

1. Consider the ER diagram shown in the figure for part of a bank database. Each bank can have multiple branches and each branch can have multiple accounts and loans.
 - (a) List the non weak entity types in the ER diagram.
 - (b) Is there a weak entity type? If so, give its name, partial key and identifying relationship.
 - (c) What constraints do the partial key and the identifying relationship of the weak entity type specify in this diagram?
 - (d) List the names of all relationship types and specify the (min, max) constraint on each participation of an entity type in a relationship type. Justify your choices.
 - (e) List concisely the user requirements that led to this ER schema design.
 - (f) Suppose that 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 that 1000 loans. How does this show up on the (min, max) constraints?

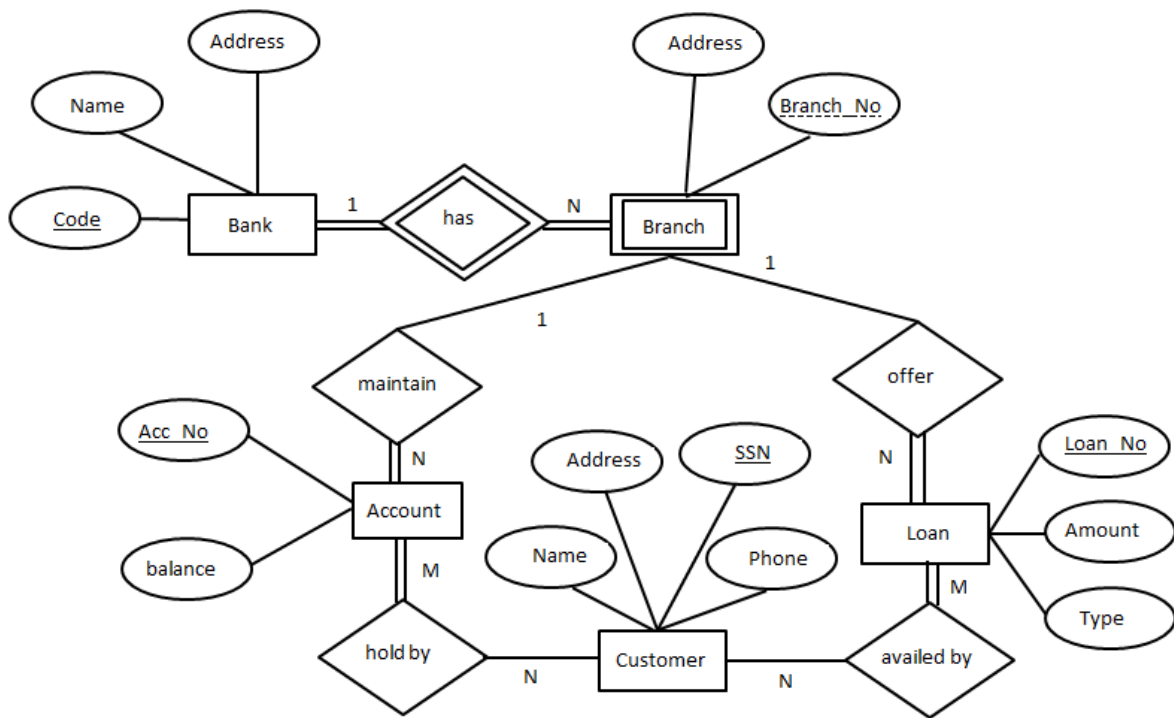
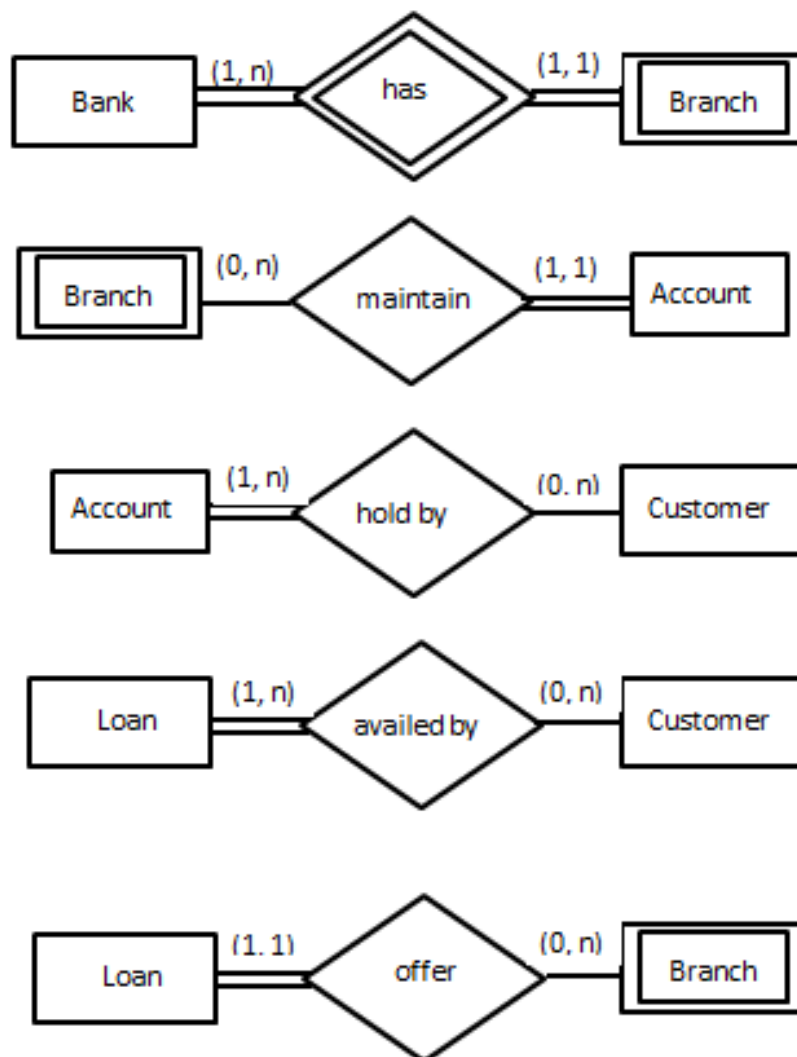


Figure 1: ER diagram of Bank database

Solution:

- (a) Non weak / Strong entity type are Bank, Account, Customer, Loan
- (b) Weak entity type are Branch,
- (i) Partial key is Branch No
 - (ii) Identifying relationship is Branch
- (c) (i) The constraint of the partial key “Branch_No” is that we need to combine “Branch_No” with “Code” (owner entity type key) to uniquely identify Bank “Branch”.
- (ii) Constraint of the identifying relationship are
- The weak entity set must have total participation in the identifying relationship set “Branch”.
 - The identifying relationship between Bank and Bank-Branch must be one-to-many.
- (d) The relationship types:



(e) Requirements can be stated as follows:

- (i) Each bank has a unique code, name and address.
- (ii) Each bank has one or more branches, each of which has a Branch number and address.
- (iii) Each bank branch has zero or more loans and zero or more accounts.
- (iv) Each account has a unique account number, type and balance. It is related to exactly one Bank-Branch and to at-least one customer.
- (v) Each loan has unique loan number, amount and type. It is also related to exactly one Bank-Branch and to at-least one customer.
- (vi) Each customer has a unique SSN, name, address and phone and is related to zero or more accounts and zero or more loans.

- (f)
- Every customer must have at-least one account.
 - A customer can have maximum of 2 loans.
 - A bank branch can give maximum of 1000 loans.

