An Introduction to the Database Management Systems

By
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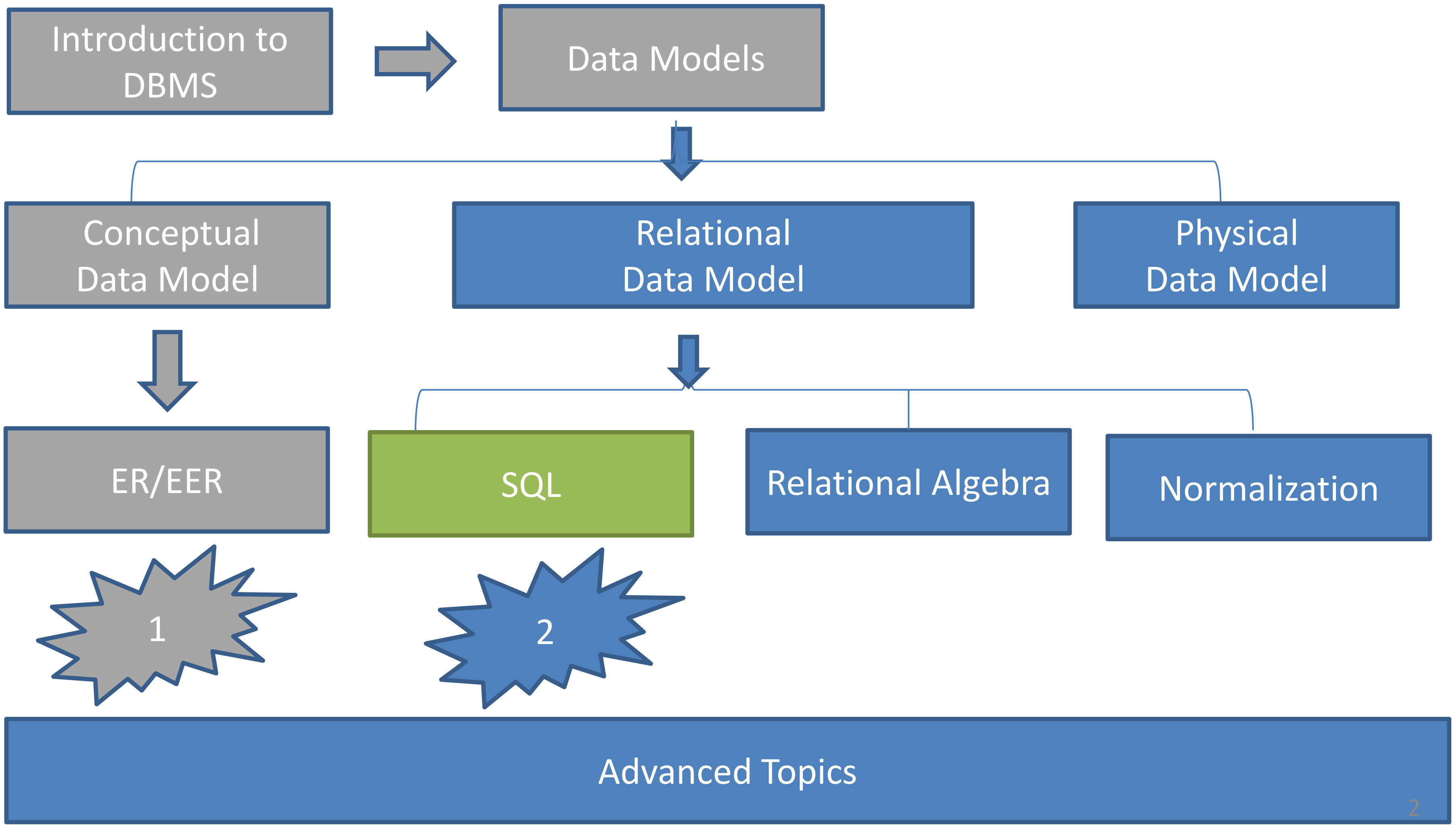
Slides originally by Book(s) Resources

Road Map

(Might change!)



SQL Basics

- SQL Data Definition and Data Types
- Specifying Constraints in SQL
- Basic Retrieval Queries in SQL
- `INSERT`, `DELETE`, and `UPDATE` Statements in SQL
- Additional Features of SQL

Basic SQL

- SQL language
  - Considered one of the major reasons for the commercial success of relational databases
- **SQL**
  - **Structured Query Language**
  - Statements for data definitions, queries, and updates (both DDL and DML)
  - <u>Core</u> specification
  - Plus specialized **extensions**

SQL Data Definition and Data Types

- Terminology:
  - **Table**, **row**, and **column** used for relational model terms relation, tuple, and attribute
- `CREATE` statement
  - Main SQL command for data definition

Schema and Catalog Concepts in SQL

- **SQL schema**
  - Identified by a **schema name**
  - Includes an **authorization identifier** and **descriptors** for each element
- Schema **elements** include
  - Tables, constraints, views, domains, and other constructs
- Each statement in SQL ends with a semicolon

Data Types in SQL

- Characters:
  - CHAR(20) -- fixed length
  - VARCHAR(40) -- variable length
- Numbers:
  - BIGINT, INT, SMALLINT, TINYINT
  - REAL, FLOAT -- differ in precision
  - MONEY
- Times and dates:
  - DATE
  - DATETIME -- SQL Server
- Others... All are simple

Tables in SQL

Table name

Attribute names

Product

PName	Price	Category	Manufacturer
Gizmo	$19.99	Gadgets	GizmoWorks
Powergizmo	$29.99	Gadgets	GizmoWorks
SingleTouch	$149.99	Photography	Canon
MultiTouch	$203.99	Household	Hitachi

Tuples or rows

Tables Explained

- A tuple = a record
  - Restriction: all attributes are of atomic type
- A table = a set of tuples
  - Like a list…
  - …but it is unordered: no **first()**, no **next()**, no **last()**.

Tables Explained

- The *schema* of a table is the table name and its attributes:

Product(PName, Price, Category, Manfacturer)

- A *key* is an attribute whose values are unique;
  we underline a key

Product(<u>PName</u>, Price, Category, Manfacturer)

Schema and Catalog Concepts in SQL (cont'd.)

- `CREATE SCHEMA` statement
  - `CREATE SCHEMA COMPANY AUTHORIZATION 'Jsmith';`
- **Catalog**
  - Named collection of schemas in an SQL environment
- SQL **environment**
  - Installation of an SQL-compliant RDBMS on a computer system

The CREATE TABLE Command in SQL

- Specify a new relation
  - Provide name
  - Specify attributes and initial constraints
- Can optionally specify schema:
  - `CREATE TABLE COMPANY.EMPLOYEE ...`

