CIE Portions

• Unit 1

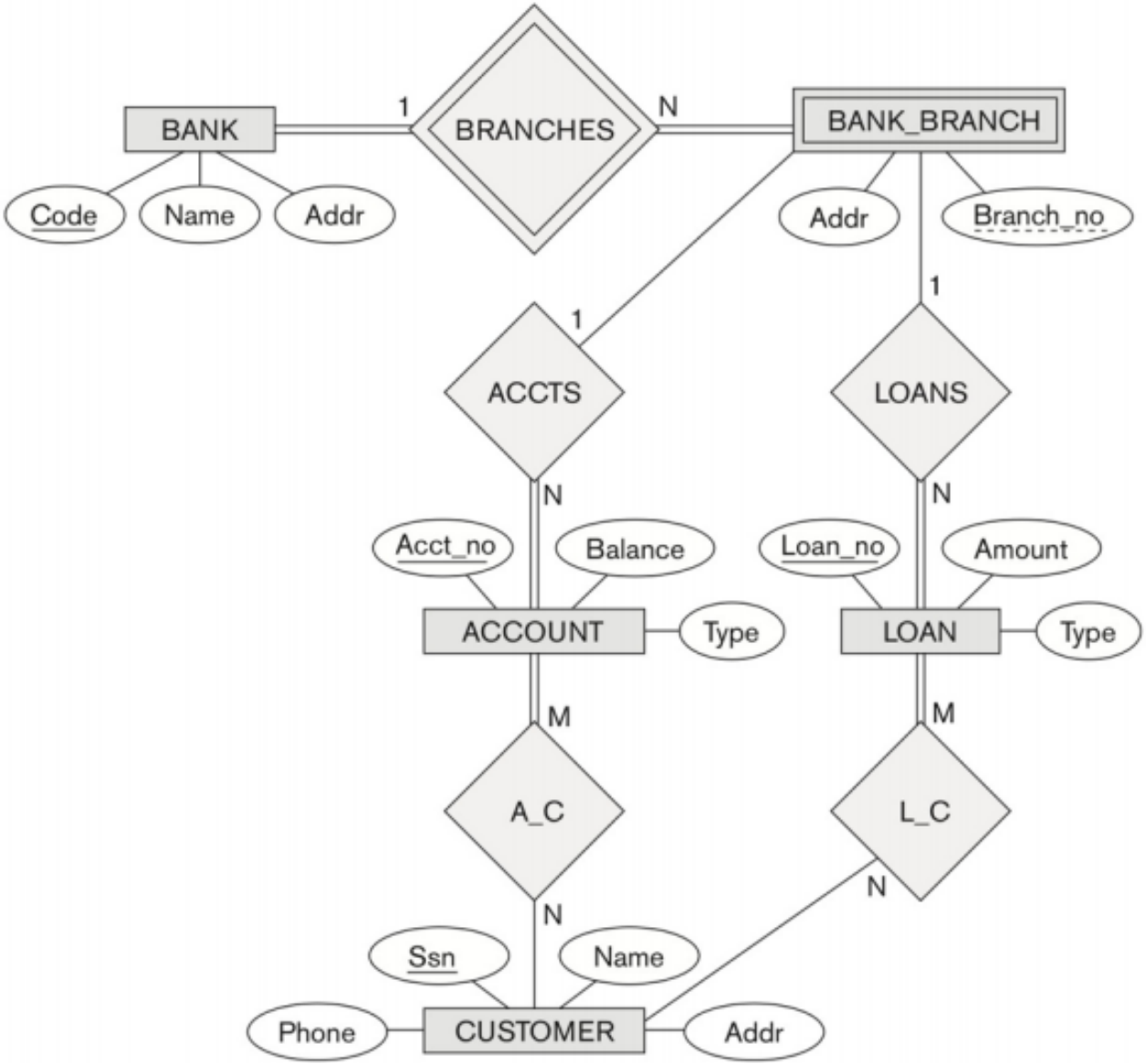
- Introduction: Characteristics of Database approach, Actors on the Scene, Workers behind the scene, Advantages of using DBMS approach, Data models, schemas and instances, Three-schema architecture and data independence, Database languages and interfaces, the database system environment, Centralized and client-server architectures, Classification of Database Management systems, Entity-Relationship Model: Conceptual Database using high level conceptual data models for Database Design, A Sample Database Application, Entity types, Entity sets Attributes and Keys Relationship types, Relationship Sets, Roles and Structural Constraints Weak Entity Types.

• Unit 2

- Relational Model and Relational Algebra: Relational Model Concepts, Relational Model Concepts, Relational Model Constraints and Relational Database Schema Update Operations, Transactions and Dealing with Constraint violations, Unary Relational operations, Relational Algebra Operations from Set Theory, Examples of Queries in Relational Algebra Relational Database Design Using ER- to-Relational Mapping

Each bank can have multiple branches, and each branch can have multiple accounts and loans.

