Project Title: National Blood Inventory Database

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Team Name: PNW Developers
Group: 32

Project Step 2 Draft: Normalized Schema + DDL with Sample Data

Note: We have not received any feedback yet for step 2, only peer feedback from step 1 which was implemented for the final version of step 1.

Feedback by peer reviewers (Step 1)

Mark De Guzman

Blood donation is definitely an important one and it seems complicated too as there are many interconnecting information involved!

Does the overview describe what problem is to be solved by a website with DB back end?

The problem to be solved relates to the information management system for blood storage and transportation logistics. The proposal specifically describes the kind of system for the problem including, but not limited to, millions of blood transfusions, expiration date for blood, storage inventory, usage, and blood components.

Are at least four entities described and does each one represent a single idea to be stored as a list?

There are six entities described in the proposal with each one representing a single idea to be stored as a list.

Does the outline of entity details (1) describe the purpose of each, (2) list attribute datatypes and constraints, and (3) describe relationships between entities?

Blood_Donation_Centers: (1) yes, (2) yes, (3) M:M relationship between Blood_Donation_Centers and Blood_Banks not implemented as intersection (see week 2 - Database Designs/ Entity Relationships, slide 9). It also doesn't follow the same writing convention (FK Blood Donation Center ID instead of donationCenterID). Entities

doesn't follow consistent naming format in description (Blood_Donation_Centers vs Blood Donation Center).

Blood_Banks: (1) yes, (2) yes, (3) Add M:M between Blood_Donation_Inventories and Blood_Banks as they reference each other. *Suggestion for improvement: list attributes in same order on the ER diagram.*

Blood_Donors: (1) yes, (2) yes, (3) *Optional suggestion:* M:M between Blood_Donors and Donation_Centers

Blood_Recipients: (1) yes, (2) yes bloodRecipientID PK in Blood_Recipients vs FK recipientID in Hospitals, (3) Relationship 2: M:1 Blood_Recipients:Hospital

Blood_Donation_Inventories: (1) yes, (2) yes, (3) relationship 2 should be M:1 Blood_Donation_Center:Blood_Donation_Inventory, order of writing entities matter. Relationship 3 doesn't mention that the relationship is 1:M

Hospitals: (1) yes, (2) yes FK recipientID in entity Hospitals vs bloodRecipientID in entity Blood_Recipients , (3) Implement M:M as intersection, add 1:M relationship to Blood_Recipients entity (a hospital can have one or more blood recipients)

Blood_Bags: (1) yes, could add to say attributes of blood, (2) yes, (3) See comment in Blood_Donation_Centers

Are 1:M relationships correctly formulated? Is there at least one M:M relationship?

Most of the relationships are correctly formulated, however some 1:M relationship creates confusion in the ER diagram. For example, the diagram shows that bloodInventoryID has a 1:M relationship to itself and with blood banks, however the FK fails to reflect this which leads me to conclude that this is the result of not expressing the M:N relationship in the ER diagram using an intersection table. There is at least one M:M relationship (e.g. entity Blood Bags).

a) naming between overview and entity/attributes

The naming is not exactly 1:1 between overview and the entity/attributes as some details that are inherent in the entity are spared being mentioned in the overview. For example, donor information includes name and address. However, this is overview still works since a reader informed in database development and competent knowledge in basic biology and logistics can correctly formulate the entities and attributes. The naming of entities in ER diagram uses a space, which was specified to be avoided as it introduces error when using SQL and this naming is in conflict with the database outline.