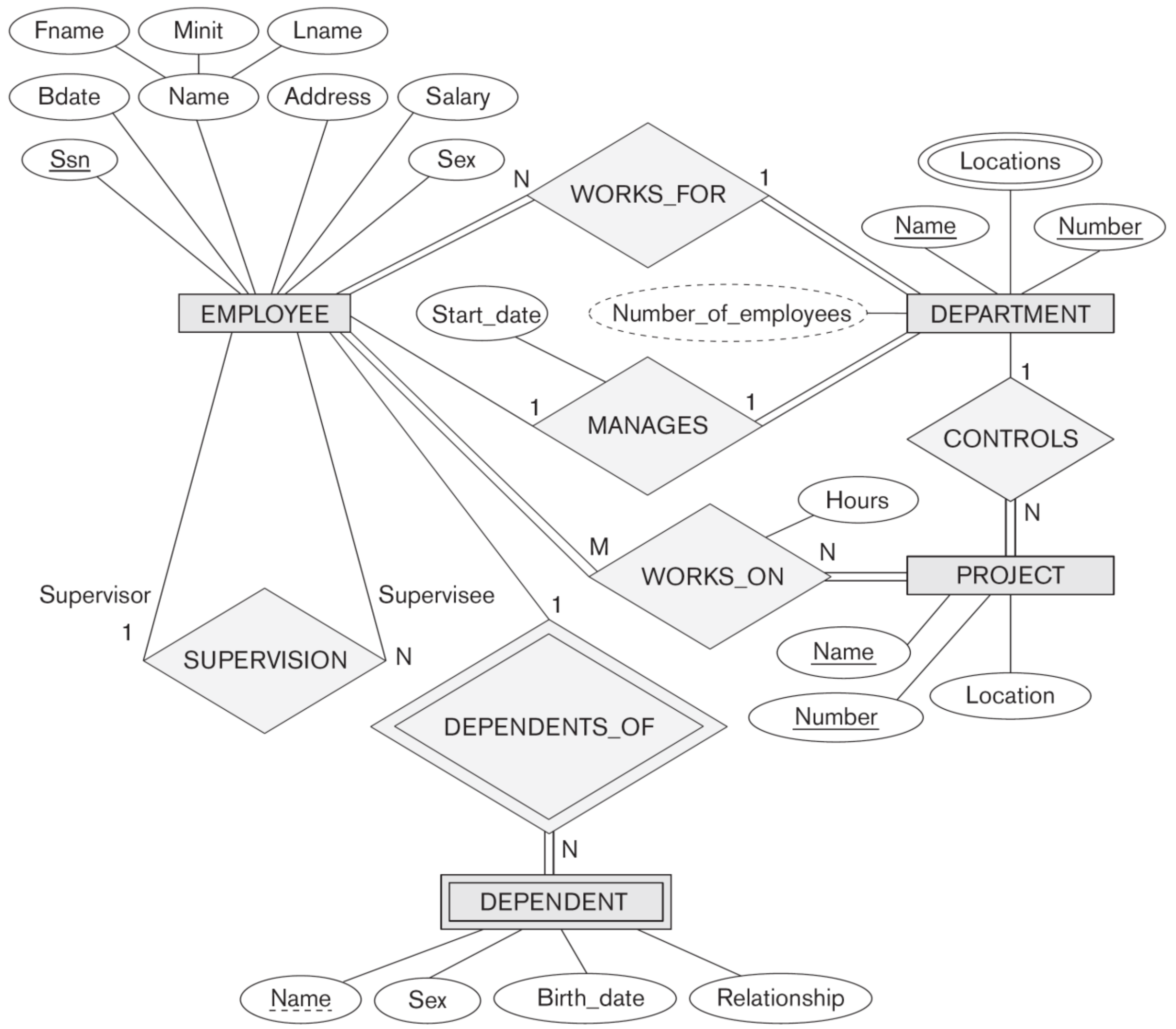
    or
  - `CREATE TABLE EMPLOYEE ...`

The CREATE TABLE Command in SQL (cont'd.)

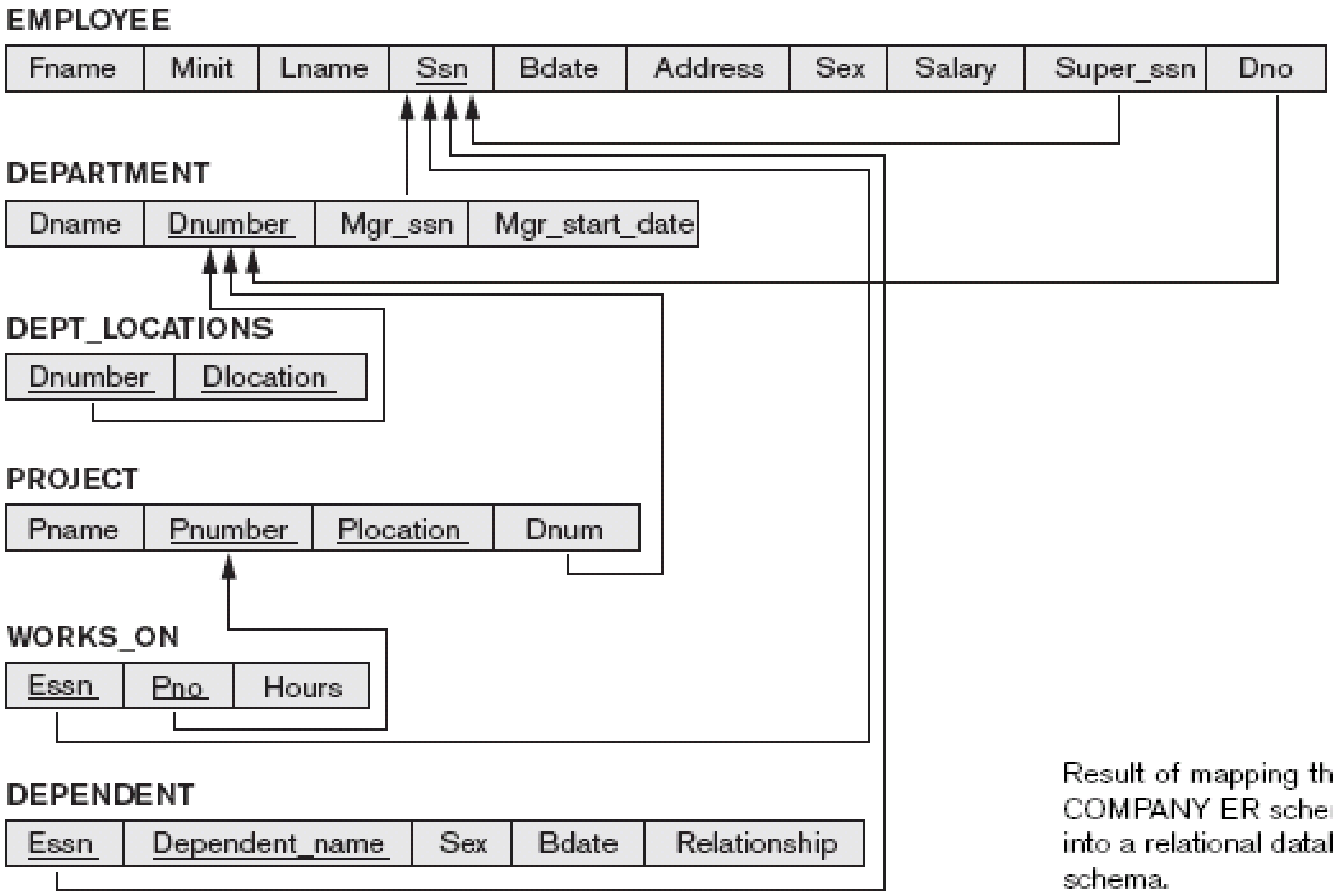
- **Base tables (base relations)**
  - Relation and its tuples are actually created and stored as a file by the DBMS
- **Virtual relations**
  - Created through the `CREATE VIEW` statement

Start from conceptual ER diagram

Figure 9.1
The ER conceptual schema diagram for the COMPANY database.



Finish at relational database schema



Result of mapping the COMPANY ER schema into a relational database schema.

```
CREATE TABLE EMPLOYEE
      ( Fname            VARCHAR(15)          NOT NULL,
        Minit            CHAR,
        Lname            VARCHAR(15)          NOT NULL,
        Ssn              CHAR(9)              NOT NULL,
        Bdate            DATE,
        Address          VARCHAR(30),
        Sex              CHAR,
        Salary           DECIMAL(10,2),
        Super_ssn        CHAR(9),
        Dno              INT                  NOT NULL,
      PRIMARY KEY (Ssn),
      FOREIGN KEY (Super_ssn) REFERENCES EMPLOYEE(Ssn),
      FOREIGN KEY (Dno) REFERENCES DEPARTMENT(Dnumber) );
CREATE TABLE DEPARTMENT
      ( Dname            VARCHAR(15)          NOT NULL,
        Dnumber          INT                  NOT NULL,
        Mgr_ssn          CHAR(9)              NOT NULL,
        Mgr_start_date   DATE,
      PRIMARY KEY (Dnumber),
      UNIQUE (Dname),
      FOREIGN KEY (Mgr_ssn) REFERENCES EMPLOYEE(Ssn) );
```