1. List the strong (nonweak) entity types in the ER diagram.
2. Is there a weak entity type? If so, give its name, partial key, and identifying relationship.
3. What constraints do the partial key and the identifying relationship of the weak entity type specify in this diagram?
4. List the names of all relationship types, and specify the (min, max) constraint on each participation of an entity type in a relationship type.
5. List concisely the user requirements that led to this ER schema design.
6. 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 than 1,000 loans. How does this show up on the (min, max) constraints?


BANK
1
BRANCHES
N
BANK_BRANCH
Code
Name
Addr
Addr
Branch_no
1
1
ACCTS
LOANS
N
N
Acct_no
Balance
Loan_no
Amount
ACCOUNT
Type
LOAN
Type
M
M
A_C
L_C
N
N
Ssn
Name
Phone
CUSTOMER
Addr

1. List the strong (nonweak) entity types in the ER diagram.

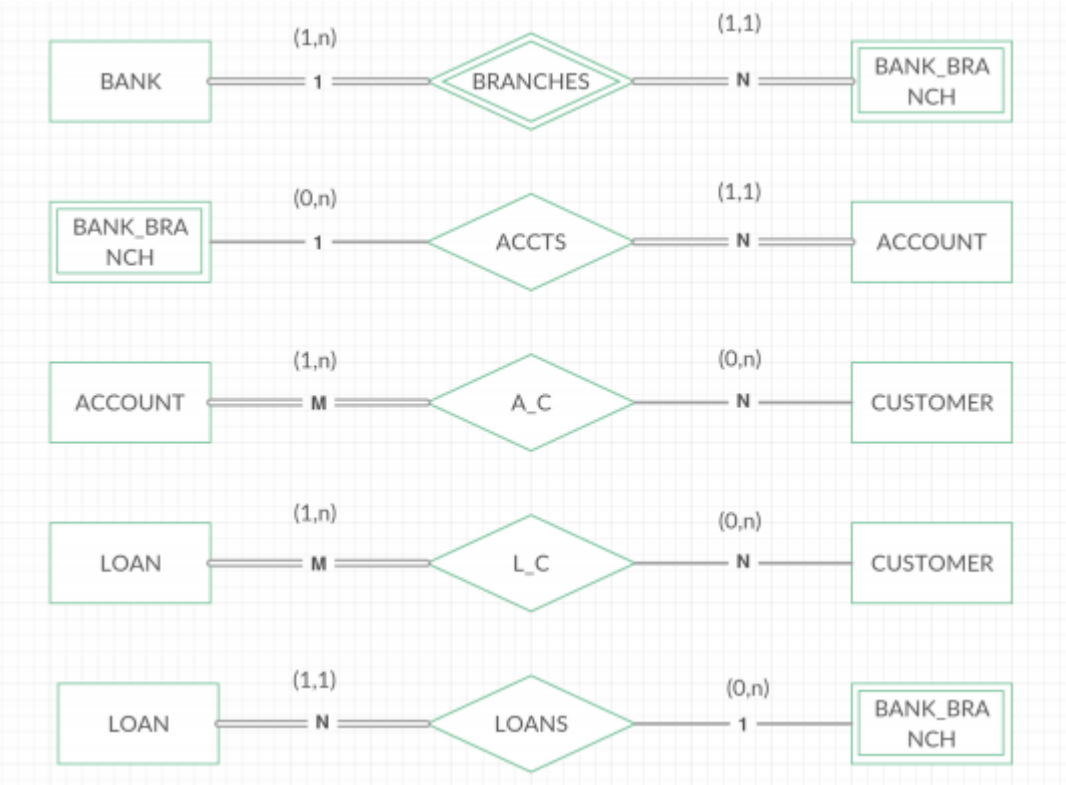
2.Is there a weak entity type? If so, give its name, partial key, and identifying relationship.

- Entity types: BANK, ACCOUNT, CUSTOMER, LOAN
- Weak entity type: BANK-BRANCH. Partial key: BranchNo. Identifying relationship: BRANCHES.

and the identifying relationship of the weak entity type specify in this diagram?

- The partial key BranchNo in BANK-BRANCH specifies that the same BranchNo value may occur under
- different BANKs. The identifying relationship BRANCHES specifies that BranchNo values are uniquely
- assigned for those BANK-BRANCH entities that are related to the same BANK entity. Hence, the combination of BANK Code and BranchNo together constitute a full identifier for a BANK-BRANCH

