Additional assumptions from the logical model but not initially in assumptions made by conceptual diagram :

1) It is assumed that a borrower cannot reserve the same book until the reservation the borrower made to the book is processed .

2) It is assumed that BORROWERCLASS is a predefined lookup table to classify borrowers into several predefined borrower classes , in this case Adult , Child and Organisation.

3) It is assumed that not all managers have either first name or last name , thus the manager_first name and manager_lastname are not mandatory attributes.

4) It is assumed that not all borrowers have either first name or last name , thus the borrower_first name and borrower_lastname are not mandatory attributes.

5) It is assumed that not all authors have either first name or last name , thus the author_first name and author_lastname are not mandatory attributes.

6) It is assumed that authors are not predefined because they are embedded more with real works, that is, books, publications, and the likes. An author only materially exists when he has written something that is classified hence every author must have at least 1 AUTHOR_CATALOGUE_ENTRY.

7) It is assumed that a contact number is only needed in case when a borrower wants to make a request for getting a book on hold. In the case where a borrower wants to reserve a book but there is no phone number in the borrower's details, such details will be input into the saved borrower details in case of future use.

8) It is assumed that SUBJECT is predefined for the use of classifying CATALOGUE , thus a subject can exist initially without associated with any CATALOGUESUBJECT.
9) It is assumed that the client of the library system may need to add additional statuses for books in the future, similar to how they transitioned from conceptual requirements to the logical model requirements .
10) It is assumed that each book must have exactly one status such that no book can have no status or more than 1 status .

Reason for adding surrogate key loan_id :
loan_id is added in LOAN relation due to the fact that the current primary key of the LOAN relation consists of several attributes (for example, loan_start_datetime, book_copyid, and branch_code), it becomes rather difficult to process because several fields should be used for each reference. This also makes queries, indexing and joins less convenient particularly when other tables require to relate to this relation. As for the discussed approach of adding a surrogate key, it is a simplification of the data structure to the presence of only one key; this approach comes helpful in managing the database and querying it in the most efficient way.

Reason for adding surrogate key reservation_id :
The reservation_id is essential as a surrogate key because it simplifies referencing reservations, avoiding the complexity of using multiple fields like book_copyid,,branch_code and borrower_no as a composite key. It allows for easier querying, management, and flexibility, especially if any of the business-related attributes change. Additionally, it improves database performance by optimizing indexing and lookups through a single, unique identifier.

To ensure the validity and consistency of the logical diagram, the following assumptions are made based on the assumptions from conceptual diagram:

Assumptions Made Between LGA And BRANCH relations:
1) It is assumed that the library system only records an LGA that oversees library services in its area, so each LGA must have at least one branch.
2) It is assumed that each branch cannot exist without being associated with an LGA , each branch belongs to exactly one LGA in minimum .
3) LGAs are unique geographical or administrative areas, each of which is charged with the delivery of public services such as libraries in its jurisdiction. Thus , it is assumed that a branch can only belong to that particular LGA but not multiple LGAS.

Assumptions Made Between BRANCH And MANAGER relations:
  i) Branch - Manager Relationship:
   1) It is assumed that a manager must manage at least one branch as from the question it states that all managers are assigned one particular branch as their home branch, meaning every manager must have managed at least one branch which is their home branch.

  ii) HomeBranch relationship between BRANCH and MANAGER relations:
    1) It is assumed that a manager may manage multiple branches

      but only one of these branches will be designed as the home branch , thus there could be some branches that are not the home branch of any manager.
    2) It is assumed that once a given branch is assigned as home branch for a single manager. The same home branch cannot be registered as the home branch of other managers.

Assumption Made Between BRANCH and BOOK relations :

1) It is assumed that a branch might exist without a book initially for example a newly opened branch, meaning in minimum a branch can have 0 book.

Assumption Made For HomeBranch Relationship Between BRANCH and BORROWER relations:
1) It is assumed that a borrower can only have exactly one and only one home branch which is the branch where the borrower registered as a borrower, with maximum and minimum cardinality of 1.
2) It is assumed that a branch can have a minimum of 0 borrowers registered , meaning it is possible that a branch exists without anyone registering as a borrower at that branch.

Assumption Made For The Relationship Between BORROWER and LOAN relations:
1) It is assumed that a borrower can exist without having borrowed any book yet after registering as a borrower , so does not have any loan .

Assumption Made For Relationship Between BOOK and LOAN relations.

1) It is assumed that it is possible where a book might not being loaned out immediately as it is a newly added book to the library, so a book can have 0 loans.
2) It is assumed that it is impossible for a loan to exist without referencing a particular book copy that is being loaned out.
3) It is assumed that a loan transaction must deals with a single book copy , a loan cannot involve multiple book copies in the same loan, Each loan is referring to a single book copy.

Assumption Made For Relationship Between BOOK and ISBN relations:

1) It is assumed that every book copy must have an ISBN to identify the specific edition or format the book copy belongs to , so book copy cannot exist without an ISBN .
2) It is assumed that a book copy can have a maximum of only one ISBN because it belongs to a specific edition, meaning it cannot represent multiple editions.
3) It is assumed that it is possible for multiple copies of the same edition of a book to exist across different branches or within the same branch , thus an ISBN can be linked to multiple book copies.
4) It is assumed that an ISBN can exist without any physical copies of the book being available or purchased as the book may be on order or reserved for future acquisition.

Assumption Made For Relationship Between CATALOGUE and ISBN relations :

1) It is assumed that a catalogue cannot exist without at least one ISBN because without an ISBN, the catalogue entry wouldn't be able to track or distinguish different editions of the book, this is important for both inventory management and user access in the library system.

2) It is assumed that each ISBN is linked to one and only one catalogue entry because ISBNs reflect specific editions or versions of books, and so it is impossible that one version is catalogued two different ways. Hence, one ISBN corresponds to a single catalogue entry only.

Assumption Made For Relationship Between CATALOGUE and AUTHOR relations:

1) It is assumed that every author who is recorded in the system has written at least one book that is catalogued in the library , meaning the author must appear in at least one catalogue .

Assumption Made For Relationship Between CATALOGUE and PUBLISHER relations:

1) It is assumed that every catalogue entry must have one and only one publisher , meaning every book listed in the catalogue is published by a single publisher .
2) It is assumed that the library system only records publishers that have published at least one book that is included in the catalogue of the library , thus a publisher will have published at least one catalogue entry with minimum cardinality of 1.