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Public Library Catalog System

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Project Description

As both a student and someone who feels strongly about the accessibility of information I believe that libraries are invaluable resources that can help educate us and provide us with various resources that can make a difference in our lives. I am a library worker and have been working at my local library for the past 3 years and over time I've seen the impact the resources we've provided the community has made. Having had experience for such a long time with my local library system I've seen the capabilities and the limitations the library can have which is why I intend to create a database that can address these. With any publicly available resource, there come issues when it grows in scale, specifically with the library it can lead to the mismanagement of items and user information that can negatively impact both the library and patrons alike. The most common issue I've seen is items appearing on patrons' accounts even after they've been checked in, deleted, and sometimes even paid for if they were fined. This leads to many difficult conversations and has led to these patrons no longer using the library. The unfortunate aspect is that it affects low-income patrons, teachers, and mostly children granted their Library card.

To address these issues I'd like to design my database to diversify the types of accounts available to users, rather than having a singular account classification. There should be many depending on the situation. Currently, a lot of libraries offer welcome cards which are available to any Patron so long as they can provide contact information but have limitations placed on them for the same reason that they lack other information that can verify their identity if and when they need to be contacted. I am similarly adapting this by having specific types of accounts based on age, use, institutional affiliation, and personal circumstances. This will be a vast improvement upon the pre-existing Library systems Foundation-wide since most children will

have the same accessibility as adults and even institutional cards for teachers even though they should have limitations based on them to protect them and their families from having to pay needless fines. Personal circumstances can also be a factor in the way people use libraries because not everyone will have a stable housing situation or the means to come to the library physically which by having as a consideration will increase the accessibility of library resources. By creating this database in the manner described it can then be adapted to any County library system meaning that interlibrary loans will be much easier to manage and will make it possible for patrons to check out and return materials regardless of their registration within that County so long as they have some form of library affiliation.

As of right now, the two most commonly used services within Library systems are Carl X for internal transactions and Millennium which is now being phased out by Sierra for external transactions. Due to these Services being split up, it can cause various issues when it comes to interlibrary loans from one County to another leading to patrons being fined massive amounts for something that is potentially an error due to the software. The other issue is that because these software Solutions rely on Library systems having an already established database they often carry over outdated information which can sometimes result in decades-old transactions still appearing on someone's account. Using my database will allow software solutions such as Sierra and Carl X to work together seamlessly without any information you need to input manually or any conflicts due to potential differences in classifications and data fields.

Lastly, when thinking of use cases for the database the following three were the ones I had in mind to effectively display the use of the database model. Teachers placing holds and checking items out will be able to have priority for item holds, and extended loan periods, and the responsibility for the items will be on their institution. Children will have most of the same

access as a full-service card but their cards will be linked to that of their parents to ensure parents are aware of any issues such as fines, and items returned will be removed from their accounts immediately and placed onto a library review account to prevent potential mistakes. Adult patrons will be able to decide on the type of card they would like to sign up for based on their use and or circumstances, welcome cards in the form of E-Cards will be given. These only allow for the use of computers in the library and for patrons to access all online and digital materials and resources, and full-service cards will be given the same access but will also be able to check out items in person but without the restrictions of a welcome and child account.

Functional Requirements

1. Public Library
 - i. Shall have libraryId of Admin
 - ii. Must have a County Name
 - iii. Must have only one Library Address
 - iv. Shall have many branches
 - v. Shall have one and only E-Library
2. Library Branch
 - i. Shall have unique libraryId
 - ii. Shall have many Patrons
 - iii. Must have only one Library Address
 - iv. Shall have many Items
 - v. Shall have many transactions
3. E-Library
 - i. Shall have libraryId of Virtual
 - ii. Must have only one Library Address shared with Public Library
 - iii. Shall have many Patrons
 - iv. Shall have many Digital Items
 - v. Shall have many transactions

Patrons

4. Patron
 - i. Shall have a Library Card Number
 - ii. Must have a Library Card Type
 - iii. Shall have access to many libraries
 - iv. Shall have access to one e-library
 - v. Must have only one email
 - vi. Can only have one account
 - vii. Can use one computer

Patron Types

5. E-Card
 - i. Can only check out many digital items
 - ii. Only has access to computer items in branch
 - iii. Must have a birthday
 - iv. Must have full name
 - v. Does not need an address
6. Child
 - i. Must have at least one parent's full-service account linked
 - ii. Can check out 10 physical items and 15 digital items
 - iii. Must have a birthday
 - iv. Must have full name
 - v. All other info derived from parent account

