.gmail', '(831)142-5566', 'aaa5'),
 ('kelp@this.gmail', '(408)711-3543', 'aaa3'),
 ('grogu@this.gmail', '(831)353-7774', 'aaa2'),
 ('cat@this.gmail', '(408)715-1245', 'aaa04'),
 ('fish@this.gmail', '(831)142-5566', 'aaa05'),
 ('sponge@this.gmail', '(408)711-3543', 'aaa03'),
 ('will@this.gmail', '(831)353-7774', 'aaa031'),
 ('collie@this.gmail', '(408)715-1245', 'aaa07'),
 ('ansu@this.gmail', '(831)142-5566', 'aaa6'),
 ('nvidia@this.gmail', '(408)711-3543', 'aaa7'),
 ('kfc@this.gmail', '(831)345-5556', 'aaa21'),
 ('md@this.gmail', '(831)756-1754', 'aaa22'),
 ('coldstone@this.gmail', '(831)262-5886', 'aaa23'),
 ('grave@this.gmail', '(831)741-3742', 'aaa24'),
 ('rank@this.gmail', '(831)357-4776', 'aaa204'),
 ('leech@this.gmail', '(831)671-4576', 'aaa205'),
 ('boots@this.gmail', '(408)755-1325', 'aaa203'),
 ('coldone@this.gmail', '(831)232-2245', 'aaa2031'),
 ('greystone@this.gmail', '(408)731-4678', 'aaa25'),
 ('keystone@this.gmail', '(831)353-9254', 'aaa207'),
 ('goldmember@this.gmail', '(408)731-1279', 'aaa26'),
 ('apexpreditor@this.gmail', '(831)351-2342', 'aaa27');


--drug
```



```sql
insert into drug(trade_name, generic_name, pharmaceutical_name)
values
 ('Tylenol', 'Acetaminophen', 'Johnson'),
 ('FastTylenol', 'Acetaminophen', 'TheBoringCompany'),
 ('Asprin', 'Acetylsalicylic acid', 'Czar'),
 ('Sominex', 'Diphenhydramine', 'BNGO'),
 ('Trexan', 'Naltrexone', 'Johnson'),
 ('Vivelle', 'Estradiol', 'CRSP'),
 ('Entresto', 'Sacubitril', 'Roche'),
 ('Xanax', 'alprazolam', 'Novartis'),
 ('Viagra', 'sildenafil', 'Merck'),
 ('Bunavail', 'buprenorphine', 'AbbVie'),
 ('Omeprazole', null, 'Phizer'); -- null generic_name


--PharmacyDrug
insert into PharmacyDrug(pharmacy_name, trade_name, price, quantity)
values
 ('CVS Pharmacy', 'Tylenol', 23.42, 60),
 ('Lucky Pharmacy', 'Tylenol', 30.42, 80),
 ('Walgreens Pharmacy', 'Tylenol', 22.50, 40),
 ('CVS Pharmacy', 'Asprin', 19.23, 23),
 ('Lucky Pharmacy', 'Asprin', 20.42, 45),
 ('Walgreens Pharmacy', 'Asprin', 22.55, 36),
 ('Lucky Pharmacy', 'Sominex', 43.21, 4),
 ('Walgreens Pharmacy', 'Sominex', 34.23, 14),
 ('CVS Pharmacy', 'Trexan', 49.23, 6),
 ('Medical Pavilion Pharmacy', 'Vivelle', 33.13, 12),
 ('Walgreens Pharmacy', 'Vivelle', 28.42, 30),
 ('Lucky Pharmacy', 'FastTylenol', 21.13, 12),
 ('Walgreens Pharmacy', 'FastTylenol', 24.42, 30),
 ('Py Pharmacy', 'Xanax', 43.36, 43),
 ('Cough Pharmacy', 'Xanax', 49.89, 79),
 ('Siri Pharmacy', 'Entresto', 67.50, 42),
 ('Icon Pharmacy', 'Entresto', 87.23, 20),
 ('Handa Pharmacy', 'Entresto', 64.42, 45),
 ('Py Pharmacy', 'Viagra', 67.55, 27),
 ('Cough Pharmacy', 'Viagra', 49.31, 8),
 ('Icon Pharmacy', 'Viagra', 47.31, 14),
 ('Siri Pharmacy', 'Bunavail', 49.88, 43),
 ('Handa Pharmacy', 'Bunavail', 33.99, 56),
 ('Siri Pharmacy', 'Omeprazole', 47.79, 30),
 ('Py Pharmacy', 'Omeprazole', 46.79, 30);
```