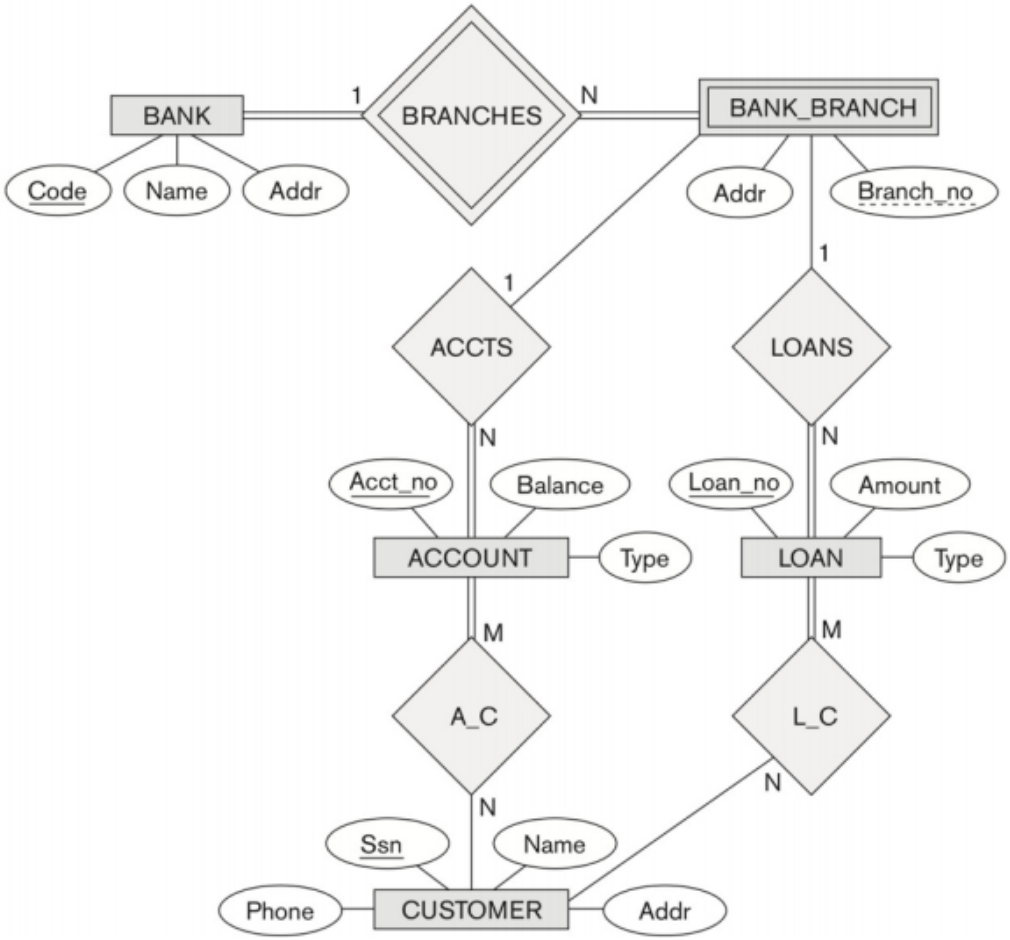
4. List the names of all relationship types, and specify the (min, max) constraint on each participation of an entity type in a relationship type.