7. Full-Service

- i. Can have zero to many child accounts linked
- ii. Can check out 100 physical items and 50 digital items
- iii. Must have a phone number
- iv. Must have a birthday
- v. Must have full name

8. Institutional

- i. Can have an additional full-service library card linked
- ii. Can check out 250 physical items and no digital items
- iii. Must have Institutional Address
- iv. Must have full name

9. Staff

- i. Can check out 250 physical items and 50 digital items
- ii. Must have a phone number
- iii. Must have a birthday
- iv. Must have full name

Addresses

10. Address

- i. Shall have an address id
- ii. Shall have one to many users linked
- iii. Can have up to one address type
- iv. Must have Street Number
- v. Must have a Street Name
- vi. Must have City
- vii. Must have State
- viii. Must have Zipcode

Address Types

11. Apartment Address

- i. Must have a Building Number
- ii. Must have Apartment Number
- iii. Must have Phone Number Listed

12. P.O. Box Address

- i. Must have P.O. Box Number
- ii. Must have Servicer Listed
- iii. Must have Phone Number Listed

13. Institutional Address

- i. Must have School District listed
- ii. Must have School Name listed
- iii. Must have Phone Number Listed

14. Library Address

- i. Must have County Region
- ii. Must have branch ID
- iii. Must have Phone Number Listed

Items

15. Item

- i. Shall only be checked out to one patron at a time
- ii. Must have Item barcode number
- iii. Must have Call Number
- iv. Shall have zero to one Owning Library branch ID
- v. Must have Title
- vi. Shall have item type

Item Types

16. Computer

- i. Must have computer number
- ii. Shall have status of express or hourly
- iii. Must have area assigned
- iv. Shall have description (laptop or pc)

17. A/V

- i. Shall only be checked out when all materials are present
- ii. Must have a timestamp length
- iii. Must have an age rating
- iv. Must have an item count
- v. Must have a description

18. Fiction

- i. Must have at least one genre
- ii. Must have an Author
- iii. Must have an age rating
- iv. Must have a description

19. NonFiction

- i. Must have a Dewey decimal number
- ii. Must have a topic
- iii. Must have an Author
- iv. Must have an age rating

20. Archival

- i. Shall only be viewed inside the library
- ii. Must have a Dewey decimal number
- iii. Must have a topic
- iv. Must have a description

21. Periodical

- i. Current issues shall not be checked out
- ii. Must have an age rating
- iii. Must have Date
- iv. Must have Volume/Issue

22. Kit
- i. Shall only be checked out when all materials are present
 - ii. Must have an age rating
 - iii. Must have a description
 - iv. Must have an item count

23. Pass
- i. Shall only be checked out when all materials are present
 - ii. Must have a description
 - iii. Must have an item count

24. Digital Item
- i. Must have Call Number
 - ii. Must have Title
 - iii. Must have description

Transactions

25. General
- i. Must have patron Library Card Number
 - ii. Must have Transaction Type
 - iii. Must have transaction ID

Transaction Types

26. Payment
- i. Must have staff library card number
 - ii. Must have total paid
 - iii. Must have date of transaction

27. Computer Loan
- i. Must have Item Barcode Number
 - ii. Must have computer number
 - iii. Must have Item's Library branch ID

28. Holds
- i. Must have Item Barcode Number
 - ii. Must have Hold Library branch ID
 - iii. Must have Owning Library Branch ID

29. Checkout
- i. Shall have one or many Item Barcode Numbers
 - ii. Must have item count
 - iii. Have date of transaction
 - iv. Must have Checkout Library branch ID

30. Return
- i. Shall have one or many Item Barcode Numbers
 - ii. Must have item count
 - iii. Have date of transaction
 - iv. Must have Return Library branch ID

Non-Functional Requirements

1. Performance

- i. Library Transactions will be able to be performed simultaneously without conflicts and strain on the database
- ii. Requested and Held items will have status updates every day to prevent conflicting Patron Transactions
- iii. Digital Items will be separate from physical items on patron records to allow simultaneous transactions

2. Security

- i. Library card numbers are unique when created and assigned, upon the closure of an account or request for new library card old numbers are deleted and cannot be generated once more
- ii. Child account can only access account information in branch with Parent accounts being able to access information online and in branch
- iii. Accounts will be locked if library card is reported lost or stolen with a new library card number being assigned

