7.23

a, Strong entity types:

- BANK
- ACCOUNT
- LOAN
- CUSTOMER

b, There is 1 weak entity types:

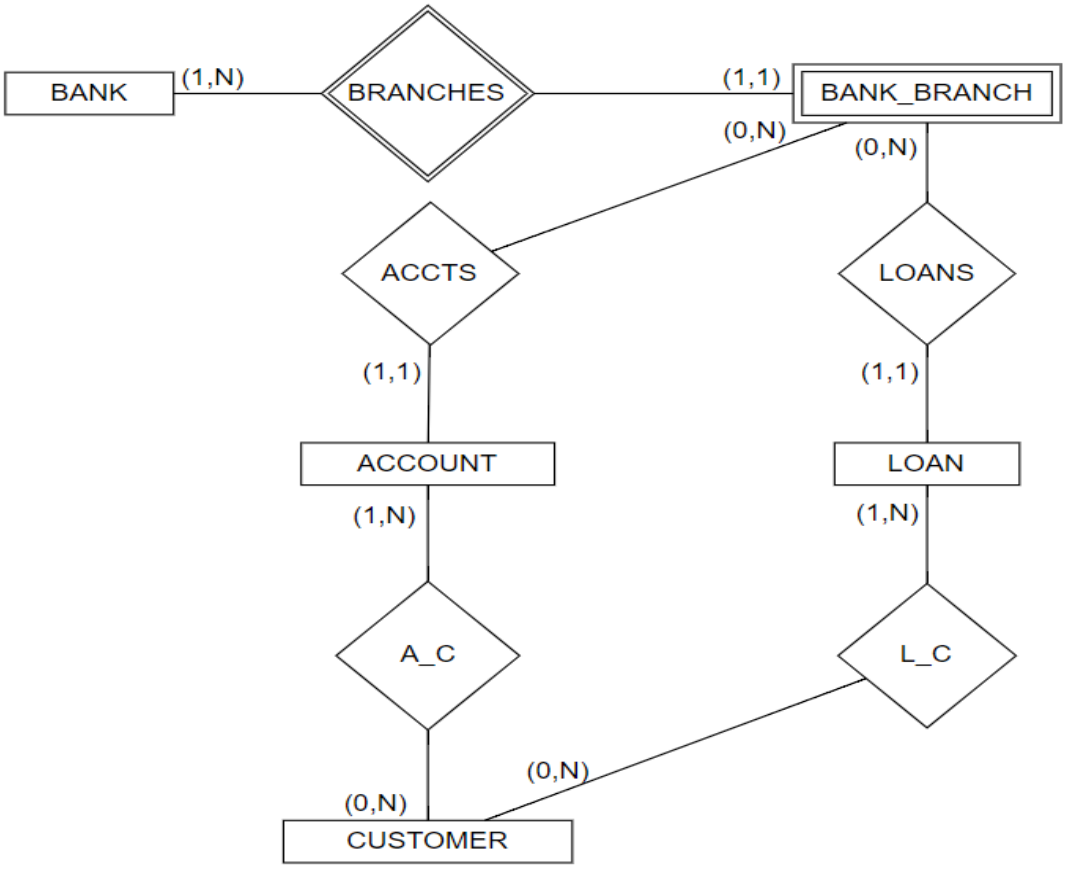
- Name: BANK_BRANCH
- Partial key: Branch_no
- Identifying relationship: BRANCHES (with BANK entity type)

c,

- The identifying relationship specifies that a bank branch cannot be uniquely identified with its attributes alone and must be associated with one particular entity from BANK entity type.
- The partial key specifies that each branch of a specific bank has a unique branch_no.

d,

Name	The (min, max) constraints	Justification (from the figure 7.21)
BRANCHES	- BANK: (1, N) - BANK_BRANCH: (1, 1)	- BRANCHES is identifying relationship of BANK_BRANCH - BANK has a total participation - BANK_BRANCH has a total participation
ACCTS	- BANK_BRANCH: (0, N) - ACCOUNT: (1, 1)	- ACCTS is 1 – N (1 on BANK_BRANCH side) - BANK_BRANCH has a partial participation - ACCOUNT has a total participation
LOANS	- BANK_BRANCH: (0, N) - LOAN: (1, 1)	- LOANS is 1 – N (1 on BANK_BRANCH side) - BANK_BRANCH has a partial participation - LOAN has a total participation
A_C	- ACCOUNT: (1, N) - CUSTOMER: (0, N)	- BRANCHES is M – N - ACCOUNT has a total participation - CUSTOMER has a partial participation
L_C	- LOAN: (1, N) - CUSTOMER: (0, N)	- BRANCHES is M – N - LOAN has a total participation - CUSTOMER has a partial participation



