



Full DBMS Physical ERD

I will continue to use my associative structural database rules to implement their relationship classification. Most synthetic primary keys that I choose will have a default DECIMAL datatype for 12 digits and an ID number as per standard practice. There will be some primary keys that I've decided to use natural keys instead, as explain later on.

Rule #1:

An account is a pharmacist account, a technician account, or none of these.

Rule#3:

A pharmacy is associate with one or more accounts. An Account is associated with a pharmacy.

Rule #3 is a 1:M relationship. There will be multiple accounts inside one pharmacy. The foreign key will be placed into the account entity referencing the pharmacy entity. In addition, the account entity is a super type entity. The account subtype will depend on who the user is. It can be broken down into a pharmacist account, a technician account or none of these. Most pharmacy will be managed be either a pharmacist or a technician, but I wanted to add the flexibility that someone neither a pharmacist nor a technician can also use the program. Thus, the physical ERD will show a partial complete with a disjoint.

Rule#2:

A prescription is billed by a pharmacy. A pharmacy can bill one or more prescription.

Rule#2 is a 1:M relationship. A pharmacy can bill many prescriptions, but a prescription can only be billed from a pharmacy. From my conceptual ERD, I will use the pharmacy's National Provider Identifier as the primary key for the pharmacy entity and the foreign key into the prescription entity. The primary key for the prescription entity is a natural key, prescription number. In the real world, a prescription number identifies an individual prescription. I kept the datatype to DECIMAL(12), because it offers flexibility but prescription numbers almost never reaches 12 digits.

Rule #4:

Each Prescription can be associated with a drug. Each drug is associated with one or more prescription.

This rule is a 1:M relationship. A prescription will be associated with one drug, but a drug will be on at least one prescription if not more. A prescriber can prescribe the same drug for the same patient or different patient. The primary key for the drug entity is a natural key, the National Drug Code (NDC). The NDC is a 11 digit number that identifies a drug's manufacture, drug name and strength, and package size. The first 5 digit identifies the drug's manufacture, the next 4 digit identifies the drug's name and strength, last 2 digit is for package size. The primary will reference the foreign key in the Prescription table. I will keep the datatype for NDC as varchar, because some NDC starts with zeros.

Rule #5:

A pharmacy can have to one or more patient. A patient can belong to one or more pharmacy.

This rule is a M:N relationship, since multiple people can belong to more than one pharmacy and many pharmacy can belong to many people. I made the relation 'Belong' into an entity and it's primary key is a composite key made of both pharmacy primary key and patient's primary key. This new entity splits the M:N into two 1:M relationship. Both the pharmacy and the patient has a 1:M relation with the Belong entity.

Rule#6:

A prescription has one patient. A patient can have one or more prescriptions.

This is a 1:M relationship. A patient can multiple prescriptions, but each prescription is associated with one patient. The singular is the prescription entity, thus the foreign key will be added to it.

Rule #7

A prescriber can prescribe one or more prescription. A prescription is prescribed from a prescriber.

This is a 1:M relation. It would be one prescriber able to prescriber one or more prescriptions. However, a prescription only need to be signed by one prescriber to be legitimate.

Rule #8

A prescriber has one or more patient appointment. A patient is appointed to one or more prescriber.

This is a M:N. Thus, I would have to break this relation up to two 1:M relation. The 'Appointment' relation is transform into a 'Care' entity with it's primary key compose of both the primary key from Patient entity and the Prescriber entity. I will use the prescriber's National Provider Identifier (NPI) as a natural key for the entity.

Rule #9

A patient has a payment method. A payment Method belongs to one or more patient.

This is a 1:M relation. A patient will have one payment method, insurance or cash. A payment method can come from multiple patients. The method would be assigned to a sequence.

Rule #10

A pharmacist verifies one or more prescription. A prescription is verified by a pharmacist

This is a 1:M relation. A pharmacist will verify multiple prescription, and a prescription have to be verified by a pharmacist.

Rule #11:

A Pharmacy stocks one or more drug. A drug can be stock by one or more pharmacy.

Many pharmacy can stock many drug, making this rule is a M:N relationship. I convert the relation 'stock' into an entity and splits the M:N into two 1:M relations . The stocks entity's primary key is a composite key of pharmacy's primary key and drug's primary key. Both the pharmacy and drug entity has a 1:M relation with the stock entity.

Rule#12:

A prescription can be picked up by someone. A person can pick up multiple prescription.

Rule#12 is a 1:M relationship. A person can pickup one or more drug, but a prescription can only be picked up by one person. The prescription is the singular so the foreign key that references the pickup_person is added to it. Often times, it's not the actual patient that's picking up his/her drug, but someone else. However, I cannot think of any attributes that that will distinguish between patient, family member, friends, or none of these, so I will make an attribute indicating if the pickup person is a particular type instead of making a super-sub type relationship.

