

Introduction to Database Systems

Lecture 4

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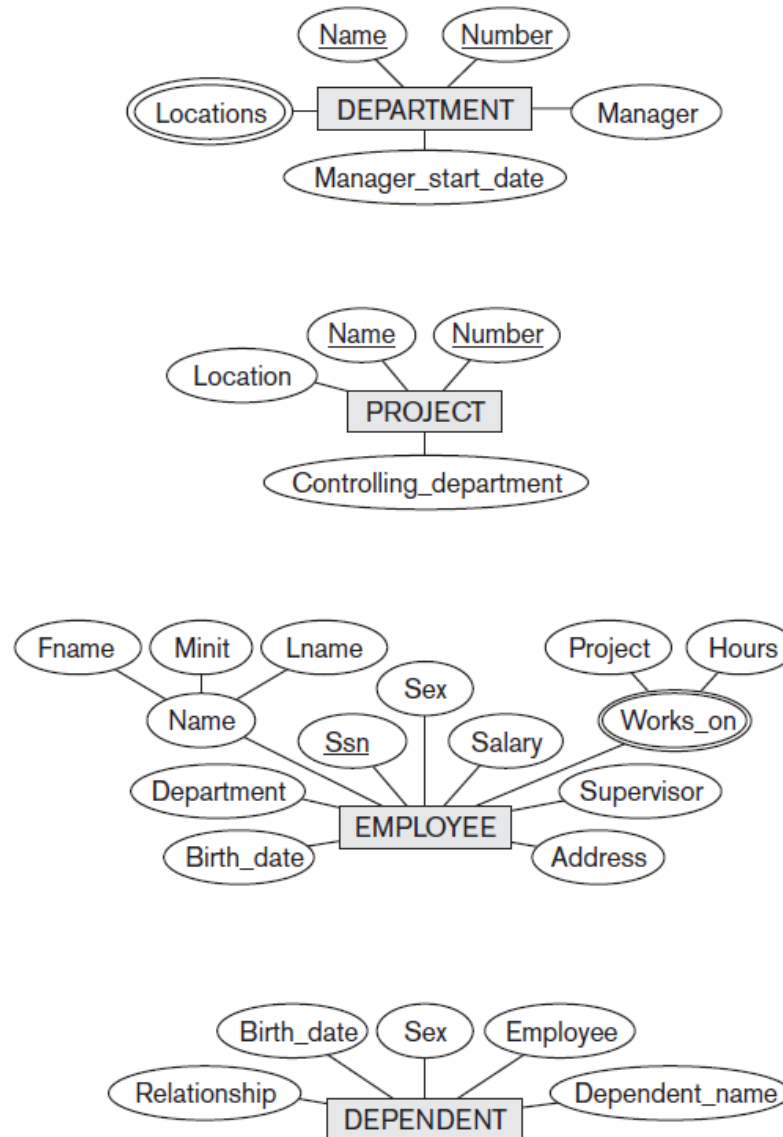
Conceptual Database Design

- Let us consider Initial Conceptual Design of a COMPANY Database:
- we can identify four entity types:
- An entity type **DEPARTMENT** with attributes Name, Number, Locations, Manager, and Manager_start_date.
- Locations is the only multivalued attribute.
- We can specify that both Name and Number are (separate) key attributes because each was specified to be unique.
- An entity type **PROJECT** with attributes Name, Number, Location, and Controlling_department.
- Both Name and Number are (separate) key attributes.

Conceptual Database Design

- An entity type **EMPLOYEE** with attributes Name, Ssn, Sex, Address, Salary, Birth_date, Department, and Supervisor.
- Both Name and Address may be composite attributes.
- We must go back to the users to see if any of them will refer to the individual components of Name—First_name, Middle_initial, Last_name—or of Address.
- An entity type **DEPENDENT** with attributes Employee, Dependent_name, Sex, Birth_date, and Relationship (to the employee).

Conceptual Database Design



Preliminary design of entity types for the COMPANY database. Some of the shown attributes will be refined into relationships.

Keys in Database

- A Key is an attribute or a set of attributes in a relation that identifies a tuple (record) in a relation.
- The keys are defined in a table to access or sequence the stored data quickly and smoothly.
- They are also used to create relationship between different tables.

Keys in Database

- Types of Keys in Database:
 - Primary Key
 - Candidate Key
 - Alternate Key
 - Super Key
 - Composite Key
 - Foreign Key
 - Unique Key

Primary Key

- Which is Unique & Can't have NULL Value.
- Is the column you choose to maintain uniqueness in a table at row level.
- Here in Employee table we can choose either EmployeeID or SSN column for a PK.
- EmployeeID is preferable choice because SSN is a secure value.

Employee
<u>EmployeeID</u>
EmployeeName
SSN
DeptID
DOB

Primary Key

- It is a candidate key that is chosen by the database designer to identify entities within an entity set.
- Primary key is the minimal super key. In the ER diagram primary key is represented by underlining the primary key attribute.
- Ideally a primary key is composed of only a single attribute.
- But it is possible to have a primary key composed of more than one attribute.

Primary Key

- To define a field as primary key, following conditions had to be met :
 - No two rows can have the same primary key value.
 - Every row must have a primary key value.
 - The primary key field cannot be null.
 - Value in a primary key column can never be modified or updated, if any foreign key refers to that primary key.

Candidate Key

- Are individual columns in a table that qualifies for uniqueness of each row/tuple.
- Here in Employee table EmployeeID & SSN are eligible for a Primary Key and thus are Candidate keys.
- Candidate Keys are super keys for which no proper subset is a super key. In other words candidate keys are minimal super keys.

Employee
<u>EmployeeID</u>
EmployeeName
<u>SSN</u>
DeptID
DOB

Alternate Key

- Candidate column other than the Primary column, like if EmployeeID is set for a PK then SSN would be the Alternate key.

Employee
EmployeeID
EmployeeName
<u>SSN</u>
DeptID
DOB

Super Key

- If you add any other Column / Attribute to a Primary Key then it become a Super Key, like EmployeeID + EmployeeName is a Super Key.
- Super key stands for superset of a key.

Employee
<u>EmployeeID</u>
<u>EmployeeName</u>
SSN
DeptID
DOB

Super Key

- A Super Key is a set of one or more attributes that are taken collectively and can identify all other attributes uniquely.
- Any set of attributes containing a super key is also a super key since it too uniquely identifies an entity e.g. {StudID, major}

Composite Key

- If a table do not have a single column that qualifies for a Candidate key, then you have to select 2 or more columns to make a row unique.
- Like if there is no EmployeeID or SSN columns, then you can make EmployeeName + DateOfBirth (DOB) as Composite Primary Key.
- But still there can be a narrow chance of duplicate rows.

Employee
EmployeeID
<u>EmployeeName</u>
SSN
DeptID
<u>DOB</u>

Foreign Key

Employee
EmployeeID
EmployeeName
SSN
<u>DeptID</u>
DOB

Department
<u>DeptID</u>
DeptName

- Here in above tables DeptID of Department table is Primary Key where as DeptID of Employee is an Foreign key.
- It means it has referred to another table. This concept is also know as Referential Integrity.

Unique key

- Unique key is same as primary with the difference being the existence of null.
- Unique key field allows one value as NULL value.

Employee

EmployeeID

EmployeeName

SSN

EmailID

DOB

Examples

- Table R1.
- Suppose A,B,C,D,E are the attributes of this relation.
- $A \rightarrow BCDE$ (This means the attribute 'A' uniquely determines the other attributes B,C,D,E.)
- $BC \rightarrow ADE$ (This means the attributes 'BC' jointly determines all the other attributes A,D,E in the relation.)

Table – R1
A
B
C
D
E

Examples

- Find the following: – Primary Key – Candidate Key – Super Key – Composite Key
- Answers:
 - Primary Key: A
 - Candidate Key: A & BC
 - Super Key: A, BC, AE, AD & ABC
 - Composite Key: BC

Examples

- Let a Relation R have attributes $\{a_1, a_2, a_3\}$ & a_1 is the candidate key.
- Then how many super keys are possible?
- Here, any superset of a_1 is the super key.

Examples

- Answer:
 - Super keys are = {a1, a1 a2, a1 a3, a1 a2 a3}
- Thus we see that 4 Super keys are possible in this case.

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