3. Scalability

- i. Database is capability of expansion in order to account for new patrons, items, and transactions while avoiding compromising county wide performance
- ii. Data is stored locally and remotely, locally stored information is vital item, patron, and transaction information while remotely shared information is limited to allow branch level expansion without affecting other libraries
- iii. Main admin branch will be able to handle a large portion of the database in the form of transactions and general item and patron information taking a load off of the branches

4. Capability

- i. Items and Patrons are abstractions which will allow for future expansion on account types and new forms of materials
- ii. Digital Transactions such as Ebooks and Audio Books will be supported independently of in branch transactions
- iii. Account types will allow for different priority levels and capabilities to ensure patron need and circumstance is considered

5. Environmental

- i. Database will be hosted on server farm located in the main administrative branch with energy efficient design to remove the need for various large servers at each branch allowing for remote transfer and manipulation of data
- ii. In branch servers will be small raid configurations using solid state drives which can be stored in electrical room
- iii. As storage is expanded on servers old HDD's will be repurposed for archival and back up storage and be replaced with SSD's

6. Coding Standard

- i. Client Side support will be offered through the use of explicit error handling and reporting allowing staff to have accurate information on ongoing issues for them to generate work requests
- ii. Documentation and commenting will be common place and regularly updated for new and old staff to be able to work irregardless of familiarity with the database
- iii. Future Proofing will be essential and prioritized in order to make sure improvements and expansion to the database can be done without making it inaccessible county wide for a long period of time