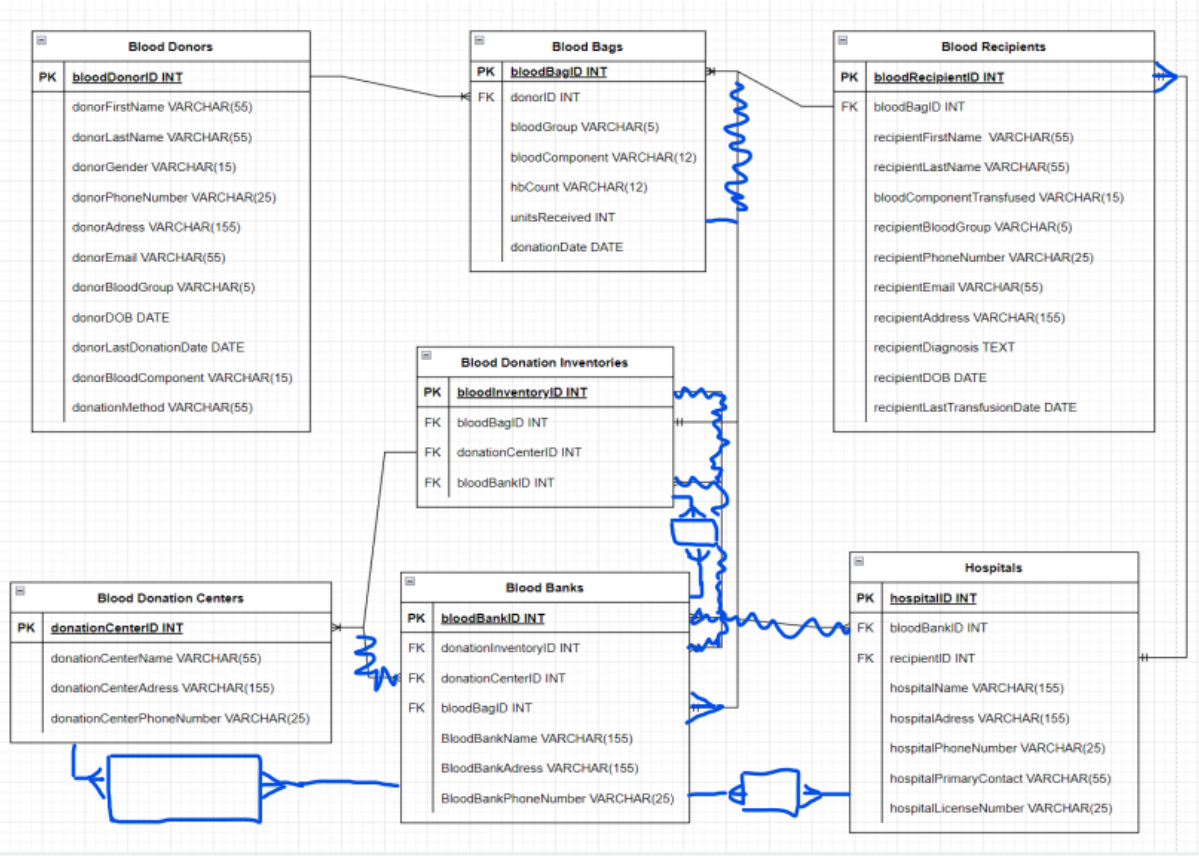
b) entities plural, attributes singular

Entities are plural and attributes singular

c) use of capitalization for naming

The attributes follow the camelCase naming convention. The entities follow the first letter capitalized convention.

ER diagram feedback following the overview text



Sara Biebuyck

Does the overview describe what problem is to be solved by a website with DB back end?

Yes, the draft is very explicit in the problem, listing sources and data in what the blood crisis is and what they need to solve it. Love the idea behind this proposal!

Does the overview list specific facts?

Yes, very detailed in what the specific lifespan of platelets are, however, I would have liked to see a stronger focus on your specific database and what it all will entail (even though I know the outline goes into these details). It felt like an introduction paragraph to an essay as opposed to on overview of the solution.

Are at least four entities described and does each one represent a single idea to be stored as a list?

Yes, there are actually way more than four. Blood_Donation_Centers, Blood_Banks, Blood_Donors, Blood_Recipients, Blood_Donation_Inventories, Hospitals, and Blood Bags (I'm slightly peeved that Blood Bags doesn't have an underscore lol). It is represented as a list.

Does the outline of entity details describe the purpose of each, list attribute datatypes and constraints and describe relationships between entities?

Yes, it is a very detailed entity, listing all attribute datatypes, attributes, and constraints within and a short synopsis on how they are related to other tables.

Are 1:M relationships correctly formulated? Is there at least one M:M relationship? Does the ERD present a logical view of the database?

I believe so. There multiple M:M relationships, between Blood_Banks and Blood_Donation_Centers and another between Hospitals and Blood_Banks.

Is there consistency in a) naming between overview and entity/attributes b) entities plural, attributes singular c) use of capitalization for naming?

There is not consistency as sometimes the items are Blood_Donors and Blood Donors. Overall, great work!

Ezequiel Sandoval Caro

Does the overview describe what problem is to be solved by a website with DB back end?