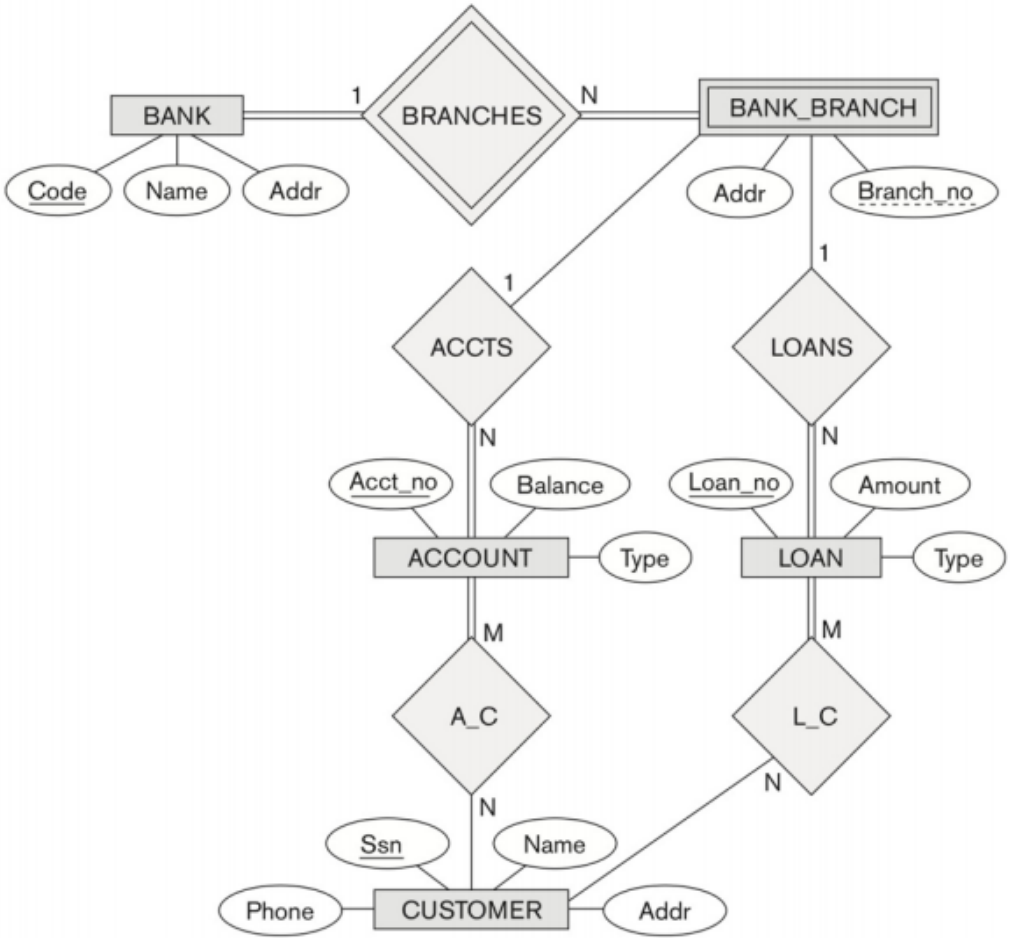


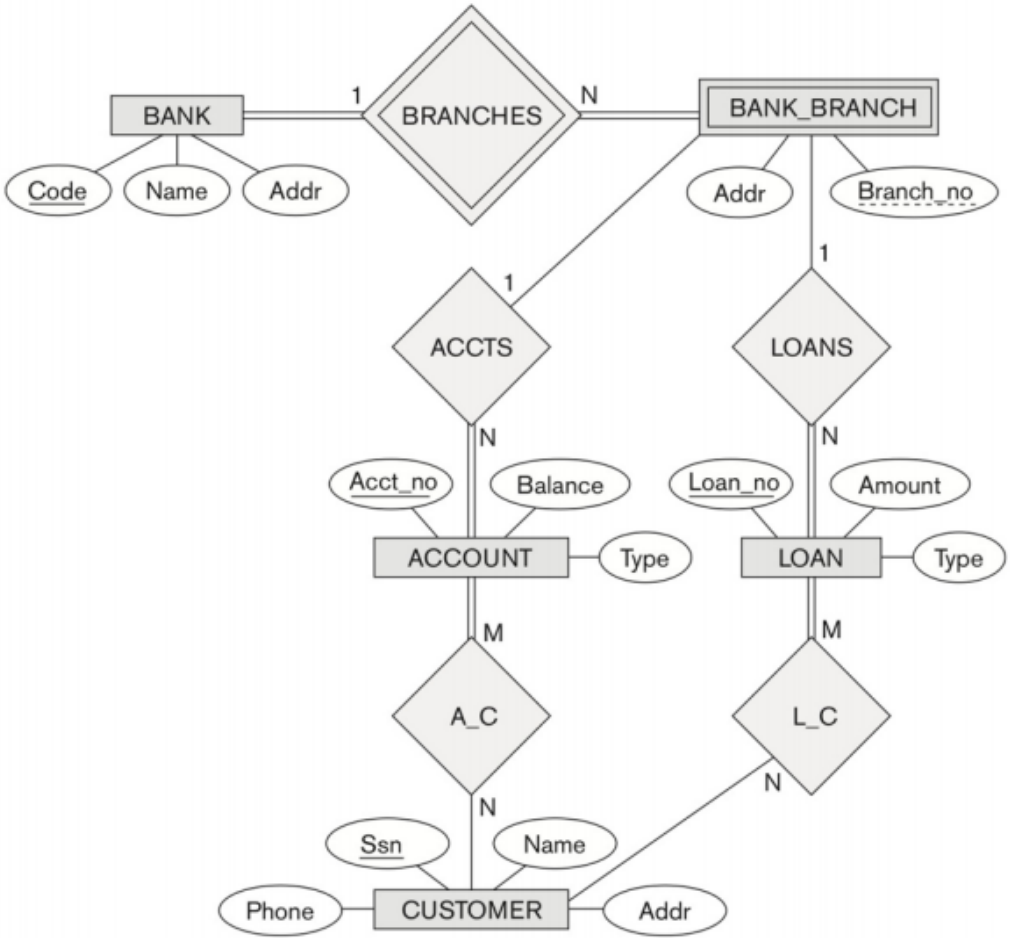
5. List concisely the user requirements that led to this ER schema design.

- The requirements may be stated as follows: Each BANK has a unique Code, as well as a Name and Address. Each BANK is related to one or more BANK-BRANCHes, and the BranhNo is unique among each set of BANK-BRANCHes that are related to the same BANK. Each BANK-BRANCH has an Address. Each BANK-BRANCH has zero or more LOANS and zero or more ACCTS. Each ACCOUNT has an AcctNo (unique), Balance, and Type and is related to exactly one BANK-BRANCH and to at least one CUSTOMER. Each LOAN has a LoanNo (unique), Amount, and Type and is related to exactly one BANK-BRANCH and to at least one CUSTOMER. Each CUSTOMER has an SSN (unique), Name, Phone, and Address, and is related to zero or more ACCOUNTs and to zero or more LOANs.

account but is restricted to at most two loans at a time, and that a bank branch cannot have more than 1,000 loans. How does this show up on the (min, max) constraints?




BANK
1
BRANCHES
N
BANK_BRANCH
Code
Name
Addr
Addr
Branch_no
1
1
ACCTS
LOANS
N
N
Acct_no
Balance
Loan_no
Amount
ACCOUNT
Type
LOAN
Type
M
M
A_C
L_C
N
N
Ssn
Name
Phone
CUSTOMER
Addr


BANK
1
BRANCHES
N
BANK_BRANCH
Code
Name
Addr
Addr
Branch_no
1
1
ACCTS
LOANS
N
N
Acct_no
Balance
Loan_no
Amount
ACCOUNT
Type
LOAN
Type
M
M
A_C
L_C
N
N
Ssn
Name
Phone
CUSTOMER
Addr

Consider the ER diagram given.

