

BLOOD PLASMA BANK MODEL FOR COVID-19

Team: Quirky Queries

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1. After mapping ER to relational model

- All entities and their attributes with corresponding data types have been listed
- References between entities have been formed
- Multivalued attributes (skills from staff; allergies from patient) have been put into separate tables and referenced accordingly
- Supply as a quaternary relationship and Works_for as a binary relationship with cardinality ratio of M:N have been identified as relations in the model
- Key attribute of superclasses have been added as foreign keys to subclasses for the reference (superclass-user subclasses-donor,staff,hospital; superclass-department subclasses-plasma inventory,logistics)
- Key attribute of owner entity added as a part of the partial key of the weak entity (Hospital Id added to patient and staff id added to dependent)

2. Relational model after conversion to 1NF

No need as our initial model satisfies the following criteria enforced by 1NF :

- a. Elimination of repeating groups in individual tables(relations)
- b. Creation of a separate table for each set of related data
- c. Identifying each set of related data with a primary key.

This automatically implies no column(attribute) should have multiple values.

3. Relational model after conversion to 2NF

A relation is said to be in 2NF if it is in 1NF and every non-prime attribute of the relation is dependent on the whole of every candidate key. In the previous model, the “Plasma” table violates 2NF because:

- The attribute “blood_type” is functionally dependent on the attribute “donor_id”.
- “blood_type” is not a part of a candidate key so it is a non-prime attribute.
- “donor_id” is a subset of candidate key {donor_id, donation_date, sample_no}
- Therefore “blood_type” is a non-prime attribute of the relation that is functionally dependent on a part of a candidate key.

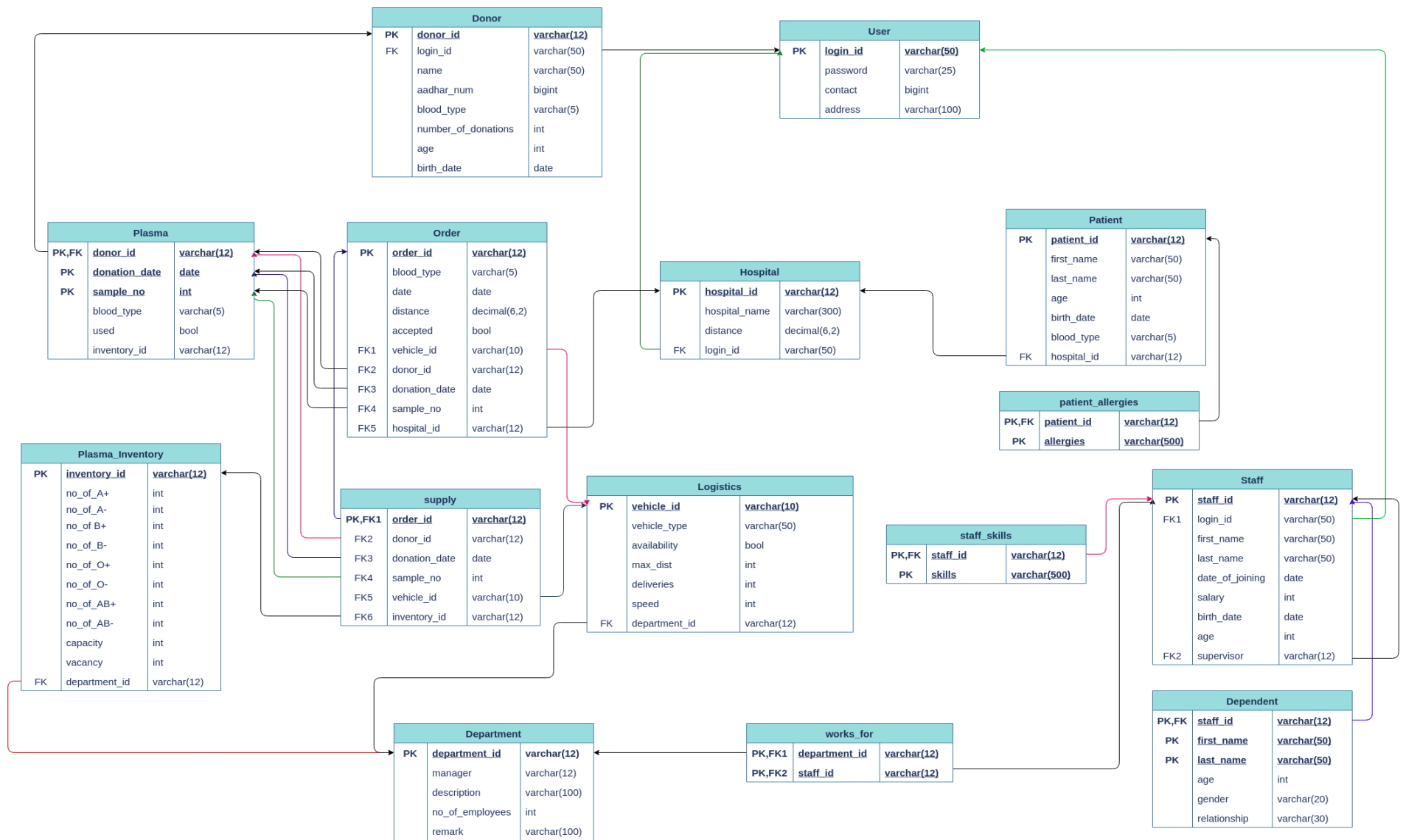
To conform to 2NF, usual practice would be to create another relation that stores donor_id as primary key, blood_type as non-prime attribute and then remove “blood_type” from Plasma. However in our case, this table would be redundant as this information is already stored in the “Donor” table. Hence we simply remove blood_type from the relation “Plasma”.