Yes the overview describes what the problem is to be solved. It talks about efficient storage, tacking and usage of blood and blood components.

Does the overview list specific facts?

Yes this group uses a lot of facts, more specifically explaining how often someone in the US need a blood donation. Also give a short explanation about red blood cells. As well as talking about how the HHS needs a way to track data for health emergencies.

Are at least four entities described and does each one represent a single idea to be stored a s a list?

Yes there are 7 entities described. Each one also represents a single idea to be stored as a list. They are Blood donors, Blood Bags, Blood recipients, Blood Donation Inventories, Blood Donation Centers, Blood Banks, and Hospitals.

Does the outline of entity details describe the purpose of each, list attribute datatypes and constraints and describe relationships between entities?

Yes the outline describes in detail the purpose of each entity. It also lists the attribute data types and constraints. Lastly, it describes the relationships between entities.

Are 1:M relationships correctly formulated? Is there at least one M:M relationship? Does the ERD present a logical view of the database?

The 1:M relationships seem to be formulated correctly. There is also atleast one M:M relationship. The ERD presents a logical view of the database.

Is there consistency in a) naming between overview and entity/attributes b) entities plural, attributes singular c) use of capitalization for naming?

There is not full consistency between the overview and entity/attributes. An example of this is in the outline "Blood_Donation_Inventories" and the ERD "Blood Donation Inventories". Entities are plural and attributes seem to be singular. There is capitalization for naming.

Victor Aquino

- **Does the overview describe what problem is to be solved by a website with DB back end?**

yes. The overview states that a DB back end is needed to help this important public need. The problem: National blood crisis.

- **Does the overview list specific facts?**

yes. Very well-written overview with references included. Due to the pandemic, we have the worse blood shortage in over a decade. Overview explains lifespan of red blood cells and platelets.

- **Are at least four entities described and does each one represent a single idea to be stored as a list?**

yes. There are Blood_Banks, Blood_Donation_Center, Blood_Donors, Blood_recipients, and 3 more entitites that describes what each one represent.

- **Does the outline of entity details describe the purpose of each, list attribute datatypes and constraints, and describe relationships between entities?**

yes. Each entity describes its purpose, attribute datatypes are listed accordingly to their role relationships between entities are described.

- **Are 1:M relationships correctly formulated? Is there at least one M: M relationship? Does the ERD present a logical view of the database?**

1:M relationships are correctly formulated and described in each entity. There are a couple of M: M relationships between such Blood Banks with Blood Donation Centers AND Blood Donation Centers with Blood Banks.

- **Is there consistency in a) naming between overview and entity/attributes b) entities plural, attributes singular c) use of capitalization for naming?**

There is consistency in using capitalization for naming and entities plural with attributes as singular. However, there is no consistency on part 3 ERD when naming the

entitities. I believe "Blood Bags" should be written as "Blood_Bag" or "BloodBag". Other than that, Great project Draft!

Actions based on feedback (Step 1)

We took Mark's advice and changed our M:M relationships to incorporate intersection tables and changed the relationship between Blood_Recipients and Hospitals to 1:m instead of 1:1 because a hospital can have many Blood_Recipients. Also improved some inconsistencies in naming and added the missing relationships in the entities overview.

Upgrades to the Draft version (Step 1)

Other than the actions based on feedback we switched to MySQL Workbench to make and display the ERD.

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1. Overview:

“Every 2 seconds someone in the U.S. needs blood and or platelets” and “nearly 16 million blood components are transfused”. “Each year, an estimated 6.8 million people in the U.S. donate blood”. Even so, across the nation we are finding ourselves frequently short on blood supply and earlier this year the American REd Cross announced a “blood crisis”, citing the worst blood shortage in over a decade. I imagine that the pandemic impacted the supply of blood as much as it has everything else.
Red blood cells must be used within 42 days and platelets must be used within 5 days. Something like granulocytes are only collected on demand as they have to be used within 24 hours. Thus, efficient storage, tracking and usage of blood and blood components (whole blood, red blood cells (RBCs), platelets, and plasma) is important to assure we have a proper supply of these vital life-saving products. In 2020 the Department of Health and Human Services issues a report to congress speaking to the need for “collecting real-time data to meet everyday needs, respond to public health emergencies…”. This database would be a first step in helping to meet this important public need.
Goals/purpose of database:

- Database tracks blood products by location in near real time from donor to recipient as processed.
- Blood product donor to recipient history is maintained indefinitely.

