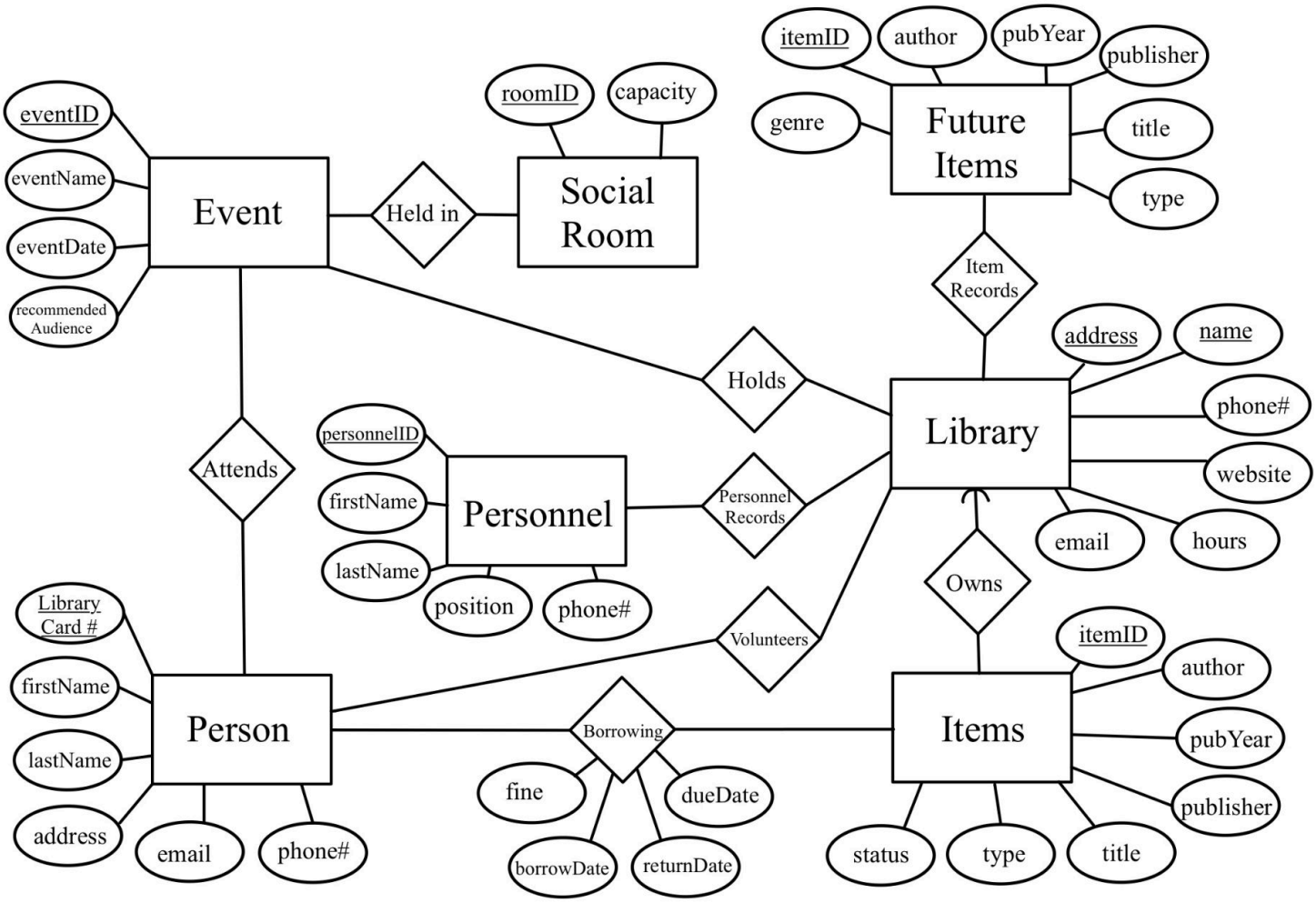
Step (2): Project Specifications

1. Person = {libraryCardNumber, firstName, lastName, email, address, phoneNumber}
2. Library = {libraryName, address, phoneNumber, email, website, hours}
3. Item = {itemID, title, type, publicationYear, authorName, publisherName, status}
4. futureItem= {futureItemID, title, type, publicationYear, authorName, publisherName}
5. Event = {eventID, eventName, eventDate , recommendedAudience}
6. Personnel = {personnelID , firstName, lastName, position, phoneNumber}
7. SocialRoom = {roomID , capacity }
8. Borrowing = {libraryCardNumber$^{FK\text{-}Person}$, itemID$^{FK\text{-}Item}$, dueDate, returnDate, fine}
9. heldIn = {eventID$^{FK\text{-}Event}$, roomID$^{FK\text{-}SocialRoom}$}
10. Holds = {libraryName$^{FK\text{-}Library}$, libraryAddress$^{FK\text{-}Library}$, eventID$^{FK\text{-}Event}$}
11. Attends = {libraryCardNumber $^{FK\text{-}Person}$, eventID$^{FK\text{-}Event}$ }
12. Owns = {itemID$^{FK\text{-}Item}$, libraryName$^{FK\text{-}Library}$, libraryAddress$^{FK\text{-}Library}$}
13. personnelRecords = {libraryName$^{FK\text{-}Library}$, address$^{FK\text{-}Library}$, personnelID$^{FK\text{-}Personnel}$}
14. itemRecords = {libraryName$^{FK\text{-}Library}$, address$^{FK\text{-}Library}$, itemID$^{FK\text{-}futureItems}$}
15. volunteers = {libraryName$^{FK\text{-}Library}$, address$^{FK\text{-}Library}$, libraryCardNumber $^{FK\text{-}Person}$}
16. heldIn = {eventID$^{FK\text{-}Event}$, roomID$^{FK\text{-}SocialRoom}$}
17. Holds = {libraryName$^{FK\text{-}Library}$, libraryAddress$^{FK\text{-}Library}$, eventID$^{FK\text{-}Event}$}
18. Attends = {libraryCardNumber $^{FK\text{-}Person}$, eventID$^{FK\text{-}Event}$ }
19. Owns = {itemID$^{FK\text{-}Item}$, libraryName$^{FK\text{-}Library}$, libraryAddress$^{FK\text{-}Library}$}
20. personnelRecords = {libraryName$^{FK\text{-}Library}$, address$^{FK\text{-}Library}$, personnelID$^{FK\text{-}Personnel}$}
21. itemRecords = {libraryName$^{FK\text{-}Library}$, address$^{FK\text{-}Library}$, itemID$^{FK\text{-}futureItems}$}

Step (3): E/R Diagrams



Step (4): Does your design allow anomalies?

To prove our relation is in BCNF, we must show that for every non-trivial functional dependency X → Y in the relation, X is a key:

1. **libraryCardNumber → firstName, lastName, email, address, phoneNumber**

   Since every person is assigned a unique library card number, libraryCardNumber is a key for the Person relation, as no two tuples can have the same libraryCardNumber.

2. **libraryName, address → phoneNumber, email, website, hours**

   Since no two libraries share the same name and address simultaneously, {libraryName, address} is a key for the Library relation, as no two tuples can share the same libraryName and address attributes.

3. **itemID → title, type, publicationYear, authorName, publisherName, status**

   Since each library item is assigned a unique ID, itemID is a key for the Item relation, as no two tuples can have the same itemID value.

4. **futureItemID → title, type, publicationYear, authorName, publisherName**

   Since each future library item is assigned a unique ID, futureItemID is a key for the futureItem relation, as no two tuples can have the same futureItemID value.

5. **eventID → eventName, eventDate, recommendedAudience**

   Since each event is assigned a unique eventID, eventID is a key for the Event relation, as no two tuples can have the same eventID value.

6. **personnelID → firstName, lastName, position, phoneNumber**

   Since each personnel member has a unique personnelID, personnelID is a key for the Personnel relation, as no two tuples can have the same personnelID value.

7. **roomID → capacity**

   Since each room has a unique roomID, roomID is a key for the Personnel relation, as no two tuples can have the same roomID value.

8. **libraryCardNumber$^{FK\text{-}Person}$, itemID$^{FK\text{-}Item}$ → dueDate, returnDate, fine**

   Since no two people can have the same libraryCardNumber, and no two items have the same itemID, {libraryCardNumber$^{FK\text{-}Person}$, itemID$^{FK\text{-}Item}$} is a key for the Borrowing relation, as no two tuples can have the values for {libraryCardNumber$^{FK\text{-}Person}$, itemID$^{FK\text{-}Item}$}.

Since all our FDs are in BCNF, and there are no bad FDs in the relation as X is a key for every functional dependency X → Y in our relation, our design does not allow for anomalies.