Figure 4.1
SQL CREATE TABLE data definition statements for defining the COMPANY schema from Figure 3.7.

```
CREATE TABLE DEPT_LOCATIONS
        ( Dnumber              INT                  NOT NULL,
          Dlocation            VARCHAR(15)          NOT NULL,
        PRIMARY KEY (Dnumber, Dlocation),
        FOREIGN KEY (Dnumber) REFERENCES DEPARTMENT(Dnumber) );
CREATE TABLE PROJECT
        ( Pname                VARCHAR(15)          NOT NULL,
          Pnumber              INT                  NOT NULL,
          Plocation            VARCHAR(15),
          Dnum                 INT                  NOT NULL,
        PRIMARY KEY (Pnumber),
        UNIQUE (Pname),
        FOREIGN KEY (Dnum) REFERENCES DEPARTMENT(Dnumber) );
CREATE TABLE WORKS_ON
        ( Essn                 CHAR(9)              NOT NULL,
          Pno                  INT                  NOT NULL,
          Hours                DECIMAL(3,1)         NOT NULL,
        PRIMARY KEY (Essn, Pno),
        FOREIGN KEY (Essn) REFERENCES EMPLOYEE(Ssn),
        FOREIGN KEY (Pno) REFERENCES PROJECT(Pnumber) );
CREATE TABLE DEPENDENT
        ( Essn                 CHAR(9)              NOT NULL,
          Dependent_name       VARCHAR(15)          NOT NULL,
          Sex                  CHAR,
          Bdate                DATE,
          Relationship         VARCHAR(8),
        PRIMARY KEY (Essn, Dependent_name),
        FOREIGN KEY (Essn) REFERENCES EMPLOYEE(Ssn) );
```

Figure 4.1
SQL CREATE TABLE data definition statements for defining the COMPANY schema from Figure 3.7.

The CREATE TABLE Command in SQL (cont'd.)

- Some foreign keys may cause errors
  - Specified either via:
    - Circular references
    - Or because they refer to a table that has not yet been created

Attribute Data Types and Domains in SQL

- Basic **data types**
  - **Numeric** data types
    - Integer numbers: `INTEGER`, `INT`, and `SMALLINT`
    - Floating-point (real) numbers: `FLOAT` or `REAL`, and `DOUBLE PRECISION`
  - **Character-string** data types
    - Fixed length: `CHAR(`*n*`)`, `CHARACTER(`*n*`)`
    - Varying length : `VARCHAR(`*n*`)`, `CHAR VARYING(`*n*`)`, `CHARACTER VARYING(`*n*`)`

Attribute Data Types and Domains in SQL (cont'd.)

- **Bit-string** data types
  - Fixed length: `BIT(`*n*`)`
  - Varying length: `BIT VARYING(`*n*`)`
- **Boolean** data type
  - Values of `TRUE` or `FALSE` or `NULL`
- **DATE** data type
  - Ten positions
  - Components are `YEAR`, `MONTH`, and `DAY` in the form YYYY-MM-DD

Attribute Data Types and Domains in SQL (cont'd.)

- Additional data types
  - **Timestamp** data type (`TIMESTAMP`)
    - Includes the `DATE` and `TIME` fields
    - Plus a minimum of six positions for decimal fractions of seconds
    - Optional `WITH TIME ZONE` qualifier
  - **`INTERVAL`** data type
    - Specifies a relative value that can be used to increment or decrement an absolute value of a date, time, or timestamp

Attribute Data Types and Domains in SQL (cont'd.)

- Domain
  - Name used with the attribute specification
  - Makes it easier to change the data type for a domain that is used by numerous attributes
  - Improves schema readability
  - Example:
    - `CREATE DOMAIN SSN_TYPE AS CHAR(9);`

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Specifying Constraints in SQL

- Basic constraints:
  - Key and referential integrity constraints
  - Restrictions on attribute domains and NULLs
  - Constraints on individual tuples within a relation

Specifying Attribute Constraints and Attribute Defaults

- `NOT NULL`
  - `NULL` is not permitted for a particular attribute
- Default value
  - **`DEFAULT`** `<value>`
- **`CHECK`** clause

  -
    ```
    Dnumber INT NOT NULL CHECK
     (Dnumber > 0 AND Dnumber < 21);
    ```

```
CREATE TABLE EMPLOYEE
    (   . . . ,
        Dno          INT                NOT NULL          DEFAULT 1,
    CONSTRAINT EMPPK
        PRIMARY KEY (Ssn),
    CONSTRAINT EMPSUPERFK
        FOREIGN KEY (Super_ssn) REFERENCES EMPLOYEE(Ssn)
                     ON DELETE SET NULL            ON UPDATE CASCADE,
    CONSTRAINT EMPDEPTFK
        FOREIGN KEY(Dno) REFERENCES DEPARTMENT(Dnumber)
                    ON DELETE SET DEFAULT          ON UPDATE CASCADE);
CREATE TABLE DEPARTMENT
    (   . . . ,
        Mgr_ssn    CHAR(9)         NOT NULL              DEFAULT '888665555',
        . . . ,
    CONSTRAINT DEPTPK
        PRIMARY KEY(Dnumber),
    CONSTRAINT DEPTSK
        UNIQUE (Dname),
    CONSTRAINT DEPTMGRFK
        FOREIGN KEY (Mgr_ssn) REFERENCES EMPLOYEE(Ssn)
                     ON DELETE SET DEFAULT   ON UPDATE CASCADE);
CREATE TABLE DEPT_LOCATIONS
    (   . . . ,
    PRIMARY KEY (Dnumber, Dlocation),
    FOREIGN KEY (Dnumber) REFERENCES DEPARTMENT(Dnumber)
                 ON DELETE CASCADE                 ON UPDATE CASCADE);
```

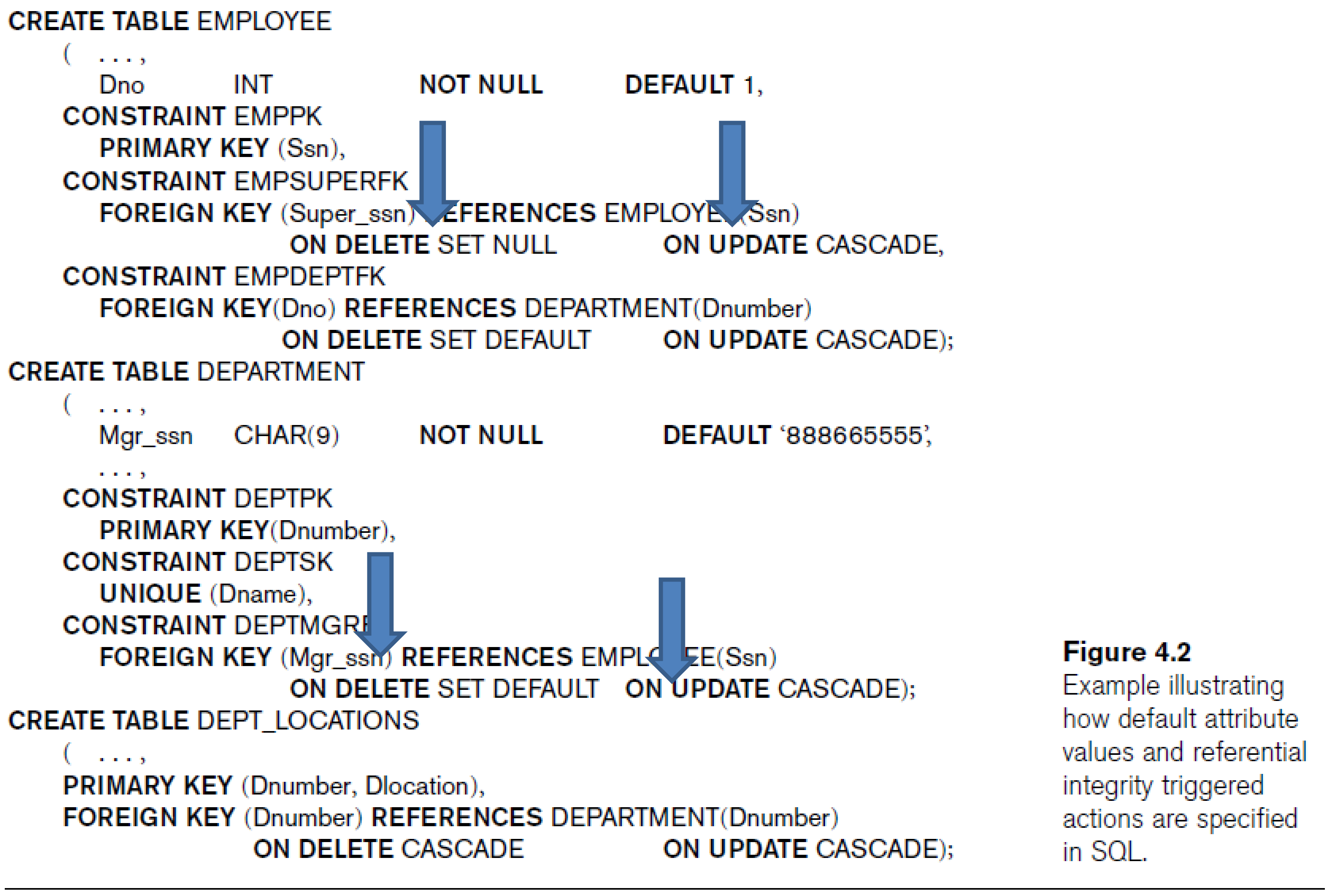
Figure 4.2
Example illustrating how default attribute values and referential integrity triggered actions are specified in SQL.

Specifying Key and Referential Integrity Constraints

- **`PRIMARY KEY`** clause
  - Specifies one or more attributes that make up the primary key of a relation
  - `Dnumber INT PRIMARY KEY;`
- **`UNIQUE`** clause
  - Specifies alternate (secondary) keys
  - `Dname VARCHAR(15) UNIQUE;`

Specifying Key and Referential Integrity Constraints (cont'd.)

- **`FOREIGN KEY`** clause
  - Default operation: reject update on violation
  - Attach **referential triggered action** clause
    - Options include `SET NULL`, `CASCADE`, and `SET DEFAULT`
    - Action taken by the DBMS for `SET NULL` or `SET DEFAULT` is the same for both <u>`ON DELETE`</u> and <u>`ON UPDATE`</u>
    - `CASCADE` option suitable for "relationship" relations