References:
ARC. Blood Components.
https://www.redcrossblood.org/donate-blood/how-to-donate/types-of-blood-donations/blood-components.html
USDHHS. Adequacy of the National Blood Supply - Report to Congress 2020.
https://www.hhs.gov/sites/default/files/hhs-adequacy-national-blood-supply-report-congress-2020.pdf

2. Database Outline:

Entities:

- **Blood_Donation_Centers:** List of blood donations centers across the country
    - bloodDonationCenterID:INT, auto_increment, unique, not NULL, PK

- donationName:VARCHAR(55), not NULL
- donationAddress:VARCHAR(155), not NULL
- donationPhoneNumber:VARCHAR(25), unique, not NULL

Relationship 1: M:M relationship between *Blood_Donation_Centers* and *Blood_Banks* implemented with FK bloodDonationCenterID inside of *Blood Banks*

Relationship 2: M:1 relationship between *Blood_Donation_Centers* and *Blood_Donation_Inventories* implemented with FK bloodDonationCenterID inside of *Blood_Donation_Inventories*

- **Blood_Banks:** List of blood banks across the country
  - bloodBankID:INT, auto_increment, unique, not NULL, PK
  - bloodDonationInventoryID:INT, unique, not NULL FK
  - bloodDonationCenterID:INT, unique, not NULL FK
  - bloodBagID:INT, unique, not Null, FK
  - bloodBankName:VARCHAR(155), not NULL
  - bloodBankAdress:VARCHAR(155), not NULL
  - bloodBankPhoneNumber:VARCHAR(25), unique, not NULL

  Relationship : M:M relationship between *Blood_Banks* and *Blood_Donation_Centers* implemented with *Blood_Donation_Centers_Blood_Banks_Intersection* table

  Relationship 2: M:1 relationship between *Blood_Banks* and *Blood_Donation_Inventories* implemented with FK bloodBankID inside of *Blood_Donation_Inventories*

  Relationship 3: 1:1 relationship between *Blood_Banks* and *Blood_Bags* implemented with FK bloodBagID inside of *Blood_Banks*

  Relationship 4 M:M relationship between *Blood_Banks* and *Hospitals* implemented with *Blood_Banks_Hospitals_Intersection* table

- **Blood_Donors:** List of blood donors
  - bloodDonorID:INT, auto_increment, unique, not NULL, PK
  - donorGender:VARCHAR(15), not NULL
  - donorLastName:VARCHAR(55), not NULL
  - donorFirstName:VARCHAR(55), not NULL
  - donorPhoneNumber:VARCHAR(25), unique, not NULL
  - donorAddress:VARCHAR(155), not NULL
  - donorEmail:VARCHAR(55), not NULL
  - donorBloodGroup:VARCHAR(5), not NULL
  - donorDOB:DATE, not NULL
  - donorLastDonationDate:DATE, not NULL

    - donorBloodComponent:VARCHAR(15), not NULL
    - donationMethod:VARCHAR(55), not NULL

  Relationship 1: 1:M relationship between *Blood_Donors* and *Blood_Bags* implemented with FK bloodDonorID in *Blood*_Bags

- **Blood_Recipients:** List of blood recipients
    - bloodRecipientID:INT, auto_increment, unique, not NULL, PK
    - bloodBagID:INT, unique, not Null, FK
    - recipientLastName:VARCHAR(55), not NULL
    - recipientFirstName:VARCHAR(55), not NULL
    - bloodComponentTransfused:VARCHAR(15), not NULL
    - recipientBloodGroup:VARCHAR(5), not NULL
    - recipientPhoneNumber:VARCHAR(25), unique, not NULL
    - recipientEmail:VARCHAR(55), not NULL
    - recipientAddress:VARCHAR(155), not NULL
    - recipientDiagnosis:TEXT, not NULL
    - recipientDOB:DATE, not NULL
    - recipientLastTransfusionDate:DATE, not NULL

  Relationship 1: 1:M relationship between *Blood_Recipients* and *Blood_Bags* implemented with FK bloodBag in *Blood_Recipients*

- **Blood_Donation_Inventories:** List of current donation inventory
    - bloodDonationInventoryID:INT, unique, not NULL, PK
    - bloodBagID:INT, unique, not Null, FK
    - bloodDonationCenterID:INT, unique, not NULL FK
    - bloodBankID:INT, unique, not NULL FK