Rule #13

A drug can have one or more price change. A price change is associated with a drug.

This is a 1:M relationship. A drug has relation to price change. It is optional for a drug to have a price change since a price can stay the same forever. Also a drug can have multiple price changes since multiple vendors can set different prices. A price change have to be associated with a drug (mandatory), if there is no drug, then there is no price change. A price change is associated with one drug (singular) since there can be only one price change at a time.

ATTRIBUTES

TABLE	ATTRIBUTE	DATATYP	REASONINGS
Pharmacy	PHARMACY_NPI	DECIMAL(10)	The pharmacy National Provider Identifier is a 10 digit number that uniquely identifies an entity for billing purposes. The format is kept same across the nation vs. license number are only state specific.
Pharmacy	Pharmacy_Name	Varchar(65)	This serves more as a surrogate key to better address the pharmacy instead of the NPI
Pharmacy	Pharmacy_address	Varchar(65)	This serves more as a surrogate key to better address the pharmacy instead of the NPI
Account	Account_Username	VARCHAR(65)	Instead of using an ID number, a username is more usable. It will be use to distinguish between accounts. I think 65 character is sufficient enough to distinguish all the potential users.
Account	Account_First_Name	Varchar(65)	Sometimes username are not meaningful and can be opaque. We should need a more legitimate user identity.
Account	Account_Last_Name	Varchar(65)	Sometimes username are not meaningful and can be opaque. We should need a more legitimate user identity.
Account	EncryptedPassword	VARCHAR(65)	Every account will have a password to ensure security. I think 65 character is sufficient enough for a password.
Account	Is_Pharmacist_Acc	Boolean	This is to confirm that the account is a pharmacist account and use to differentiate between pharmacist, technician, and other accounts.
Account	Is_Technician_Acc	Boolean	This is to confirm that the account is a technician account and use to differentiate between pharmacist, technician, and other accounts.
Account	Is_Other_Acc	Boolean	This is to confirm that the account is not a pharmacist or technician account.
Pharmacist_Acc	Pharmacist_NPI	DECIMAL(10)	This will be used to distinguish accounts between pharmacist and technicians. Only pharmacist accounts will have Pharmacist NPI numbers.

TABLE	ATTRIBUTE	DATATYP	REASONINGS
Patient	Patient_ID	DECIMAL(12)	This will be used to identify patients. I will use decimal as an identity, because multiple people can have the same name, address, or day of birth. I believe 12 digit is more than patients.
Patient	Patient_Last_Name	VARCHAR(65)	This is the patient's last name, used to identify the patient from the prescription. I think 65 character is sufficient.
Patient	Patient_First_Name	VARCHAR(65)	This is the patient's first name, used to identify the patient from the prescription. I think 65 character is sufficient.
Patient	Patient_DOB	DATE	This is the patient's date of birth, used to identify the patient from the prescription. Date of birth must be a date.
Patient	Avg_pickuptime	decimal(12)	This is the average pickup time in days for a patient to pickup a prescription. It is essentially the difference between written_on date and the pickup_date
Appointment	Appointment_date	DATE	This is the date that the patient sees the doctor
Insurance	Payment_method_Id	DECIMAL(12)	This is a synthetic key to track insurance entry as well as cash method.
Insurance	Is_cash	Boolean	This is for patients that are paying cash and thus all other insurance fields will be null
Insurance	Insurance_ID	VARCHAR(65)	This is the patient's insurance ID number. It's a natural key. There are some ID that has letter and number, so I choose varchar to capture that. Also I believe 65 character is sufficient enough.
Insurance	Insurance_Bin	VARCHAR(20)	This is the bin number. It's used to identify which insurance provider the member has.
Insurance	Insurance_PCN	Varchar(65)	This is the PCN number, it helps identify which insurance provider the member has and whether a particular drug is covered or not. PCN can be numbers, letters, or combination. <i>This is a nullable field.</i>

TABLE	ATTRIBUTE	DATATYP	REASONINGS
Insurance	Insurance_Group	Varchar(65)	This is the group number, it helps to identify which group in the insurance the member belongs to. Group numbers can be numbers, letters, or combination. <i>This is a nullable field.</i>
Insurance	Insurance_PBM	Varchar(65)	This is the PBM that the insurance belongs to. PBM regulates the relationship between the pharmacy and the insurance. PBMs are usually letters, but I can't be 100% sure it won't contain numbers.
Inventory	NDC	VARCHAR(10)	Identifies a particular drug. The NDC is a 10 digit code, but I opted for varchar because some NDC has leading zeros and that can be a problem. Thus varchar will capture all the digits as a literal string. The NDC will dictates manutfracter, drug/strength, and package size.
Inventory	Current_Quantity	DECIMAL(12,3)	This will be the current quantity that a pharmacy holds for a particular NDC. I use a Decimal 9,3 because not all drugs are measured in whole digits. There are some that will have decimals. I have see ones with 2 decimals, but I will put 3 decimals just in case. I think a 12 digit number is more than sufficient for quantity.
Inventory	Incoming_Quantity	DECIMAL(12,3)	This is the amount of drug that needs to be ordered from vendor to satisfy the reserve quantity
Inventory	Filled_Quantity	DECIMAL(12,3)	This is the amount of drug that is already filled
Inventory	ToBe_Filled_Quantity	DECIMAL(12,3)	This is the amount of drug that is billed but not filled yet. This is the amount of drug that will be filled and reaches 0 in the next few days.
Inventory	Reserved_Quantity	DECIMAL(12,3)	This is the amount of drug that will serve as reserve. It will be used when patient comes in and their prescription is not filled. This number will be maintained everyday.
Drug	Drug_Name	VARCHAR(255)	This is the drug name associated with the NDC. I used a particular long Varchar, because some drugs have very long name, especially when a drug is a combination of two or three individual drugs.

TABLE	ATTRIBUTE	DATATYP	REASONINGS
Drug	Drug_Strength	VARCHAR(65)	This will be the drug's strength. I choose a varchar instead of decimal, because some drugs' strength are in percentage (ie 2% cream/ointment) or when 2 drugs are combined into 1 drug, it's often listed with '/' (e.g. 100/300).
Drug	Drug_Price	DECIMAL(12,2)	This is the price of the drug per trade size as determined by the NDC. Most vendors don't sell drugs per pill, it's sold as a price per package size (bottle of 30, 60, 90...etc).
Drug	Drug_Tradesize	DECIMAL(12,3)	This is the package size as per the NDC. I use a Decimal 12,3 because not all drugs comes in prefect bottles of 30,60,90..etc. There are some drugs that comes in decimal grams (ie 8.5gm) I will use up to 3 decimals just in case.
Drug	Drug_Manufacturer	VARCHAR(65)	This is the drug manufacturer. I think 65 character is sufficient enough
Prescriber	Prescriber_NPI	DECIMAL(10)	This is the prescriber's NPI used to identify each particular prescriber. It is a natural key and is unique nationally. It's a 10 digit number assigned to each prescriber.
Prescriber	Prescriber_Last_Name	VARCHAR(65)	This is the prescriber's last name. I think 65 character should be sufficient
Prescriber	Prescriber_First_Name	VARCHAR(65)	This is the prescriber's first name. I think 65 character should be sufficient
Prescription	Prescription_Number	DECIMAL(12)	This is a natural key that will identify each particular prescription. Most prescription number are 7-8 digits, but that number increases as the pharmacy ages. I think 12 digit is sufficient.
Prescription	Serial_Number	VARCHAR(12)	This is the prescription serial number. It is used to differentiate if the prescription was sent electronically, written, or other form. I choose varchar because a written prescription is a combination of letters and numbers.
Prescription	Written_On	DATE	This is the date that the prescription was written or sent. Some prescriptions have an expiration date depending on the drug.

TABLE	ATTRIBUTE	DATATYP	REASONINGS
Prescription	Date_Billed	DATE	This is the date that the prescription is billed on. This will help track how many days ago a prescription was billed. The older a prescription is, the higher risk of being picked up.
Prescription	Is_Rx_Filled	Boolean	This is a boolean to indicate if this prescription is filled to not. Filled prescriptions are ready to be picked up, not filled prescription will need to be filled in the coming days.
Prescription	Signed	Boolean	This is a boolean to indicate if the prescription was signed or authenticated or not.
Prescription	Pharmacist_Signed	DECIMAL(12)	This is to indicate which pharmacist have view the prescription. I will assign this to the pharmacy's NPI, but I will designate it as the pharmacist signature or stamp.
Serial_number	Serial_Number	VARCHAR(12)	This is the serial number on the prescription. It is a natural key on the prescription. It will distinguish if the prescription was written or electronic.
Pickup_Person	Pickup_ID	DECIMAL(12)	This is a number associated with a particular prescription pickup. Each pickup can be done by the patient or someone else.
Pickup_Person	Pickup_Date	Date	This is the date that a pickup is done. A pickup date will give us an estimate time of how often a prescription gets picked up
Price_Change	Price_change_ID	DECIMAL(12)	This will be the primary key of the table. Every price change will be associated with a drug and a point in time
Price_Change	OldPrice	DECIMAL(12,2)	This is the old price of a particular drug. To trend how the price change from
Price_Change	NewPrice	DECIMAL(12,2)	This is the new price of a particular drug. To trend how the price change into
Price_Change	Change_Date	Date	This is the date that a particular price change occur