```
CREATE TABLE EMPLOYEE
    (   . . . ,
        Dno         INT             NOT NULL        DEFAULT 1,
    CONSTRAINT EMPPK
        PRIMARY KEY (Ssn),
    CONSTRAINT EMPSUPERFK
        FOREIGN KEY (Super_ssn) REFERENCES EMPLOYEE(Ssn)
                        ON DELETE SET NULL          ON UPDATE CASCADE,
    CONSTRAINT EMPDEPTFK
        FOREIGN KEY(Dno) REFERENCES DEPARTMENT(Dnumber)
                        ON DELETE SET DEFAULT       ON UPDATE CASCADE);
CREATE TABLE DEPARTMENT
    (   . . . ,
        Mgr_ssn     CHAR(9)         NOT NULL        DEFAULT '888665555',
        . . . ,
    CONSTRAINT DEPTPK
        PRIMARY KEY(Dnumber),
    CONSTRAINT DEPTSK
        UNIQUE (Dname),
    CONSTRAINT DEPTMGRFK
        FOREIGN KEY (Mgr_ssn) REFERENCES EMPLOYEE(Ssn)
                        ON DELETE SET DEFAULT   ON UPDATE CASCADE);
CREATE TABLE DEPT_LOCATIONS
    (   . . . ,
    PRIMARY KEY (Dnumber, Dlocation),
    FOREIGN KEY (Dnumber) REFERENCES DEPARTMENT(Dnumber)
                    ON DELETE CASCADE               ON UPDATE CASCADE);
```

Figure 4.2
Example illustrating how default attribute values and referential integrity triggered actions are specified in SQL.

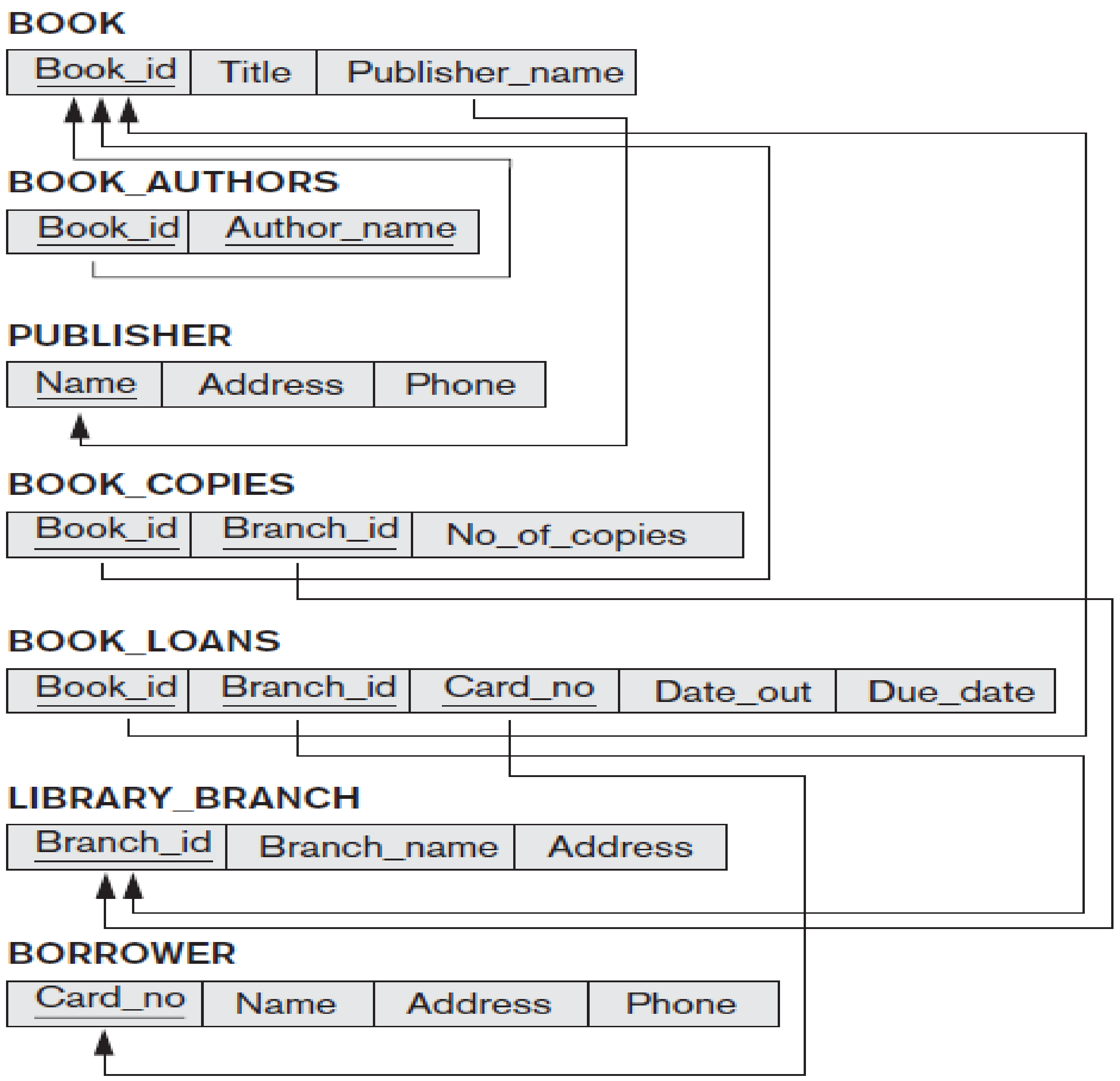
Giving Names to Constraints

- Keyword **`CONSTRAINT`**
  - Name a constraint
  - Useful for later altering

Specifying Constraints on Tuples Using CHECK

- `CHECK` clauses at the end of a `CREATE TABLE` statement
  - Apply to each tuple individually
  - `CHECK (Dept_create_date <= Mgr_start_date);`

Quiz 1


BOOK
Book_id
Title
Publisher_name
BOOK_AUTHORS
Book_id
Author_name
PUBLISHER
Name
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Book_id
Branch_id
No_of_copies
BOOK_LOANS
Book_id
Branch_id
Card_no
Date_out
Due_date
LIBRARY_BRANCH
Branch_id
Branch_name
Address
BORROWER
Card_no
Name
Address
Phone

Quiz 1

- Write <u>create table</u> commands for all the relations.
- Determine suitable <u>Constraints</u> for all the attributes
- Choose the appropriate action (reject, cascade, set to NULL, set to default) for each referential integrity constraint

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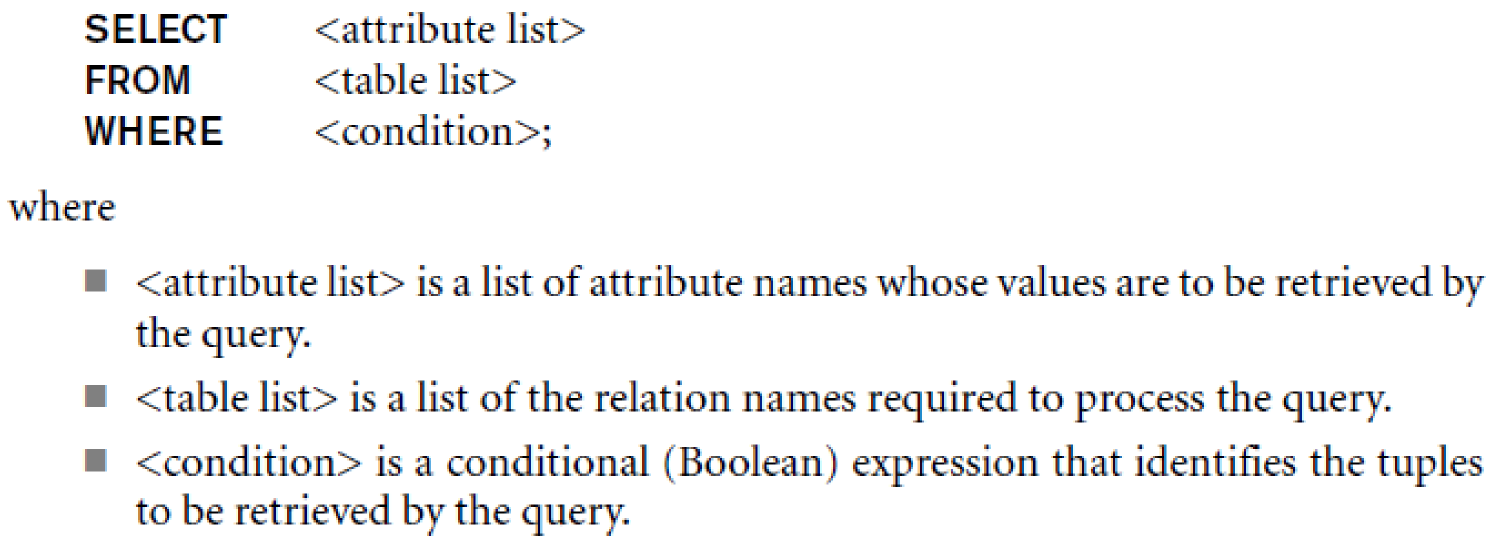
Basic Retrieval Queries in SQL

- `SELECT` statement
  - One basic statement for retrieving information from a database
- SQL allows a table to have two or more tuples that are identical in all their attribute values
  - Unlike relational model
  - Multiset or bag behavior

The SELECT-FROM-WHERE Structure of Basic SQL Queries

- Basic form of the SELECT statement:



```
SELECT    <attribute list>
FROM      <table list>
WHERE     <condition>;
```

where

- <attribute list> is a list of attribute names whose values are to be retrieved by the query.
- <table list> is a list of the relation names required to process the query.
- <condition> is a conditional (Boolean) expression that identifies the tuples to be retrieved by the query.

The SELECT-FROM-WHERE Structure of Basic SQL Queries (cont’d.)

- Logical comparison operators
  - =, <, <=, >, >=, and <>
- **Projection attributes**
  - Attributes whose values are to be retrieved
- **Selection condition**
  - Boolean condition that must be true for any retrieved tuple

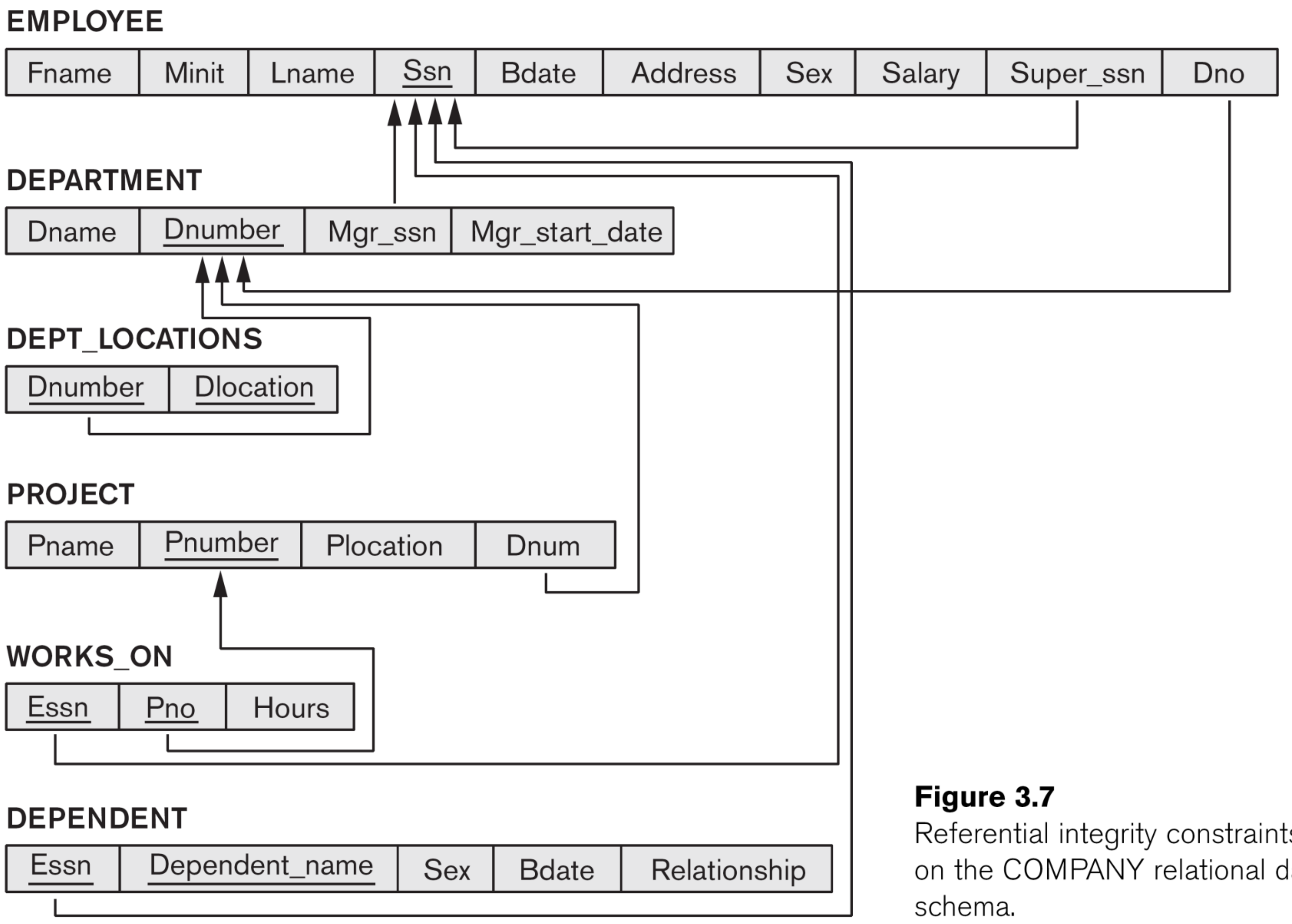


Figure 3.7
Referential integrity constraints displayed on the COMPANY relational database schema.

Figure 4.3
Results of SQL queries when applied to the COMPANY database state shown in Figure 3.6. (a) Q0. (b) Q1. (c) Q2. (d) Q8. (e) Q9. (f) Q10. (g) Q1C.

(a)

Bdate	Address
1965-01-09	731Fondren, Houston, TX

(b)

Fname	Lname	Address
John	Smith	731 Fondren, Houston, TX
Franklin	Wong	638 Voss, Houston, TX
Ramesh	Narayan	975 Fire Oak, Humble, TX
Joyce	English	5631 Rice, Houston, TX

Query 0. Retrieve the birth date and address of the employee(s) whose name is 'John B. Smith'.