  Relationship 1: 1:1 relationship with *Blood_Donation_Inventories* and *Blood_Bags* implemented with FK bloodBagID in *Blood_Donation_Inventories*

  Relationship 2: M:1 relationship with *Blood_Donation_Centers* and *Blood_Donation_Inventories* implemented with FK bloodDonationCenterID in *Blood_Donation_Inventories*

  Relationship 3: 1:M relationship with *Blood_Donation_Inventories* and *Blood_Bank* implemented with FK bloodBankID in *Blood_Donation_Inventories*

- **Hospitals:** List of hospitals
    - hospitalID:INT, auto_increment, unique, not NULL, PK
    - bloodBankID:INT, unique, not NULL FK
    - bloodRecipientID INT, not NULL FK
    - hospitalName:VARCHAR(155), not NULL
    - hospitalAddress:VARCHAR(155), not NULL
    - hospitalPhoneNumber:VARCHAR(25), not NULL

    - hospitalPrimaryContactName:VARCHAR(55), not NULL
    - hospitalLicenseNumber:VARCHAR(25), not NULL

  Relationship 1: M:M relationship between *Hospitals* and *Blood_Banks* implemented with with *Blood_Banks_Hospitals_Intersection* table

  Relationship 2: M:1 relationship between *Blood_Recipients* and *Hospitals* implemented with FK bloodRedipientID inside *Hospitals*

- **Blood Bags:** List of donated blood bags
    - bloodBagID:INT, auto_increment, unique, not NULL, PK
    - bloodDonorID:INT, unique, not NULL FK
    - bloodGroup:VARCHAR(5), not NULL
    - bloodComponent:VARCHAR(12), not NULL
    - hbCount:VARCHAR(12), not NULL
    - unitsReceived:INT, not NULL
    - donationDate:DATE, not NULL

Relationship 1: M:1 relationship between *Blood_Bags* and *Blood_Donors* implemented with FK donorID in *Blood_Bags*

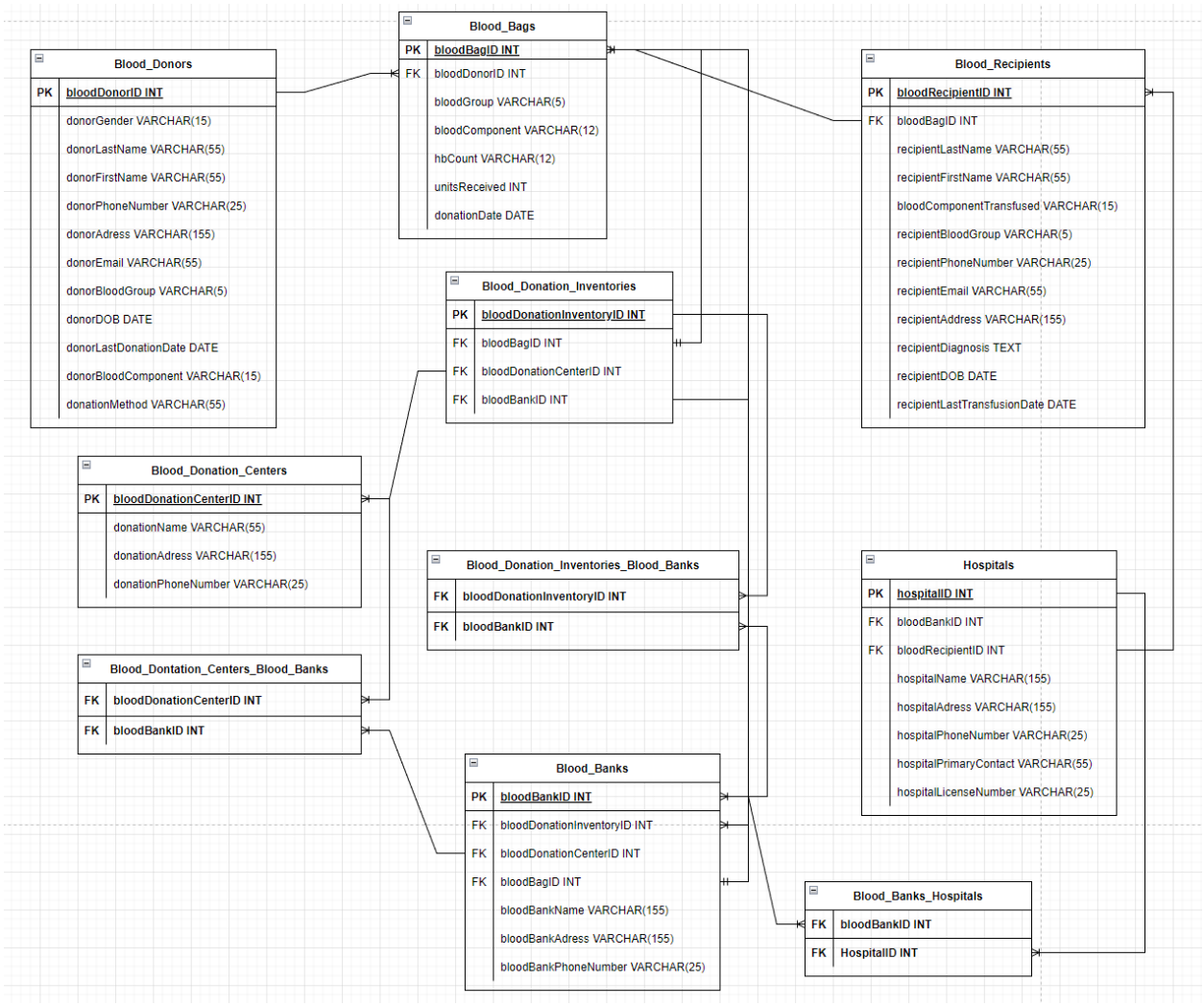
Relationship 2: M:1 relationship between *Blood_Bags* and *Blood_Recipients* implemented with FK bloodBagID in *Blood_Recipients*