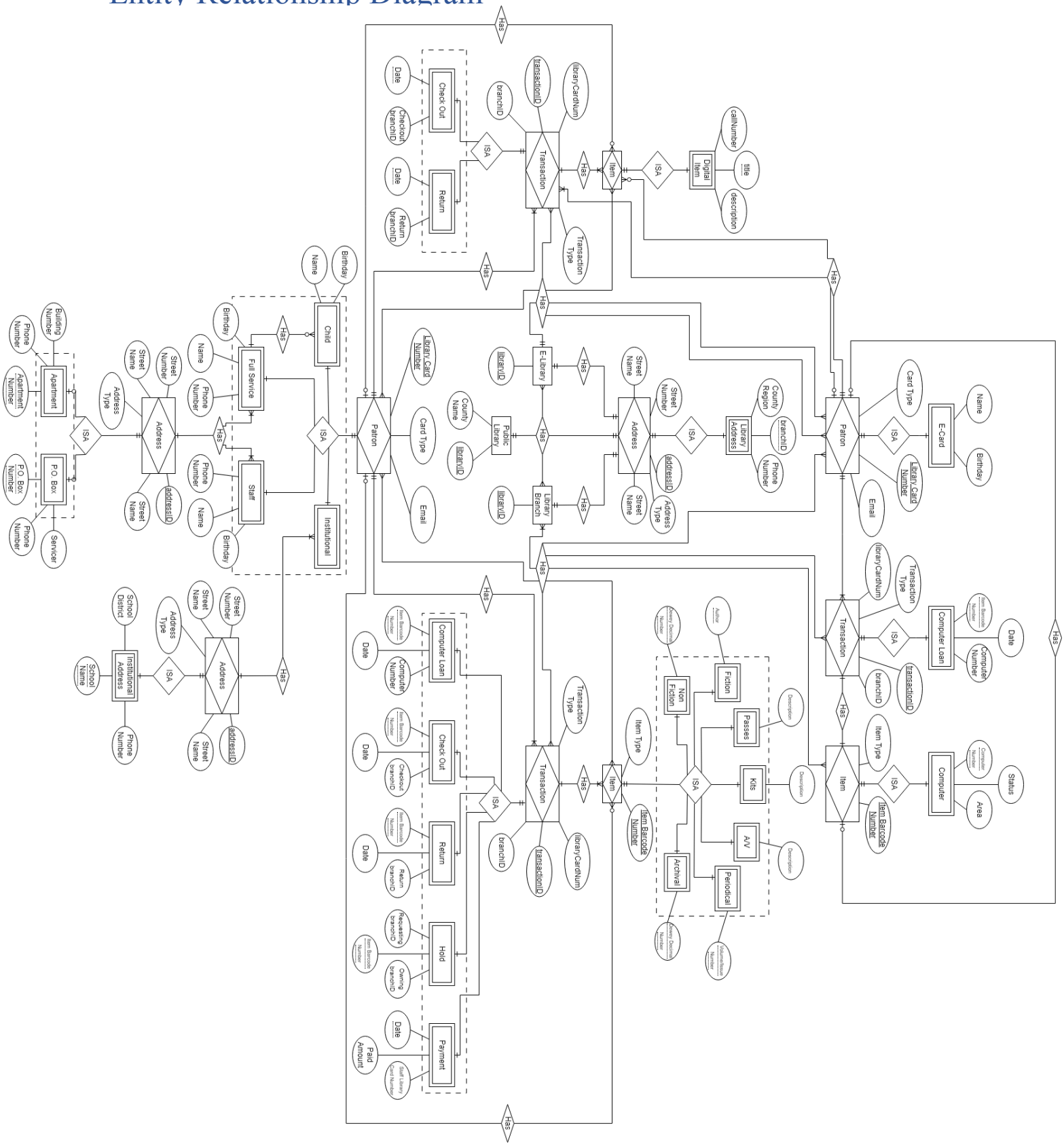
7. Storage

- i. Patron information will be stored remotely but split amongst libraries and main admin branch and provided a capacity of 10 terabytes with capability of expansion
- ii. Transaction information will be stored remotely but split amongst libraries and main admin branch and be given 2 terabytes
- iii. Item information will be stored primarily with owning branches and share limited information remotely to other branches, capacity will be based on patron count of respective library

8. Privacy

- i. Patrons can only access their accounts with their respective library card number and birthday
- ii. Patron transactions will be deleted from record upon return of items
- iii. Parent accounts can only see amount of items checked out and fines on account but cannot see item details and content matter

Entity Relationship Diagram



Entity Set Description

1. Public Library (Strong)
 - i. libraryID: numeric, primary key
 - ii. County Name: alphanumeric
 - iii. branchID: alphanumeric, unique key
 - iv. address: numeric, foreign key
 2. Library Branch (Strong)
 - i. libraryID: numeric, primary key
 - ii. branchID: alphanumeric, unique key
 - iii. address: numeric, foreign key
 - iv. is_virtual: BOOLEAN
 3. E-Library (Strong)
 - i. libraryID: numeric, primary key
 - ii. branchID: alphanumeric, unique key
 - iii. address: numeric, foreign key
 - iv. is_virtual: BOOLEAN
- Patrons
4. Patron (Strong)
 - i. library_card_number: numeric, primary key
 - ii. patronTypeID: numeric, foreign key
 - iii. email: alphanumeric, unique key (child's is derived from parent)
 - iv. address: numeric, foreign key
- Patron Types
5. E-Card (Weak)
 - i. e-cardID (typeID): numeric, primary key
 - ii. name: alphanumeric
 - iii. birthday: date
 6. Child (Weak)
 - i. childID (typeID): numeric, primary key
 - ii. parentID (parent's typeID): numeric, foreign key
 - iii. address: derived, numeric, foreign key
 - iv. first_name: alphanumeric
 - v. last_name: alphanumeric
 - vi. birthday: date
 - vii. phone_number: derived, numeric, composite and multi-value
 7. Full-Service (Weak)
 - i. patronID (typeID): numeric, primary key
 - ii. address: numeric, foreign key
 - iii. first_name: alphanumeric
 - iv. last_name: alphanumeric
 - v. birthday: date
 - vi. phone_number: numeric, composite and multi-value

8. Institutional (Weak)
- i. institutionalID (typeID): numeric, primary key
 - ii. address: numeric, foreign key
 - iii. first_name: alphanumeric
 - iv. last_name: alphanumeric
 - v. phone_number: numeric, composite and multi-value
9. Staff (Weak)
- i. staffID (typeID): numeric, primary key
 - ii. address: numeric, foreign key
 - iii. first_name: alphanumeric
 - iv. last_name: alphanumeric
 - v. birthday: date
 - vi. phone_number: numeric, composite and multi-value

Addresses

10. Address (Strong)
- i. addressID: numeric, primary key
 - ii. addressTypeID: numeric, foreign key
 - iii. street_number: numeric
 - iv. street_name: alphanumeric
 - v. city: alphanumeric
 - vi. state: alphanumeric
 - vii. zipcode: numeric