```
Q0:     SELECT    Bdate, Address
        FROM      EMPLOYEE
        WHERE     Fname='John' AND Minit='B' AND Lname='Smith';
```

Query 1. Retrieve the name and address of all employees who work for the 'Research' department.

```
Q1:     SELECT    Fname, Lname, Address
        FROM      EMPLOYEE, DEPARTMENT
        WHERE     Dname='Research' AND Dnumber=Dno;
```

Figure 4.3
Results of SQL queries when applied to the COMPANY database state shown in Figure 3.6. (a) Q0. (b) Q1. (c) Q2. (d) Q8. (e) Q9. (f) Q10. (g) Q1C.

(c)

Pnumber	Dnum	Lname	Address	Bdate
10	4	Wallace	291Berry, Bellaire, TX	1941-06-20
30	4	Wallace	291Berry, Bellaire, TX	1941-06-20

Query 2. For every project located in 'Stafford', list the project number, the controlling department number, and the department manager's last name, address, and birth date.

```
Q2:   SELECT   Pnumber, Dnum, Lname, Address, Bdate
      FROM     PROJECT, DEPARTMENT, EMPLOYEE
      WHERE    Dnum=Dnumber AND Mgr_ssn=Ssn AND
               Plocation='Stafford';
```

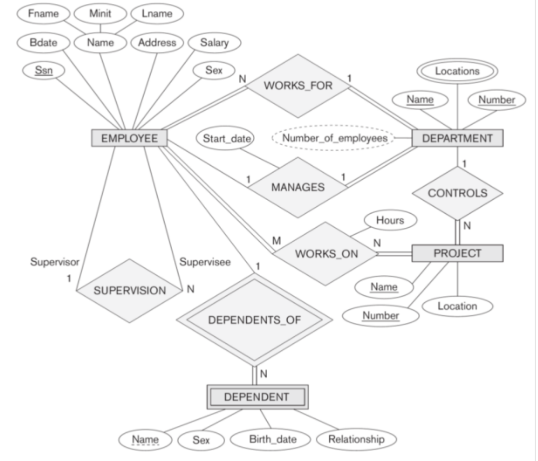
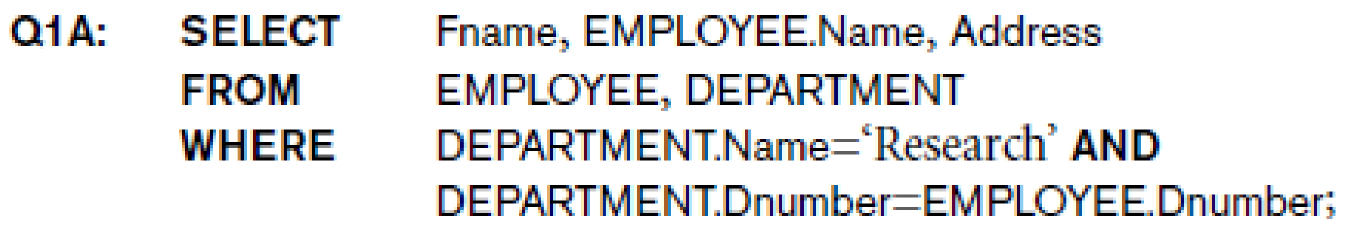


Figure 9.1
The ER conceptual schema diagram for the COMPANY database.

Ambiguous Attribute Names

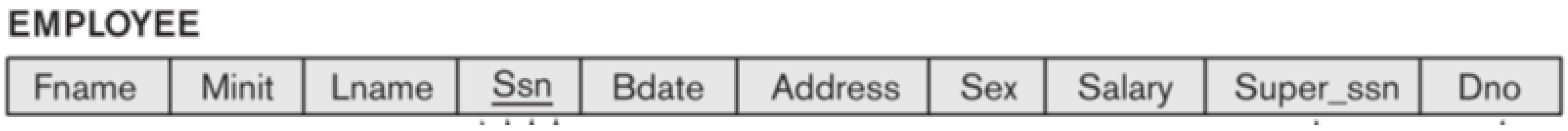
- Same name can be used for two (or more) attributes
  - As long as the attributes are in different relations
  - Must **qualify** the attribute name with the relation name to prevent ambiguity
    - 'name': employee.name or department.name?



```
Q1A:   SELECT   Fname, EMPLOYEE.Name, Address
       FROM     EMPLOYEE, DEPARTMENT
       WHERE    DEPARTMENT.Name='Research' AND
                DEPARTMENT.Dnumber=EMPLOYEE.Dnumber;
```

Aliasing, Renaming, and Tuple Variables

- **Aliases** or **tuple variables**
  - Declare alternative relation names E and S
  - `EMPLOYEE AS E(Fn, Mi, Ln, Ssn, Bd, Addr, Sex, Sal, Sssn, Dno)`

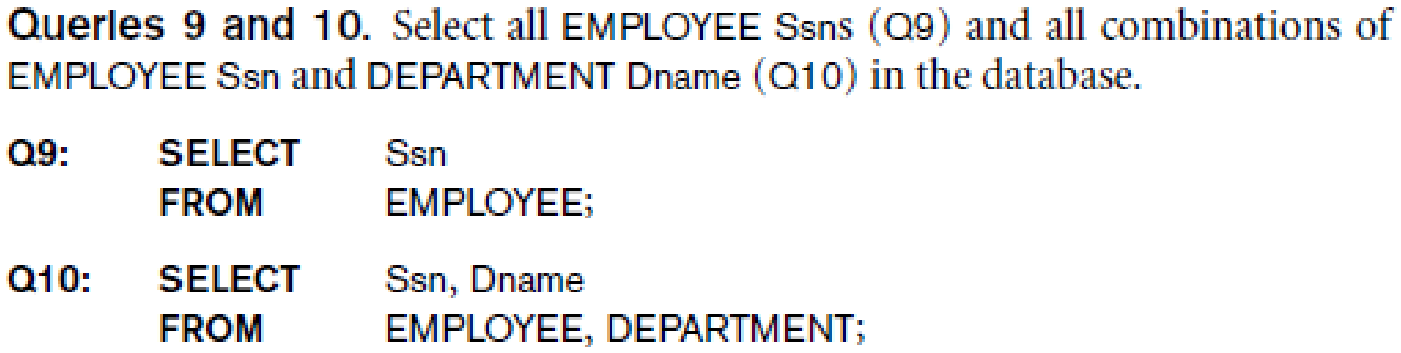


EMPLOYEE

Fname	Minit	Lname	Ssn	Bdate	Address	Sex	Salary	Super_ssn	Dno

Unspecified WHERE Clause and Use of the Asterisk

- Missing `WHERE` clause
  - Indicates <u>no condition </u>on tuple selection
- `CROSS PRODUCT`
  - All possible tuple combinations



Queries 9 and 10. Select all EMPLOYEE Ssns (Q9) and all combinations of EMPLOYEE Ssn and DEPARTMENT Dname (Q10) in the database.