Relationship 3: 1:M relationship between *Blood_Bags* and *Blood_Banks* implemented with FK bloodBagID in *Blood_Banks*

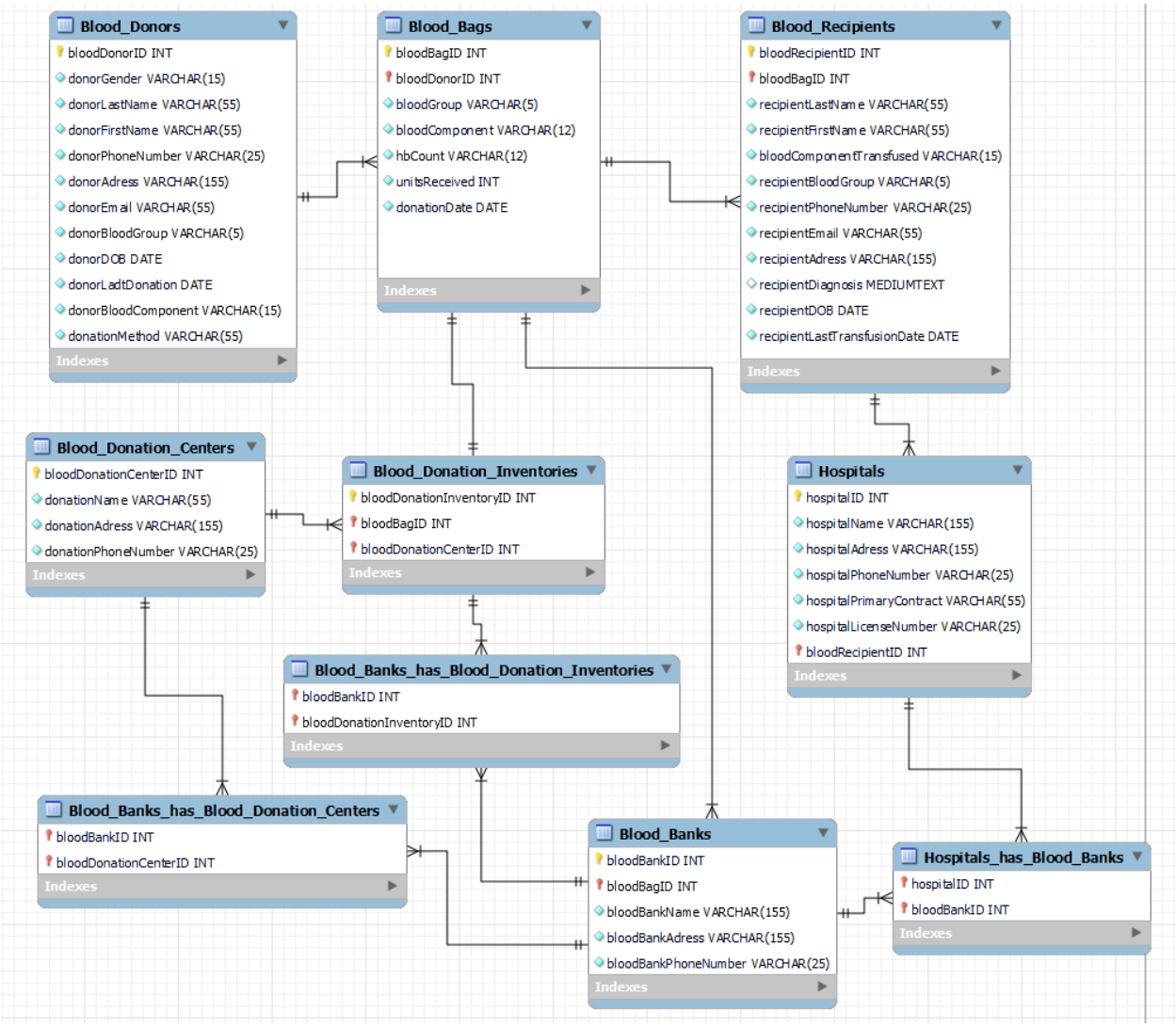
Relationship 4: 1:1 relationship between *Blood_Bags* and *Blood_Donation_Inventories* implemented with FK bloodBagID in *Blood_Donation_Inventories*