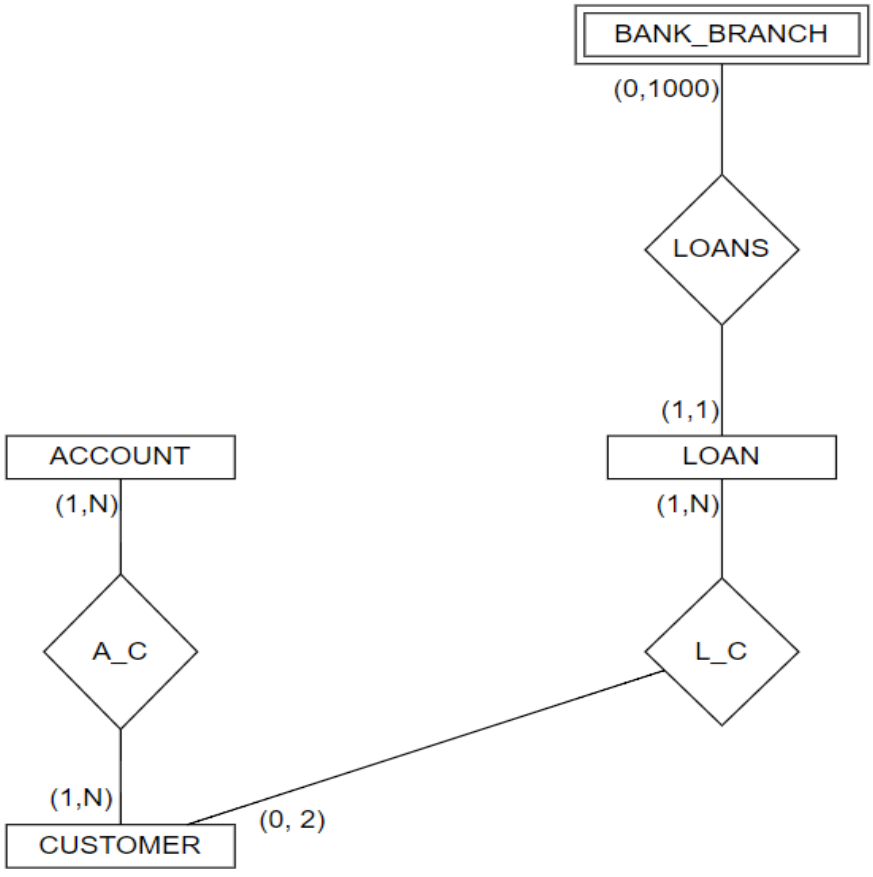
e, User requirements that may lead to this ER schema design

Design a schema for a BANK database:

- The database has information on banks, which includes the code, name, and address of each bank. One bank may have none or multiple branches. The bank branch will have a branch number, and an address.
- The database will store each customer's name, social security number, phone number and address.
- A customer can open many bank accounts at a time, a bank account can be shared by many customers. Each bank account has an account number, an account type and only belongs to one bank branch. The database also keeps track of the account's balance.
- The bank branches allow customers to take out loans. One loan is linked to one branch only but can be shared among customers. The database stores each loan's id number, type, and amount.

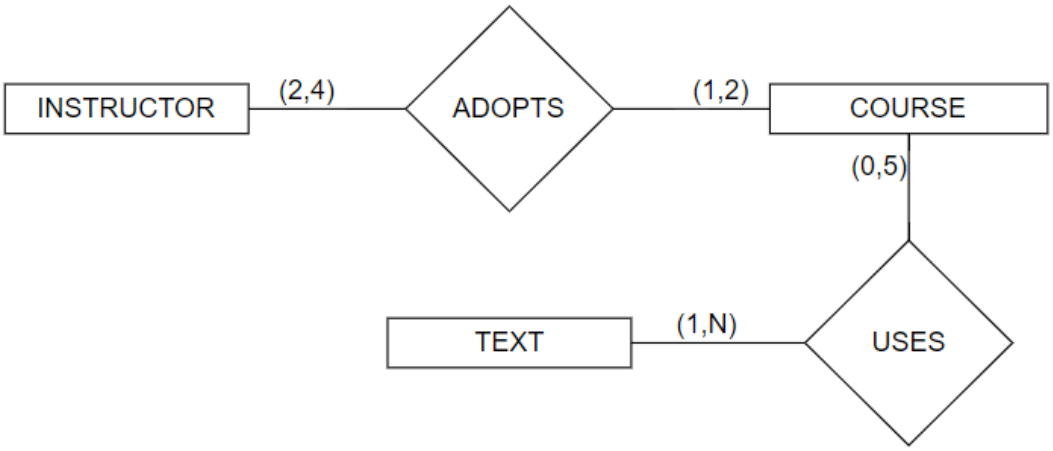
f, The (min, max) constraints for:

- Every customer must have at least one account but is restricted to at most two loans at a time
- A bank branch cannot have more than 1,000 loans



7.25

Assume that a course can be taught by up to 2 instructors.



If we add ADOPTS, it should be a binary relationship type since we can still retrieve all the needed information with ADOPTS being a binary relationship type.

Firstly, we can get the list of courses that a particular instructor teaches. Then, for each of the courses in the list, we get a corresponding list of textbooks used in the course through USES. Finally, we check if our initial instructor adopts the textbooks on the list or not. With these 3 steps, we can find the textbook(s) that an instructor uses for a course.

Since an instructor may teach from 2 to 4 courses, and a course may not use or use up to 5 textbooks, the (min, max) constraints of INSTRUCTOR in ADOPTS are (0, 20), and of TEXT are (1, N).