```sql
--prescription
insert into prescription(rxid, date_prescribed, quantity, trade_name,
refills_allowed, patient_id, doctor_id)
values
 ('zx1r', '2022-03-13', 30, 'Vivelle', 0, '131', 'ava1'),
 ('zx3r', '2022-04-22', 15, 'Vivelle', 2, '123', 'ava3'),
 ('zx6r', '2022-02-02', 15, 'Sominex', 4, '127', 'ava7'),
 ('zx7r', '2022-02-02', 20, 'Asprin', 1, '127', 'ava5'),
 ('zx9r', '2022-03-13', 20, 'Trexan', 1, '129', 'ava7'),
 ('zx10r', '2022-03-13', 40, 'Tylenol', 2, '125', 'ava5'),
 ('zx12r', '2022-04-21', 20, 'FastTylenol', 1, '131', 'ava5'),
 ('zx1r1', '2022-01-30', 30, 'Entresto', 0, '151', 'ava19'),
 ('zx3r2', '2022-04-12', 10, 'Xanax', 2, '153', 'ava17'),
 ('zx6r3', '2022-02-22', 15, 'Viagra', 4, '157', 'ava15'),
 ('zx7r4', '2022-02-17', 25, 'Viagra', 2, '151', 'ava15'),
 ('zx9r5', '2022-03-23', 20, 'Bunavail', 4, '155', 'ava13'),
 ('zx10r6', '2022-03-19', 30, 'Omeprazole', 5, '153', 'ava11'),
 ('zx12r7', '2022-04-11', 15, 'Omeprazole', 2, '157', 'ava11');


--fill
insert into fill(rxid, pharmacy_name, date_filled, pharmaceutical_name)
values
 ('zx10r', 'CVS Pharmacy', '2022-04-22', 'Johnson'),
 ('zx3r', 'Medical Pavilion Pharmacy', '2022-04-04', 'CRSP'),
 ('zx7r', 'CVS Pharmacy', '2022-04-23', 'Czar'),
 ('zx6r', 'Lucky Pharmacy', '2022-03-16', 'BNGO'),
 ('zx6r', 'Walgreens Pharmacy', '2022-04-18', 'BNGO'),
 ('zx1r', 'Walgreens Pharmacy', '2022-03-06', 'CRSP'),
 ('zx1r1', 'Handa Pharmacy', '2022-04-01', 'Roche'),
 ('zx3r2', 'Py Pharmacy', '2022-04-07', 'Novartis'),
 ('zx6r3', 'Icon Pharmacy', '2022-03-18', 'Merck'),
 ('zx6r3', 'Icon Pharmacy', '2022-04-21', 'Merck'),
 ('zx6r3', 'Icon Pharmacy', '2022-02-15', 'Merck'),
 ('zx7r4', 'Cough Pharmacy', '2022-03-12', 'Merck'),
 ('zx9r5', 'Handa Pharmacy', '2022-03-09', 'AbbVie'),
 ('zx10r6', 'Py Pharmacy', '2022-03-22', 'Phizer'),
 ('zx12r7', 'Py Pharmacy', '2022-03-22', 'Phizer');
```

Conclusion:

As a team Yuki and Matthew have implemented the ER diagram into a working and functioning database. We then inserted many values for each table with respect to the needed amount so that we can properly assess that our queries make sense and give correct results. This meant that we needed to accurately trace each foreign key so that the end result was correctly arranged.

A few things that were learned upon implementation of the ER diagram was that in order to traverse through tables there must be clear relationships between as many tables so that one can properly query through the tables with ease. We also learned that in order to produce a working query we needed to think logically how we would traverse through tables which meant that we had to make a few minor adjustments to our ER diagram like including a new table “FIll” that linked prescription, pharmaceutical and pharmacy tables.

It was completely different from the sql assignments that we have done before. This is required to design, implement, and correct databases. It is a really good opportunity for us to finish a design project.