3. Entity-Relationship Diagram

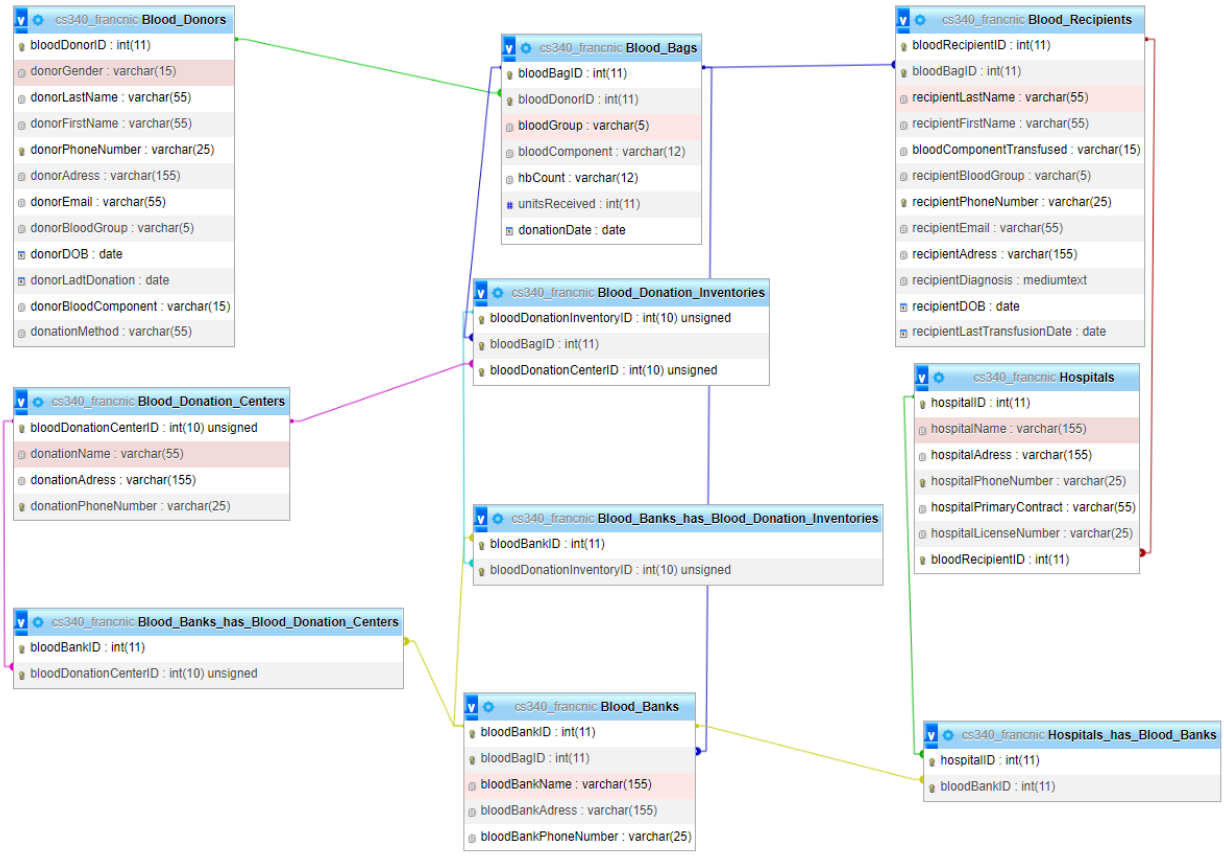
Draw.io



MySQL Workbench



Schema



Example Data

Blood_Bags

bloodBagID	bloodDonorID	bloodGroup	bloodComponent	hbCount	unitsReceived	donationDate
1	1	A-	Red	150	500	2022-01-02
2	2	O+	Plasma	142	500	2022-07-04
3	3	AB-	White	138	500	2022-03-15
NULL	NULL	NULL	NULL	NULL	NULL	NULL

Blood_Banks

bloodBankID	bloodBagID	bloodBankName	bloodBankAdress	bloodBankPhoneNumber
1	1	Seattle Blood Bank	4650 Tolt Ave Seattle, WA	4255490054
2	2	Pacific Northwest Blood Bank	17460 NE 67th Ct Seattle, WA	2067894154
3	3	Portland Blood Bank	206 Central Way Portland, OR	5128278002
NULL	NULL	NULL	NULL	

Blood_Donation_Centers

bloodDonationCenterID	donationName	donationAdress	donationPhoneNumber
1	Seattle Blood Donation	1081 Main St Seattle, WA	2062145545
2	Lynnwood Blood Donation	202 21st Pl W Lynnwood, WA	2516481212
3	Portland Blood DOnation	4151 River Way Portland, OR	4142543127
NULL	NULL	NULL	NULL

Blood_Donation_Inventories

bloodDonationInventoryID	bloodBagID	bloodDonationCenterID
1	1	1
2	2	2
3	3	3
NULL	NULL	NULL

Blood_Donors

bloodDonorID	donorGender	donorLastName	donorFirstName	donorPhoneNumber	donorAdress	donorEmail	donorBloodGroup	donorDOB	donorLadtDonation	donorBloodComponent	donationMethod
1	Male	Smith	John	8005551234	12345 55t Stre...	john.smith@gmail.com	A-	1990-02-12	2022-07-02	Red	Whole