```
Q9:     SELECT   Ssn
        FROM     EMPLOYEE;

Q10:    SELECT   Ssn, Dname
        FROM     EMPLOYEE, DEPARTMENT;
```

Unspecified WHERE Clause and Use of the Asterisk (cont'd.)

- Specify an asterisk (*)
  - Retrieve <u>all the attribute values</u> of the selected tuples

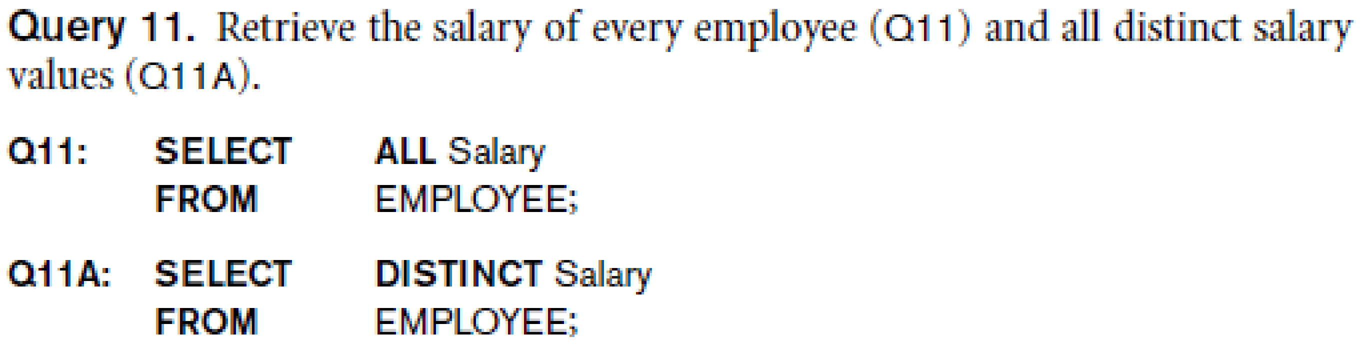
```
Q1C:    SELECT    *
        FROM      EMPLOYEE
        WHERE     Dno=5;

Q1D:    SELECT    *
        FROM      EMPLOYEE, DEPARTMENT
        WHERE     Dname='Research' AND Dno=Dnumber;

Q10A:   SELECT    *
        FROM      EMPLOYEE, DEPARTMENT;
```

Tables as Sets in SQL

- SQL does not automatically eliminate <u>duplicate tuples</u> in query results
- Use the keyword **<u>`DISTINCT`</u>** in the `SELECT` clause
  - Only distinct tuples should remain in the result



Query 11. Retrieve the salary of every employee (Q11) and all distinct salary values (Q11A).

```
Q11:    SELECT    ALL Salary
        FROM      EMPLOYEE;

Q11A:   SELECT    DISTINCT Salary
        FROM      EMPLOYEE;
```

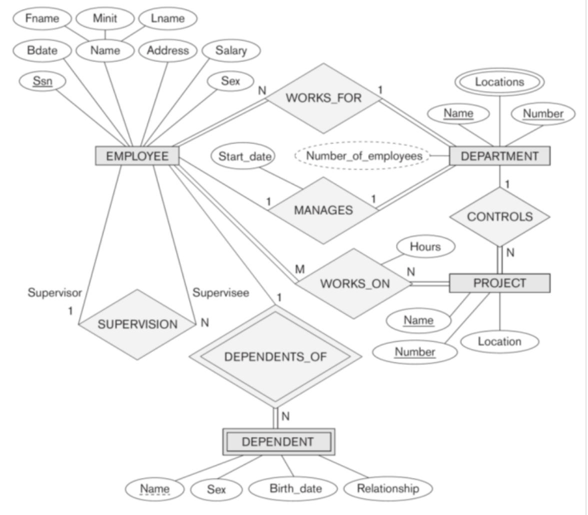
Tables as Sets in SQL (cont'd.)

- Set operations
  - `UNION`, **`EXCEPT`** (difference), **`INTERSECT`**
  - Corresponding multiset operations: `UNION ALL`, `EXCEPT ALL`, `INTERSECT ALL`)
    - Results are multisets: Duplicates are not eliminated

Query 4. Make a list of all project numbers for projects that involve an employee whose last name is 'Smith', either as a worker or as a manager of the department that controls the project.

```
Q4A:  ( SELECT   DISTINCT Pnumber
        FROM     PROJECT, DEPARTMENT, EMPLOYEE
        WHERE    Dnum=Dnumber AND Mgr_ssn=Ssn
                 AND Lname='Smith' )
        UNION
      ( SELECT   DISTINCT Pnumber
        FROM     PROJECT, WORKS_ON, EMPLOYEE
        WHERE    Pnumber=Pno AND Essn=Ssn
                 AND Lname='Smith' );
```

Figure 9.1
The ER conceptual schema diagram for the COMPANY database.



Substring Pattern Matching and Arithmetic Operators

- **`LIKE`** comparison operator
  - Used for string **pattern matching**
  - % replaces an arbitrary number of zero or more characters
  - underscore (_) replaces a single character
- Standard arithmetic operators:
  - Addition (+), subtraction (–), multiplication (*), and division (/)
- **`BETWEEN`** comparison operator

Ordering of Query Results

- Use **`ORDER BY`** clause
  - Keyword **`DESC`** to see result in a descending order of values
  - Keyword **`ASC`** to specify ascending order explicitly
  - `ORDER BY D.Dname DESC, E.Lname ASC, E.Fname ASC`

Discussion and Summary of Basic SQL Retrieval Queries

```
SELECT        <attribute list>
FROM          <table list>
[ WHERE       <condition> ]
[ ORDER BY <attribute list> ];
```

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INSERT, DELETE, and UPDATE Statements in SQL

- Three commands used to modify the database:
  - `INSERT`, `DELETE`, and `UPDATE`

The INSERT Command

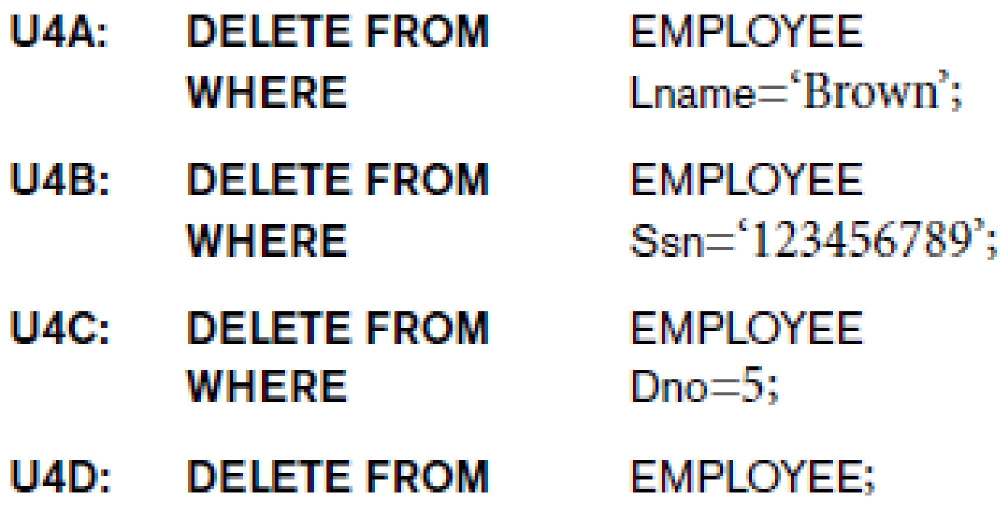
- Specify the relation name and a list of values for the tuple

```
U1:     INSERT INTO    EMPLOYEE
        VALUES         ( 'Richard', 'K', 'Marini', '653298653', '1962-12-30', '98
                         Oak Forest, Katy, TX', 'M', 37000, '653298653', 4 );

U3B:    INSERT INTO    WORKS_ON_INFO ( Emp_name, Proj_name,
                       Hours_per_week )
        SELECT         E.Lname, P.Pname, W.Hours
        FROM           PROJECT P, WORKS_ON W, EMPLOYEE E
        WHERE          P.Pnumber=W.Pno AND W.Essn=E.Ssn;
```

The DELETE Command

- Removes tuples from a relation
  - Includes a `WHERE` clause to select the tuples to be deleted



```
U4A:    DELETE FROM     EMPLOYEE
        WHERE           Lname='Brown';

U4B:    DELETE FROM     EMPLOYEE
        WHERE           Ssn='123456789';

U4C:    DELETE FROM     EMPLOYEE
        WHERE           Dno=5;

U4D:    DELETE FROM     EMPLOYEE;
```

The UPDATE Command

- Modify attribute values of one or more selected tuples
- Additional **SET** clause in the UPDATE command
  - Specifies attributes to be modified and new values