Assume that a course may or may not use a textbook, but that a text by definition is a book that is used in some course. A course may not use more than five books. Instructors teach from two to four courses.

Supply (min, max) constraints on this diagram.

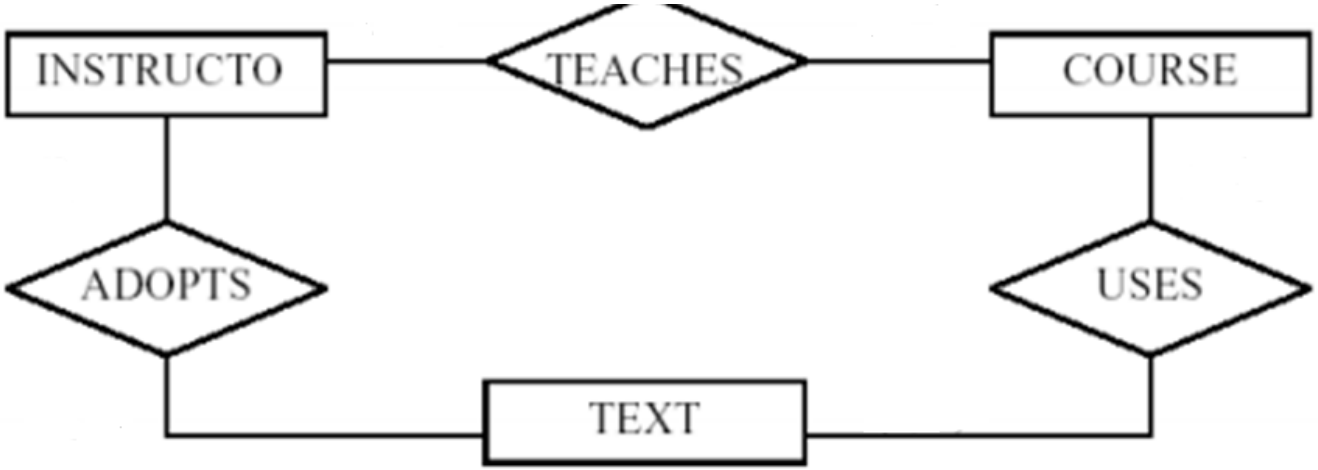
State clearly any additional assumptions you make.

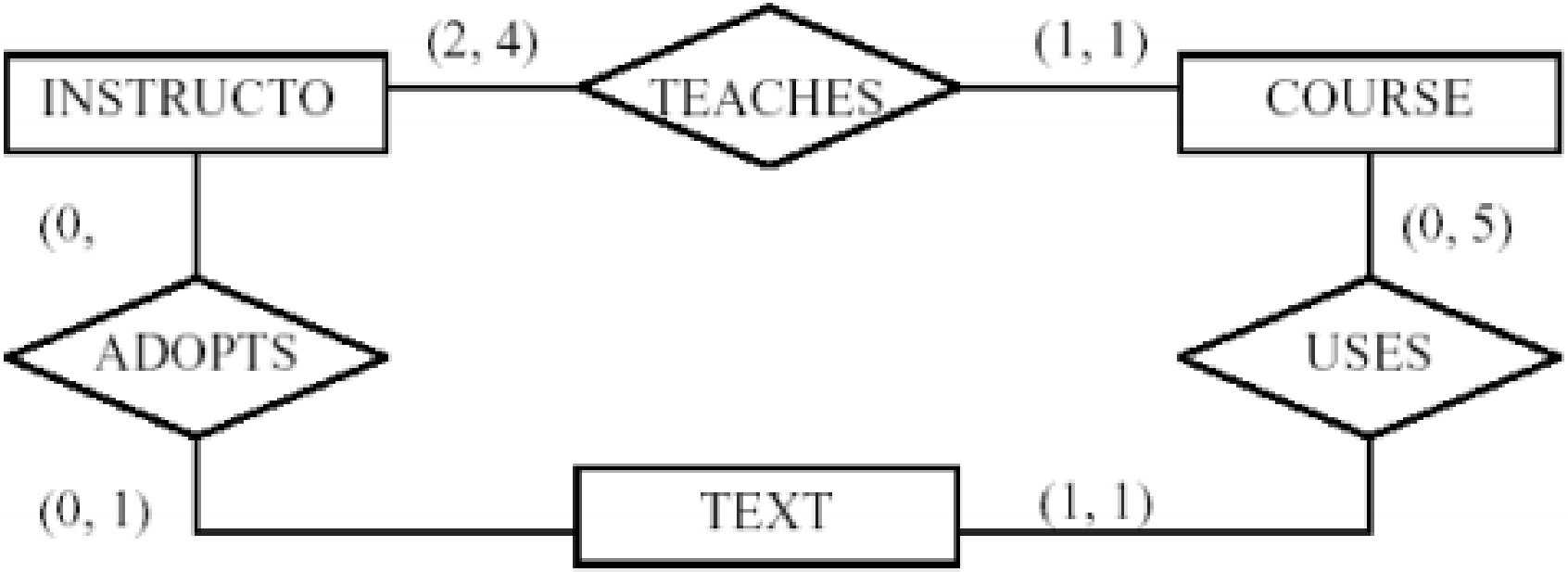
If we add the relationship ADOPTS between INSTRUCTOR and TEXT, what (min, max) constraints would you put on it? Why?

Assuming the following additional assumptions: -

Each course is taught by exactly one instructor. - Each textbook is used by one and only one course. –

An instructor does not have to adopt a textbook for all courses. - If a text exists: - it is used in some course, - hence it is adopted by some instructor who teaches that course. - An instructor is considered to adopt a text if it is used in some course taught - by that instructor.


INSTRUCTO
TEACHES
COURSE
ADOPTS
USES
TEXT


(2, 4)
(1, 1)
INSTRUCTO
TEACHES
COURSE
(0,
(0, 5)
ADOPTS
USES
(0, 1)
TEXT
(1, 1)

What are super, primary, candidate and foreign keys?

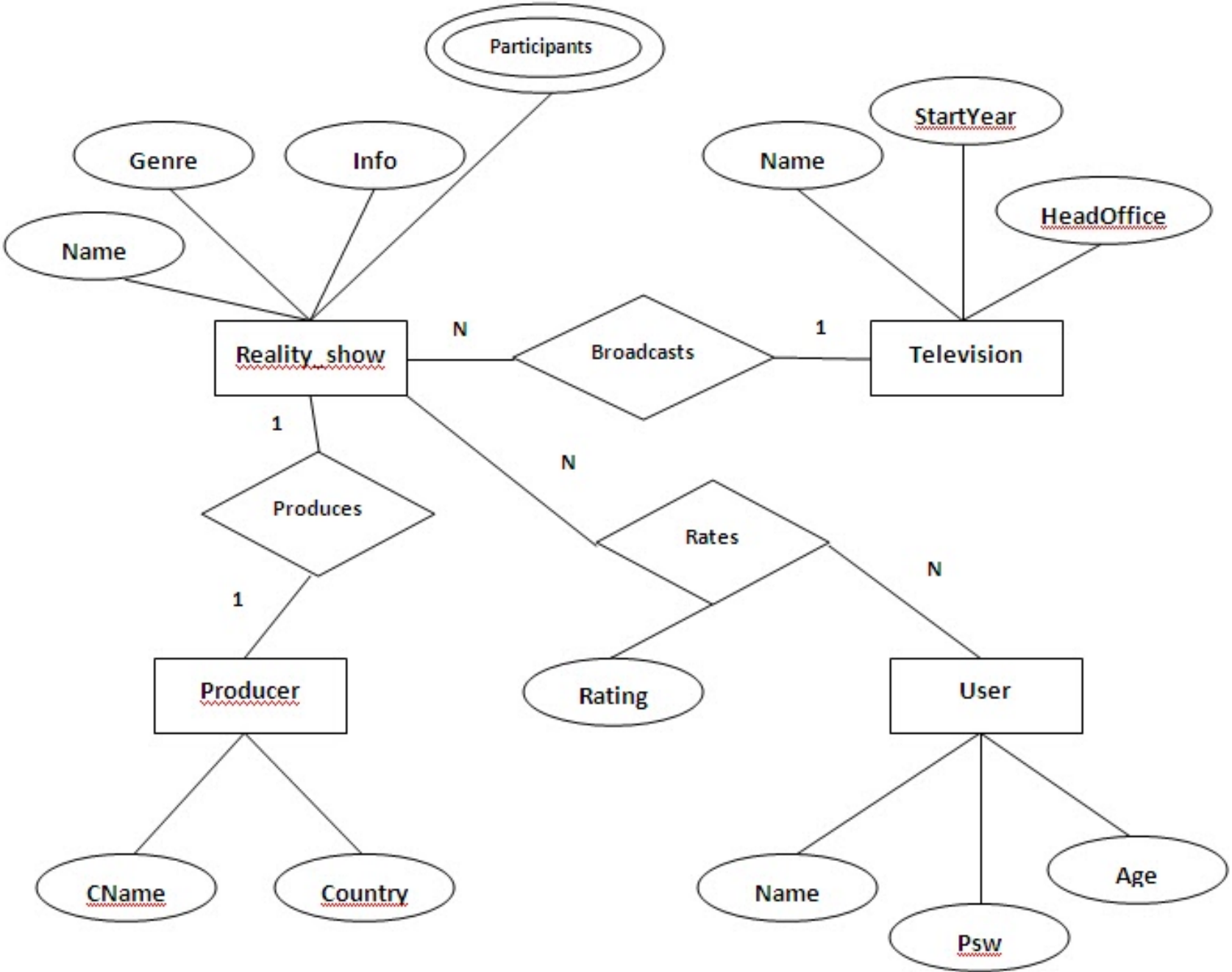
- A **super key** is a set of attributes of a relation schema upon which all attributes of the schema are functionally dependent. No two rows can have the same value of super key attributes.
  A **Candidate key** is minimal superkey, i.e., no proper subset of Candidate key attributes can be a superkey.
  A **Primary Key** is one of the candidate keys. One of the candidate keys is selected as most important and becomes the primary key. There cannot be more that one primary keys in a table.
  A **Foreign key** is a field (or collection of fields) in one table that uniquely identifies a row of another table.

Draw an entity relationship diagram for the given scenario

- Suppose that you are designing a schema to record information about reality shows on TV. Your database needs to record the following information:
- For each reality show, its name, genre, basic_info and participants name. Any reality show has at least two or more participants.
- For each producer, the company name, company country. A show is produced by exactly one producer. And one producer produces exactly one show.

Scenario contd…

- For each television, its name, start year, head office. A television may broadcasts multiple shows. Each show is broadcasted by exactly one television.
- For each user, his/her username, password, and age. A user may rate multiple shows, and a show may be rated by multiple users. Each rating has a score of 0 to 10.
- Draw an entity relationship diagram for this database.


Participants
Genre
Info
Name
Reality_show
N
Broadcasts
1
Television
StartYear
Name
HeadOffice
1
Produces
1
Producer
CName
Country
N
Rates
Rating
N
User
Name
Psw
Age

What is the difference between primary key and unique constraints?

- Primary key cannot have NULL value, the unique constraints can have NULL values. There is only one primary key in a table, but there can be multiple unique constraints.

Given the basic ER and relational models, which of the following is INCORRECT???

A) An attribute of an entity can have more than one value

B) An attribute of an entity can be composite

C) In a row of a relational table, an attribute can have more than one value

D) In a row of a relational table, an attribute can have exactly one value or a NULL value

Answer: (C)

- The maximum number of superkeys for the relation schema R(E, F,G,H) with E as key is _____.
- Answer : 8

One possible database state for the COMPANY relational database schema.

EMPLOYEE

Fname	Minit	Lname	Ssn	Bdate	Address	Sex	Salary	Super_ssn	Dno
John	B	Smith	123456789	1965-01-09	731 Fondren, Houston, TX	M	30000	333445555	5
Franklin	T	Wong	333445555	1955-12-08	638 Voss, Houston, TX	M	40000	888665555	5
Alicia	J	Zelaya	999887777	1968-01-19	3321 Castle, Spring, TX	F	25000	987654321	4
Jennifer	S	Wallace	987654321	1941-06-20	291 Berry, Bellaire, TX	F	43000	888665555	4
Ramesh	K	Narayan	666884444	1962-09-15	975 Fire Oak, Humble, TX	M	38000	333445555	5
Joyce	A	English	453453453	1972-07-31	5631 Rice, Houston, TX	F	25000	333445555	5
Ahmad	V	Jabbar	987987987	1969-03-29	980 Dallas, Houston, TX	M	25000	987654321	4
James	E	Borg	888665555	1937-11-10	450 Stone, Houston, TX	M	55000	NULL	1

DEPARTMENT

Dname	Dnumber	Mgr_ssn	Mgr_start_date
Research	5	333445555	1988-05-22
Administration	4	987654321	1995-01-01
Headquarters	1	888665555	1981-06-19

DEPT_LOCATIONS

Dnumber	Dlocation
1	Houston
4	Stafford
5	Bellaire
5	Sugarland
5	Houston

WORKS_ON

Essn	Pno	Hours
123456789	1	32.5
123456789	2	7.5
666884444	3	40.0
453453453	1	20.0
453453453	2	20.0
333445555	2	10.0
333445555	3	10.0
333445555	10	10.0
333445555	20	10.0
999887777	30	30.0
999887777	10	10.0
987987987	10	35.0
987987987	30	5.0
987654321	30	20.0
987654321	20	15.0
888665555	20	NULL

PROJECT

Pname	Pnumber	Plocation	Dnum
ProductX	1	Bellaire	5
ProductY	2	Sugarland	5
ProductZ	3	Houston	5
Computerization	10	Stafford	4
Reorganization	20	Houston	1
Newbenefits	30	Stafford	4

DEPENDENT

Essn	Dependent_name	Sex	Bdate	Relationship
333445555	Alice	F	1986-04-05	Daughter
333445555	Theodore	M	1983-10-25	Son
333445555	Joy	F	1958-05-03	Spouse
987654321	Abner	M	1942-02-28	Spouse
123456789	Michael	M	1988-01-04	Son
123456789	Alice	F	1988-12-30	Daughter
123456789	Elizabeth	F	1967-05-05	Spouse