Address Types

11. Apartment Address (Weak)
- i. apartmentID (typeID): numeric, primary key
 - ii. building_number: numeric
 - iii. apartment_number: numeric
 - iv. phone_number: numeric, composite and multi-value
12. P.O. Box Address (Weak)
- i. po_boxID(typeID): numeric, primary key
 - ii. po_box_number: numeric
 - iii. servicer: alphanumeric
 - iv. phone_number: numeric, composite and multi-value
13. Institutional Address (Weak)
- i. institutionID (typeID): numeric, primary key
 - ii. school_district: alphanumeric
 - iii. school_name: alphanumeric
 - iv. phone_number: numeric, composite and multi-value
14. Library Address (Weak)
- i. libraryAddressID (typeID): numeric, primary key
 - ii. county_region: alphanumeric
 - iii. branchID: alphanumeric, foreign key
 - iv. phone_number: numeric, composite and multi-value

Items

15. Item (Strong)

- i. item_barcode_number: numeric, primary key
- ii. itemTypeID: numeric, foreign key
- iii. call_number: alphanumeric
- iv. title: alphanumeric
- v. branchID: numeric, foreign key

Item Types

16. Computer (Weak)

- i. computerID (typeID): numeric, primary key
- ii. computer_number: numeric, unique key
- iii. is_express: BOOLEAN
- iv. is_laptop: BOOLEAN
- v. area: alphanumeric
- vi. description: alphanumeric

17. A/V (Weak)

- i. avID(typeID): numeric, primary key
- ii. content_length: timestamp
- iii. age_rating: alphanumeric
- iv. item_count: numeric
- v. description: alphanumeric

18. Fiction (Weak)

- i. fictionID (typeID): numeric, primary key
- ii. genre: alphanumeric
- iii. author_first_name: alphanumeric
- iv. author_last_name: alphanumeric
- v. age_rating: alphanumeric
- vi. description: alphanumeric

19. NonFiction (Weak)

- i. nonFictionID(typeID): numeric, primary key
- ii. dewey_decimal_number: numeric
- iii. library_of_congress_classification: alphanumeric
- iv. topic: alphanumeric
- v. author_first_name: alphanumeric
- vi. author_last_name: alphanumeric
- vii. age_rating: alphanumeric

20. Archival (Weak)

- i. archivalID (typeID): numeric, primary key
- ii. dewey_decimal_number: numeric
- iii. library_of_congress_classification: alphanumeric
- iv. item_count: numeric
- v. description: alphanumeric

21. Periodical (Weak)

- i. periodicalID (typeID): numeric, primary key
- ii. publisher: alphanumeric
- iii. age_rating: alphanumeric
- iv. issue_date: date
- v. volume: numeric
- vi. issue: numeric

22. Kit (Weak)

- i. libraryAddressID (typeID): numeric, primary key
- ii. age_rating: alphanumeric
- iii. item_count: numeric
- iv. description: alphanumeric

23. Pass (Weak)

- i. libraryAddressID (typeID): numeric, primary key
- ii. item_count: numeric
- iii. description: alphanumeric

24. Digital Item (Weak)

- i. libraryAddressID (typeID): numeric, primary key
- ii. content_length: alphanumeric
- iii. description: alphanumeric

Transactions

25. Transaction (Strong)

- i. transactionID: numeric, primary key
- ii. patronCardNumber: numeric, foreign key
- iii. transactionTypeID, numeric, foreign key
- iv. transaction_branchID: numeric, foreign key
- v. description: alphanumeric

Transaction Types

26. Payment (Weak)

- i. paymentID (typeID), numeric, primary key
- ii. staffCardNumber: numeric, foreign key
- iii. item_barcode_number: numeric, foreign key
- iv. total_paid: numeric
- v. total_due: numeric
- vi. is_paid_off: BOOLEAN
- vii. date_paid: date

27. Computer Loan (Weak)

- i. loanID (typeID), numeric, primary key
- ii. item_barcode_number: numeric, foreign key
- iii. computer_number: numeric, foreign key
- iv. branchID: numeric

28. Holds (Weak)

- i. holdID (typeID), numeric, primary key
- ii. item_barcode_number: numeric, foreign key
- iii. owning_branchID: numeric, foreign key
- iv. holding_branchID: numeric, foreign key

29. Checkout (Weak)

- i. checkoutID (typeID), numeric, primary key
- ii. item_barcode_number: numeric, foreign key
- iii. checkout_branchID: numeric, foreign key
- iv. checkout_date: date
- v. item_count: numeric

30. Return (Weak)

- i. returnID (typeID), numeric, primary key
- ii. item_barcode_number: numeric, foreign key
- iii. return_branchID: numeric, foreign key
- iv. return_date: date
- v. item_count: numeric

Enhanced Entity-Relationship Diagram

Normalization Techniques Used

ORM Architecture