Step 2.) Project Specifications

We begin our domain analysis by listing all items one can access from their local library

Entity set 1: Library (Accessible) Items

We will design an entity set for all the items one can access at the library, the following would be the attributes for this entity set:

- Item Name (Primary key)
- Items count
- Item Category

Entity set 2: Library Events

We will design an entity set for all the events hosted by a library, these include:

- Event Name (Primary key)
- Event Date
- Min age
- Max age
- Num registered

Entity set 3: Borrowed

We will design an entity set for when a person borrows an item from the library:

- Date borrowed
- Due date
- Fine
- Name of book/item borrowed (primary key)
- Extension for the item borrowed

Entity set 4: User ID
We will design an entity set that will allow library personnel to identify what items a borrower has borrowed recently.

- First name
- Last name
- Phone Number
- Date of Birth
- Card Number (primary key)
- Home Address

Entity set 5: Library Catalogue
We will design an entity set for keeping track of all future items a library can offer, these include books/dvd's/magazines that the library has requested for purchase or order.

- New Item name (primary key)
- Item category/genre
- Expected date of arrival
- Date of item order

Entity set 6: items on Hold
We will design an entity set for keeping track of what items users have put on hold.

- Item name (primary key)
- Waitlist position
- Item category
- Pickup date
- Branch Name

Entity set 7: Branch
We will design an entity set for keeping track of all branches of libraries in some common area.

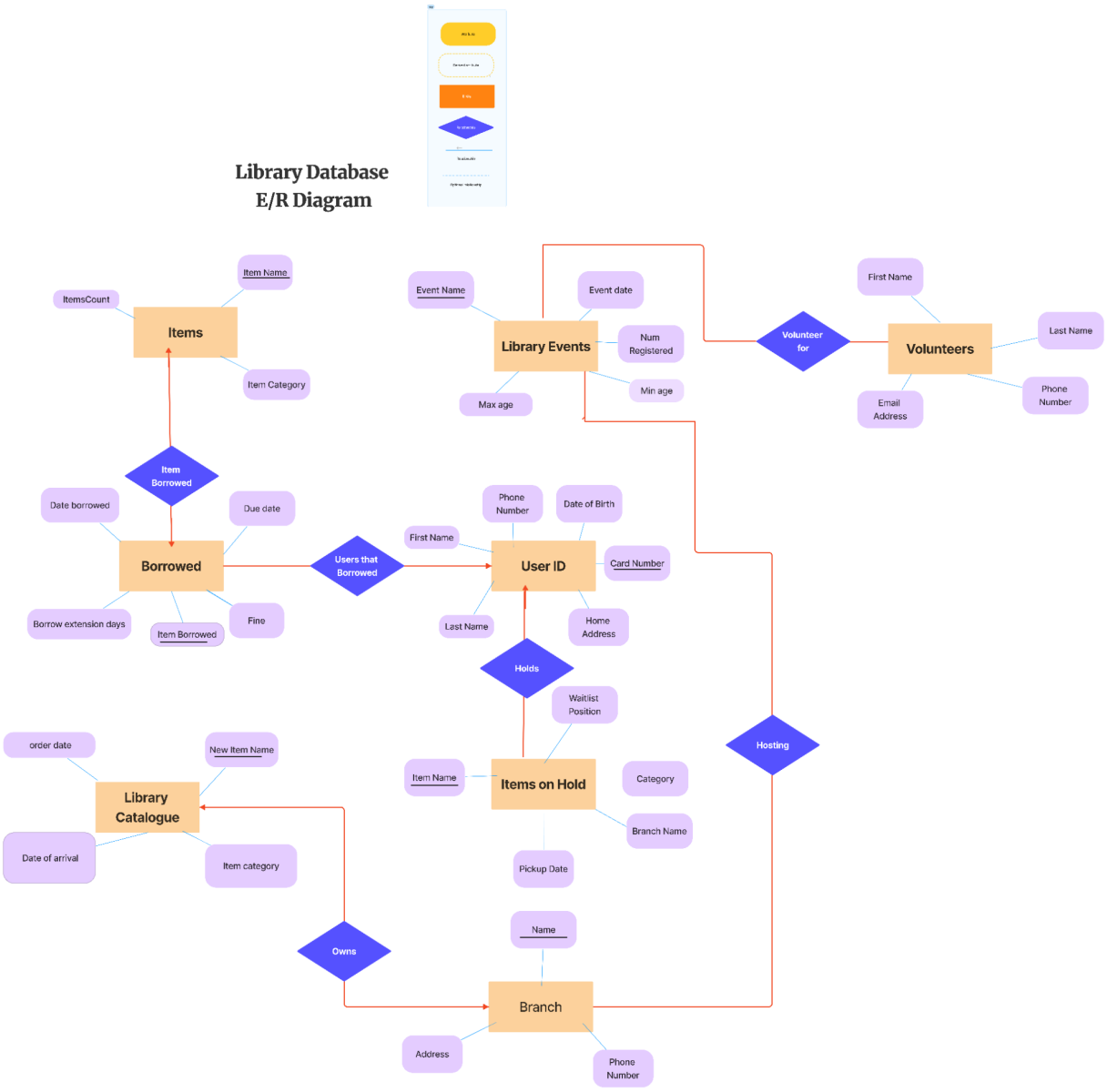
- Branch name (primary key)
- Branch address
- Phone number