```
U5:     UPDATE    PROJECT
        SET       Plocation = 'Bellaire', Dnum = 5
        WHERE     Pnumber=10;
```

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Additional Features of SQL

- Techniques for specifying complex retrieval queries
- Writing programs in various programming languages that include SQL statements
- Set of commands for specifying physical database design parameters, file structures for relations, and access paths
- Transaction control commands

Additional Features of SQL (cont'd.)

- Specifying the granting and revoking of privileges to users
- Constructs for creating triggers
- Enhanced relational systems known as object-relational
- New technologies such as XML and OLAP

MySQL: Select

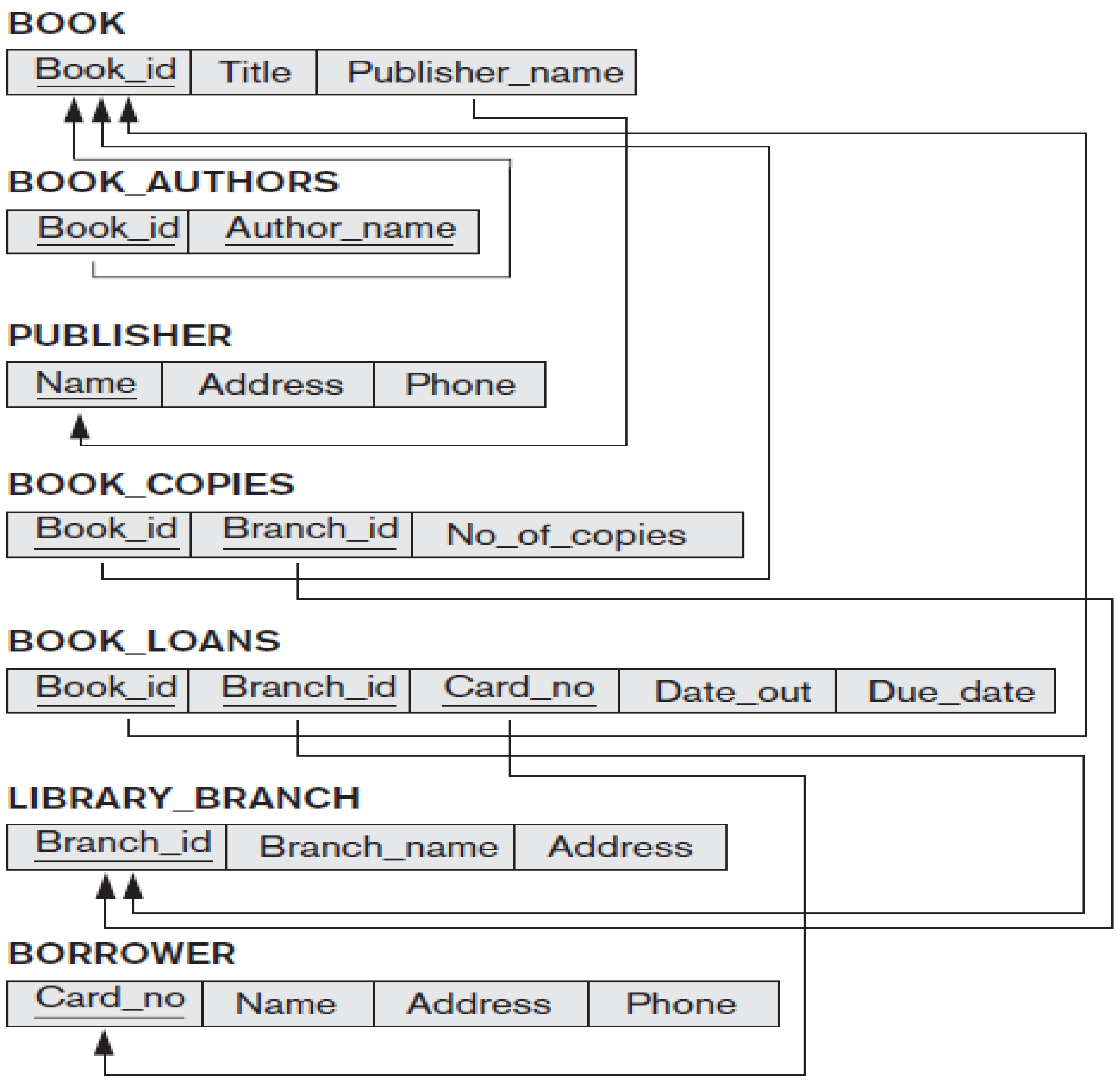
- The **general** syntax of the MySQL SELECT query is rather complex ☺

SELECT [ALL | DISTINCT | DISTINCTROW] [HIGH_PRIORITY] [STRAIGHT_JOIN] [SQL_SMALL_RESULT] [SQL_BIG_RESULT] [SQL_BUFFER_RESULT] [SQL_CACHE | SQL_NO_CACHE] [SQL_CALC_FOUND_ROWS] *select_expr*, ... [FROM *table_references* [WHERE *where_condition*] [GROUP BY {*col_name* | *expr* | *position*} [ASC | DESC], ... [WITH ROLLUP]] [HAVING *where_condition*] [ORDER BY {*col_name* | *expr* | *position*} [ASC | DESC], ...] [LIMIT {[*offset*,] *row_count* | *row_count* OFFSET *offset*}] [PROCEDURE *procedure_name*(*argument_list*)] [INTO OUTFILE '*file_name*' *export_options* | INTO DUMPFILE '*file_name*' | INTO @*var_name* [, @*var_name*]] [FOR UPDATE | LOCK IN SHARE MODE]]

Summary

- SQL
  - Comprehensive language
  - Data definition, queries, updates, constraint specification, and view definition
- Covered
  - Data definition commands for creating tables
  - Commands for constraint specification
  - Simple retrieval queries
  - Database update commands

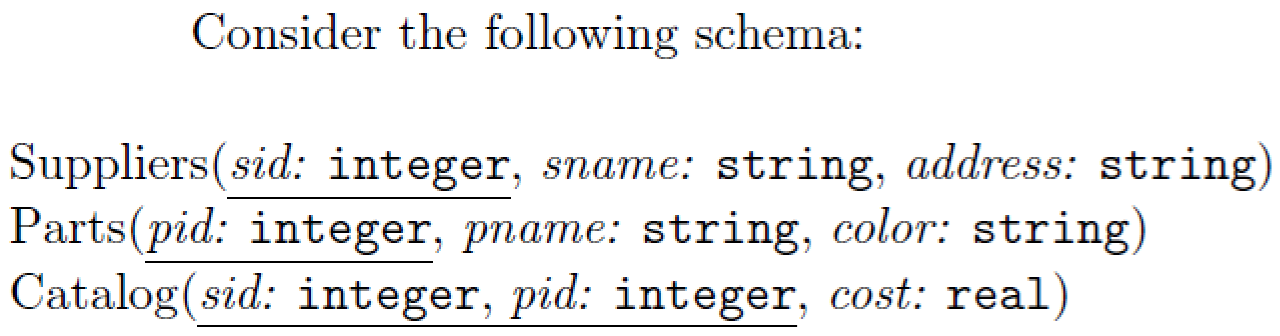
Quiz 1


BOOK
Book_id
Title
Publisher_name
BOOK_AUTHORS
Book_id
Author_name
PUBLISHER
Name
Address
Phone
BOOK_COPIES
Book_id
Branch_id
No_of_copies
BOOK_LOANS
Book_id
Branch_id
Card_no
Date_out
Due_date
LIBRARY_BRANCH
Branch_id
Branch_name
Address
BORROWER
Card_no
Name
Address
Phone

Quiz 1

- Write <u>Select</u> for:
  - “select the name of all the book authors that their books are copied at least 5000 and are borrowed by at least 10 people (borrower)”

Quiz 2



Consider the following schema:

Suppliers(*sid:* `integer`, *sname:* `string`, *address:* `string`)
Parts(*pid:* `integer`, *pname:* `string`, *color:* `string`)
Catalog(*sid:* `integer`, *pid:* `integer`, *cost:* `real`)

- Find the *pname*s of parts for which there is some supplier.
- Find the *sid*s of suppliers who supply a red part and a green part.
- Find the *sid*s of suppliers who supply a red part or a green part.