- **5.11** - Suppose that each of the following Update operations is applied directly to the database state shown in Figure 5.6. Discuss all integrity constraintsviolated by each operation, if any, and the different ways of enforcing these constraints.
- Insert <‘Sophia’, ‘M’, ‘Wood’, ‘973442298’, ‘1974-05-21’, ’23 S Lamar Blvd. Rd, Austin, TX’, ‘F’, 62000, ‘222445555’, 5> into EMPLOYEE.
- Insert <‘6Sigma’, 4, ‘Austin’, 4> into PROJECT.
- Insert <‘Information Technology’, 2, ‘987987987’, ‘2007-10-01’> into DEPARTMENT.
- Insert <‘777624972’, 15, ‘40.0’> into WORKS_ON.
- Insert <‘888665555’, ‘John’, ‘M’, null, ‘Son’> into DEPENDENT.
- Delete the DEPENDENT tuples with Essn = ‘987654321’.
- Delete the DEPARTMENT tuples with Dnumber = 5.
- Delete the WORKS_ON tuples with Pnoe = 30.
- Modify the Plocation and Dnum of the PROJECT tuples with Dnum = 5 to ‘Houston’ and 1, respectively.
- Modify the Super_ssn attribute of the EMPLOYEE tuple with Ssn = ‘333445555’ to null.
- Modify the Pnumber attribute of the PROJECT tuple with Pnumber = 30 to40

Answer:

- Violates referential integrity because Super_ssn='222445555' and there is no tuple in the EMPLOYEE relation with Super_ssn='222445555'. We may enforce the constraint by: (i) rejecting the insertion of the new EMPLOYEE tuple, (ii) changing the value of Super_sssn in the new
- EMPLOYEE tuple to the existing Mgr_ssn of Dnumber 5 of DEPARTMENT relation.
- Does not violate any integrity constraint because there is no such business rule that a project cannot be situated in a city apart from the city where the project department is located.
- No constraint violations.
- Violates referential integrity on two tables, EMPLOYEE and PROJECT. Violates referential integrity on EMPLOYEE because ESSN='777624972' and there is no tuple in the EMPLOYEE relation with SN='777624972'. We may enforce the constraint by: (i) rejecting the insertion, (ii) changing the value of ESSN to an existing SSN value in EMPLOYEE, or (iii) inserting a new EMPLOYEE tuple with SSN='777624972'.
-
- Violates referential integrity on PROJECT because Pno = 15 and there is no tuple in the PROJECT relation with Pno=15.
- We may enforce this constraint by: (i) rejecting the insertion, or (ii) changing the value of PNO in the new WORKS_ON tuple to a value of PNUMBER that exists in the PROJECT relation. (iii) inserting a new PROJECT tuple with Pno=15.
- No constraint violations.
- No constraint violations.
- Violates referential integrity because several tuples exist in the EMPLOYEE, DEPT_LOCATIONS, and PROJECT relations that reference the tuple being deleted from DEPARTMENT. We may enforce the constraint by: (i) rejecting the deletion, or (ii) deleting all tuples in the EMPLOYEE, DEPT_LOCATIONS, and PROJECT relations whose values for Dno, Dnumber, Dnum, respectively, is equal to 5.
- No constraint violations.
- No constraint violations.
- No constraint violations.
- Violates referential integrity because several tuples exist in the WORKS_ON relations that reference the tuple being modified from PROJECT. We may enforce the constraint by: (i) rejecting the update, or (ii) modifying all tuples in the WORKS_ON relation whose values for Pno, is equal to 30.

Which one is correct w.r.t. RDBMS?

1. primary key ⊆ super key ⊆ candidate key
2. primary key ⊆ candidate key ⊆ super key
3. super key ⊆ candidate key ⊆ primary key
4. super key ⊆ primary key ⊆ candidate key

Answer: B

In an RDBMS relationships between tables are created by using

A. Alternate keys
B. Foreign keys
C. Candidate keys
D. Composite keys

- In the relational model, cardinality means:

A) number of tuples

B) number of attributes

C) number of tables

D) number of constraints

- Ans:The number of tuples in a **relation** is known as **cardinality**.
- **cardinality** is a number of rows in table and **degree** is a number of columns.

- An instance of relational schema R(A,B,C) has distinct values of A, including NULL values. Which of the following is true?

A) A is a candidate key

B) A is not a candidate key

C) A is a primary key

D) Both A and C

- Ans: B

Consider the relational schema given below, where eId of the relation dependent is a foreign key referring to empId of the relation employee. Assume that every employee has at least one associated dependent in the dependent relation.

```
employee (empId, empName, empAge)
dependent(depId, eId, depName, depAge)
```

Consider the following relational algebra query:

$$\Pi_{empId}(employee) - \Pi_{empId}(employee \bowtie_{(empId = eID) \wedge (empAge \leq depAge)} dependent)$$

The above query evaluates to the set of *empIds* of employees whose age is greater than that of

(A) some dependent.
(B) all dependents.
(C) some of his/her dependents
(D) all of his/her dependents.

Answer: D

Given the relations

employee (name, salary, deptno) **and**

department (deptno, deptname, address)

Which of the following queries cannot be expressed using the basic relational algebra operations (U, -, x, π, σ, p)?

(a) Department address of every employee

(b) Employees whose name is the same as their department name

(c) The sum of all employees' salaries

(d) All employees of a given department

Answer: C