Entity set 8: Volunteers
We will design an entity set for keeping track of volunteer information such as first and last name, phone number, and email so that volunteers can participate in library events.

- First Name
- Last Name
- Phone Number
- Email address

Possible Relationships:
- User ID and borrowed
- User ID and items on Hold
- Branch to Library Events
- Branch to Library Catalog
- Library items to Borrowed.
- Volunteers to Library Events

Step 3) E/R Diagram



Step 4) Anomalies

Relation 1: Items

- Item Name -> Item Category
- Item Name -> Item Count

Relation 2: Library events

- Event Name -> Event Date
- Event Name -> Min Age
- Event Name -> Max Age
- Event Name -> Num Registered

Relation 3: Borrowed

- Name -> Date borrowed
- Name -> Fine
- Name -> Borrow Extension
- Name -> Due date

Relation 4: UserID

- Cardnumber -> firstname
- Cardnumber -> lastname
- Cardnumebr -> address
- Cardnumber -> phonenumber
- Cardnumber -> dateofbirth

Relation 5: Library Catalogue

- New item -> item category
- New item -> date of arrival
- New item -> Order Date

Relation 6: Items on Hold

- Item name -> Waitlist Position
- Item name -> Pickup date
- Item name -> Category
- Waitlist position -> Pickup date

Relation 7: Branch

- Name -> Address
- Name -> Phone number

Relation 8: Volunteers

- No functional dependencies in this relation because there are no two attributes that can determine each other.
- No 2 items are related to each other.

For each of the relations above, once we listed out the functional dependencies apparent from the attributes we mentioned, we noticed there were no bad functional dependencies that would disprove BCNF in relations 1,2, 3,4,5,7, and 8.

Consider relation 1: Items

- ItemName is a primary key in this relation, and from our listed functional dependencies, it is able to functionally determine each of the other attributes
- This satisfies the definition of BCNF

Consider relation 2: Library Events

- EventName is a primary key in this relation, and from our listed functional dependencies, it is able to functionally determine each of the other attributes
- This satisfies the definition of BCNF

Consider relation 3: Borrowed

- Notice that for this relation, Name is able to functionally determine each of the other attributes. Therefore name is a key and this relation is in BCNF.

Consider relation 4:User ID

- CardNumber is a primary key in this relation, and from our listed functional dependencies, it is able to functionally determine each of the other attributes
- This satisfies the definition of BCNF

Consider relation 5:Library Catalogue

- NewItem is a primary key in this relation, and from our listed functional dependencies, it is able to functionally determine each of the other attributes
- This satisfies the definition of BCNF

Consider relation 7: Branch

- Name is the only attribute on the LHS of each FD listed.
- Notice that it is able to functionally determine each of the other attributes.

- Therefore, this relation is in BCNF.

Consider relation 8: Volunteers

- Notice there are no listed FDs for this relation. This is because each of the attributes are distinctly independent of all the other attributes. Due to no FDs present in the relation, there would be no update or deletion anomalies.
- Therefore, trivially this relation is in BCNF.

Relation 6 is not in BCNF because the first FD violates the condition (it cannot determine item name and category), the following is the work we have shown to decompose R6 into BCNF: