

Part 1

1. Find the canonical cover:

$$B \rightarrow E$$

$$C \rightarrow F$$

$$E \rightarrow D$$

$$DF \rightarrow A$$

The original keys: B, C

R1(B, E)

R2(C, F)

R3(E, D)

R4(D, E, A)

R5(B, C) – add the original key

R1, R2, R3, R4, and R5 are in 3NF and in BCNF.

2. Find the canonical cover:

$$A \rightarrow B$$

$$B \rightarrow D$$

$$B \rightarrow C$$

The original key: A

Using $B \rightarrow D$ to decompose R, we get:

R1(A, B, C) in 1NF

R2(B, D) is already in BCNF

Using $B \rightarrow C$ to decompose R1, we get:

R11(A, B) in BCNF

R12(B, C) is already in BCNF

Group the relations with the same key:

R1(B, C, D)

R2(A, B)

Zhen Wu (zhw87), Sushruti Bansod (sd88)

R1, R2 are in BCNF form.

3.

R(patient_id, dob, name, ssn, prescription_id, prescription_date, doctor_id, medication_price, address, city, state, phone_no, pharmacy_address)

R1 includes FD1, FD2

R2 includes FD3

R3 includes FD4

	patient_id	dob	name	ssn	prescription_id	prescription_date	doctor_id	medication_price	address	city	state	phone_no	pharmacy_address
R1	K	K	K	K	K	K	K	K	U →K	U →K	U →K	U →K	U →K
R2	U	U	U	U	U	U	K	U	K	K	K	K	U
R3	K	U →K	U →K	U →K	K	U →K	U →K	U →K	U	U	U	U	K

We have a row with all known values, so the decomposition is lossless. All the FDs have been reserved. So the decomposition is good.

Part 2

1. Assumptions:

1. Doctors with a license can prescribe medications. If you don't have a license, are you a doctor?
2. pharmacy_licenseID is used more often than pharmacy name.
3. Medication barcodeNumber is used more often than medication name.
4. PCM_registrationID is used more often than pharmaceutical company name.
4. Medication must have a formula.
5. Patient must have a date of birth.
6. The doctor needs to prescribe the medication again when a refill is needed.

diagrammatic E-R: see the E-R pdf file

Textual E-R:

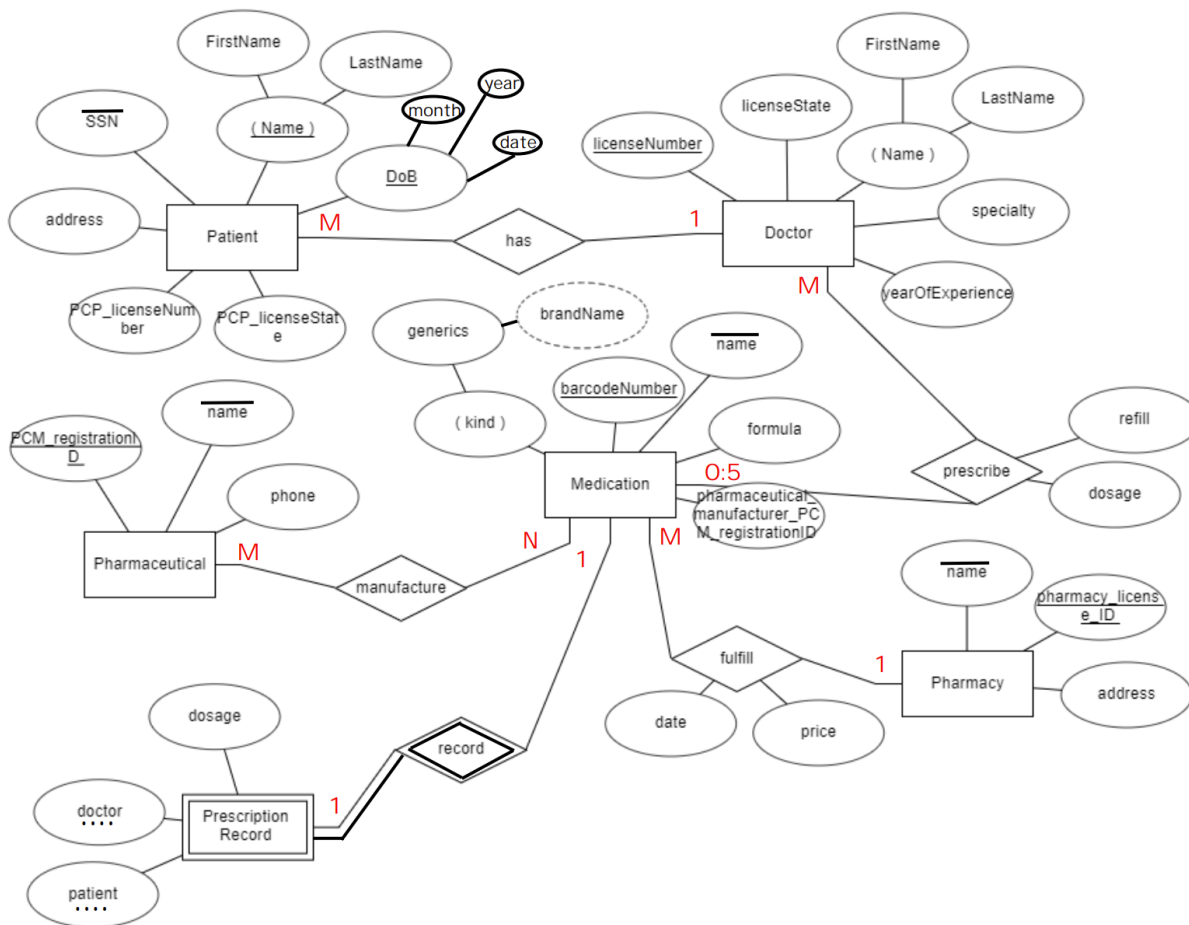
Entities

1. Patient: SSN, Name(FirstName, LastName), DoB(year, month, date), address, PCP_licenseNumber, PCP_licenseState;
2. Doctor: licenseNumber, licenseState, Name(FirstName, LastName), specialty, yearOfExperience;
3. Pharmaceutical: PCM_registrationID, : name, phone;
4. Medication: kind(generics,brandName), barcodeNumber, : name, formula, pharmaceutical_manufacturer_PCM_registrationID;
5. Pharmacy: : name, pharmacy_license_ID, address;
6. Prescription Record: dosage, doctor, patient;

Relationships:

1. has: <Patient, Doctor> M:1, PARTIAL/PARTIAL;
2. prescribe: <Medication, Doctor> (0:5):M, PARTIAL/PARTIAL;
3. manufacture: <Pharmaceutical, Medication> M:N, PARTIAL/PARTIAL;
4. fulfill: <Medication, Pharmacy> M:1, PARTIAL/PARTIAL;

5. record: <Medication, Prescription Record> 1:1, PARTIAL/TOTAL;



**a pdf copy of the diagram is also attached.

2. DOCTOR(licenseNumber, licenseState, FirstName, LastName, specialty, yearOfExperience, has, prescribe, dosage, refill)

PK (licenseNumber, has)

FK (prescribe) → MEDICATION (prescribe)

PATIENT(SSN, FirstName, LastName, DateOfBirth, address, PCP_licenseNumber, PCP_licenseState, has)

PK (FirstName, LastName, DateOfBirth)

Zhen Wu (zhw87), Sushruti Bansod (sd88)

FK(PCP_licenseNumber) → DOCTOR(licenseNumber)

FK(PCP_licenseState) → DOCTOR(licenseState)

FK (has) → DOCTOR(has)

PHARMACEUTICAL(PCM_registrationID, name, phone, manufacture)

PK (PCM_registrationID, manufacture)

FK (manufacture) → MANUFACTURE (manufacture)

PHARMACY(name, pharmacy_license_ID, and address, fulfill)

PK (pharmacy_license_ID, fulfill)

UN (name)

MEDICATION(barcodeNumber, name, formula,
pharmaceutical_manufacturer_PCM_registrationID, generics, brandName,
patient, doctor, dosage, fulfill, date, price, prescribe, manufacture)

PK (barcodeNumber, prescribe, manufacture)

FK (patient) → PATIENT(FirstName, LastName)

FK (doctor) → DOCTOR(FirstName, LastName)

FK (fulfill) → PHARMACY (fulfill)

FK (manufacture) → MANUFACTURE (manufacture)

CHECK (formula IS NOT NULL)

MANUFACTURE (manufacture)

PK (manufacture)