4. Relational model after conversion to 3NF

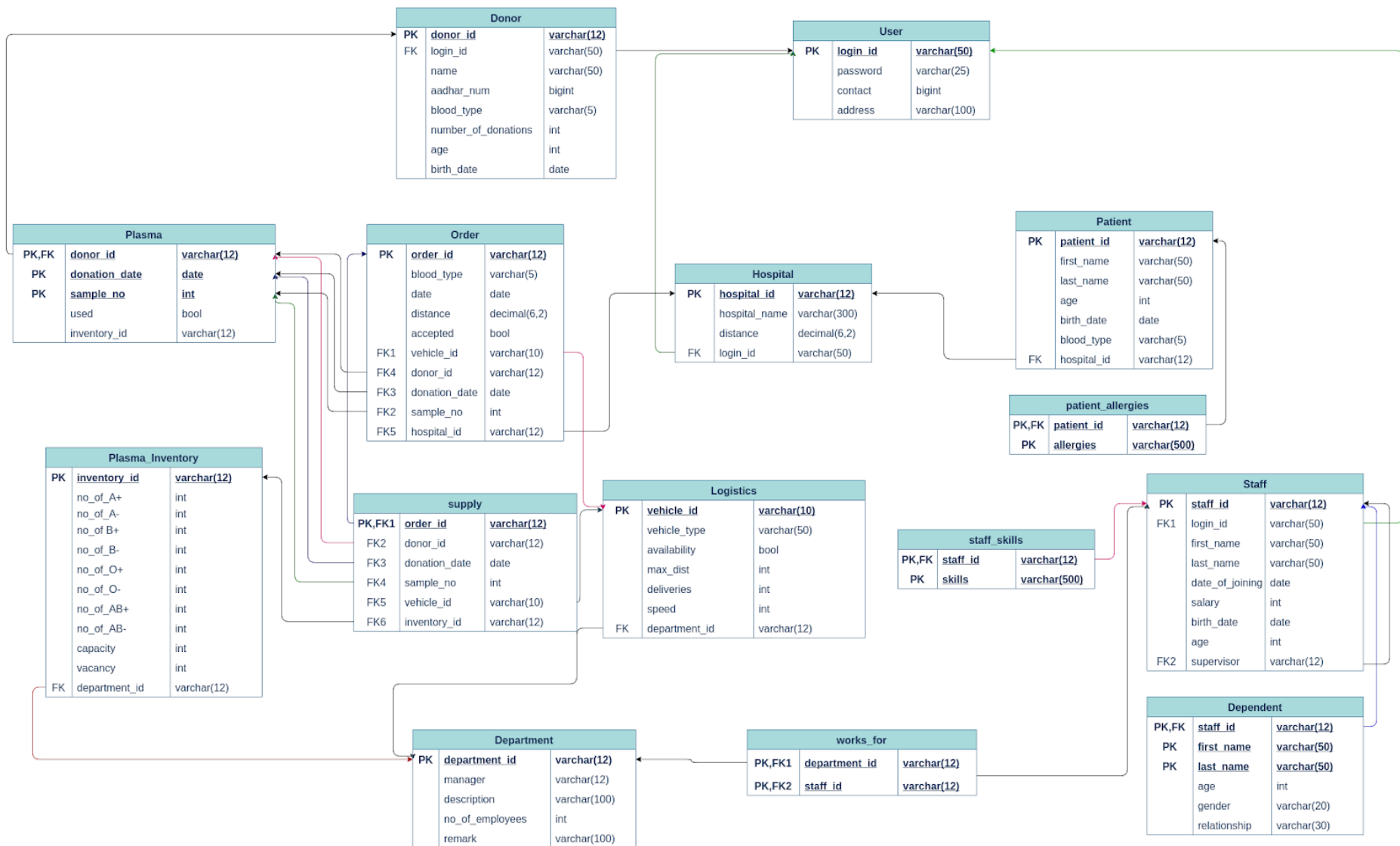
A relation is said to be 3NF if it is in 1NF and 2NF, and when there are no transitive functional dependencies of non-prime attributes on candidate keys. The previous model violated it in Logistics relation because:

- Speed depends only on vehicle_type
- Max_dist depends only on vehicle_type
- Vehicle_type depends on vehicle_id (primary key)

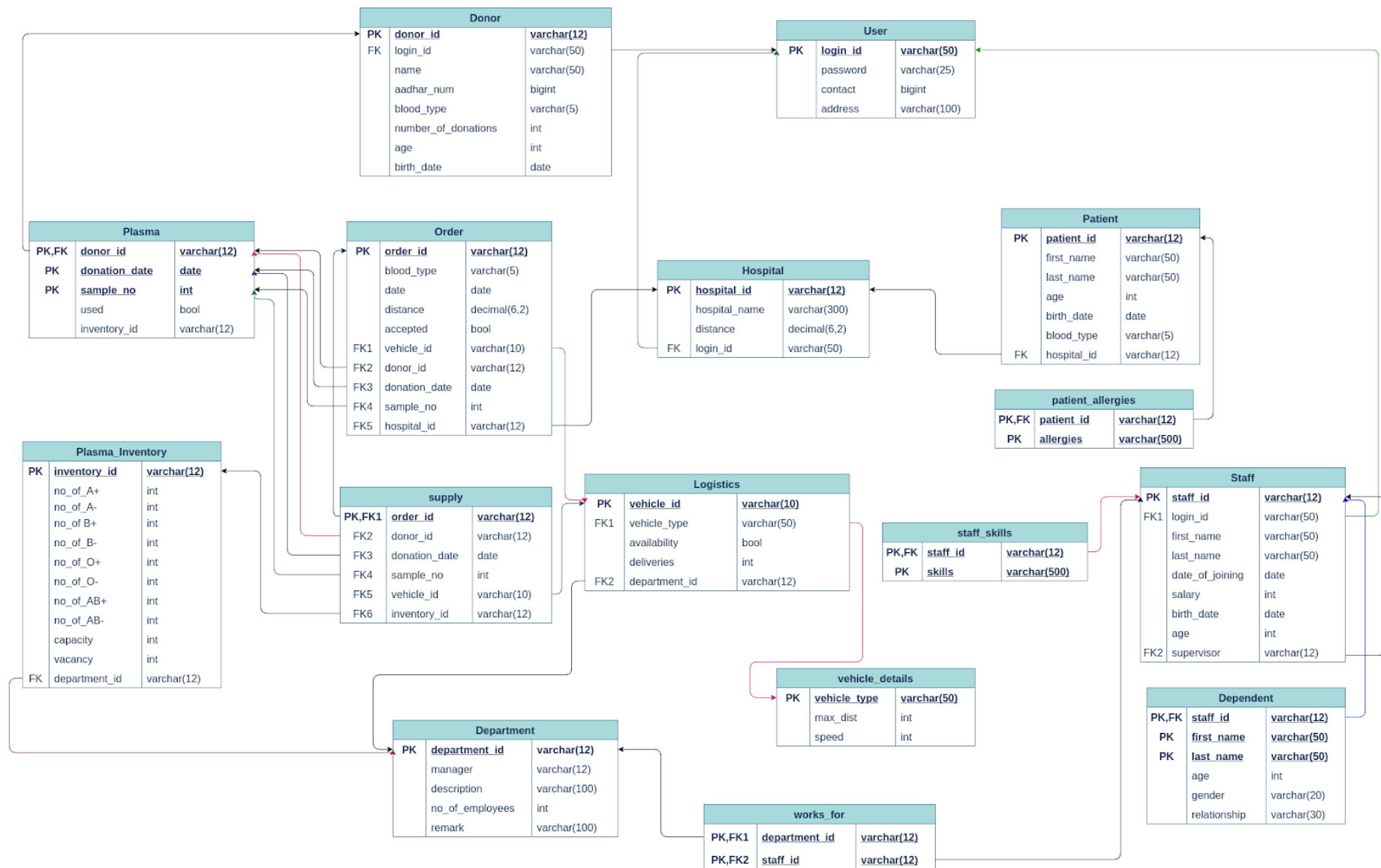
Therefore to conform to 3NF, vehicle_type, speed and max_dist values have been stored in a separate table; and we remove speed and max_dist as attributes from Logistics



Relational model after conversion



Relational model after conversion to 2NF



Relational model after conversion to 3NF