[Q.1] Answer the following questions for a simple library application.

The data requirements of the library application are summarized as follows: BOOK entity is identified by BookId, it has title and multiple author names. PUBLISHER entity consists of Name, Address, and Phone attributes. Name is the key for the PUBLISHER. LIBRARY_BRANCH entity has BranchId as a key and Branchname attribute additionally. BORROWER entity has BrowserId as key and additionally has name, address, phone attributes. Each LIBRARY_BRANCH has one or more copies of the same book. In such a case, noOfCopies attribute needs to be maintained by the relationship. A book is published by only one publisher. A book can be loaned to a borrower at a specific library branch.

(a) Draw ER diagram for the conceptual schema of the library database application.
(b) Map the conceptual schema to database relations.
(c) Explain at least two referential integrity constraints.
(d) Write SQL queries for the following queries on the library database:
   a. How many copies of the book titled “Database Systems” are owned by the library branch “Lehman”?
   b. For each library branch, retrieve the name and the total number of books loaned out from the branch.
   c. For each book authored (co-authored) by “Robert Feinerman”, retrieve the title and the number of copies owned by the library branch “Lehman”.
Consider the following ER diagram for a bank conceptual database schema

(a) List the non-weak entity types in the ER diagram.
(b) Identify any weak entity type, and give its name, its partial key, and its identifying relationship and entity.
(c) Explain rule(s) that are used to map a weak entity type to a relation (table).
(d) List the names of all relationship types, and specify the cardinality constraints. Each BANK is related to one or more BANK-BRANCHES. Each BANK_BRANCH has zero or more LOANs and zero or more ACCOUNTs. Each ACCOUNT is related to exactly one BANK-BRANCH and to at least one CUSTOMER. Each LOAN is related to exactly one BANK_BRANCH and to at least to one CUSTOMER. Each CUSTOMER is related to zero or more ACCOUNTs and to zero or more LOANs.
(e) Specify the (min, max) constraint on each participation of an entity type in a relationship type. The additional (min, max) constraints are: Every customer must have at least one account but is restricted to at most two loans at a time, and that a bank branch cannot have more than 500 loans.
(f) Identify total participations in the diagram.