2	Female	Williams	Jane	8005551212	1274 2nd Stree...	jane.williams@gmail.com	O+	1988-06-14	2022-07-04	Plasma	Plasma
3	Male	Miller	Nick	5418469824	1253 Pl W Los A...	nick.miller@gmail.com	AB-	1995-12-15	2022-01-25	White	Whole
NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL

Bloor_Recipients

bloodRecipientID	bloodBagID	recipientLastName	recipientFirstName	bloodComponentTransfused	recipientBloodGroup	recipientPhoneNumber	recipientEmail	recipientAdress	recipientDiagnosis	recipientDOB	recipientLastTransfusionDate
1	1	Davis	Scott	Red	A-	7843394510	scott.davis...	1123 53rd Pl E...	High Blood Pressure	1984-05-20	2022-07-08
2	2	Anderson	Kelly	Plasma	O+	2214683064	kelly.anders...	5412 122nd R...	None	1992-10-14	2022-07-10
3	3	Hernandez	Paul	White	AB-	5542143694	paul.hernan...	3518 1st Stree...	Diabetes	1985-09-12	2022-06-01
NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL

Hospitals

hospitalID	hospitalName	hospitalAdress	hospitalPhoneNumber	hospitalPrimaryContract	hospitalLicenseNumber	bloodRecipientID
1	Seattle Hosp...	32185 Sr 20 # 5 Seattle, WA	3606759884	Johnathan Brown	4515412	1
2	Snohomish H...	535 Bates St SW Snohomish, WA	3607544165	Jessica Green	8745215	2
3	Everett Hos...	7531 W 22nd Ave Everett, WA	2069451941	Michael Morar	1246184	3
NULL	NULL	NULL	NULL	NULL	NULL	