DDL part of SQL:
Creating (CREATE),
Modifying (ALTER), and
Removing (DROP)

Catalogs
Schemas
Relations (Tables)
Constraints
Domains

CREATE TABLE

• create base tables
• declare domains for attributes
• declare NOT NULL constraints
• declare primary key (PRIMARY KEY)
• declare foreign keys (FOREIGN KEY)
• declare candidate keys (UNIQUE)
• storage information

CREATE TABLE Example in Access
CREATE TABLE department (
    dname Text UNIQUE NOT NULL,
    dnumber Integer PRIMARY KEY,
    mgrssn Integer REFERENCES employee,
    mgrstartdate Date
);
CREATE TABLE Example in Access
CREATE TABLE dependent (essn Integer, dependent_name Text, sex Text, bdate Date, relationship Text);
CONSTRAINT deppk PRIMARY KEY (essn, dependent_name),
CONSTRAINT empfk FOREIGN KEY (essn) references employee;

Tables and Data Types (SQL2)
Numeric: integer(n) (SQLServer: int) decimal(p,s) (or number(p,s))
Character: char(n) varchar(n)
Other: date time (SQLServer: datetime)

Tables and Data Types (Access)
Numeric: number, integer
Character: text (only up to 255 characters)
Other: Yes/No Date/Time Currency (15 + 4) Memo (64K text) Hyperlink OLE Object Autonumber
Constraints and Default Values

For each attribute:
- **NOT NULL** to force non-null values
- **DEFAULT** value to specify default value

For table:
- **PRIMARY KEY** (primary key)
- **UNIQUE** (candidate/secondary keys)
- **FOREIGN KEY ... REFERENCES ...** (foreign keys)

Referential Triggered Action I

We can specify actions if referential integrity of a foreign key is violated:
- **SET NULL**
- **SET DEFAULT** (not in Access)
- **CASCADE**

Specified as
- **ON UPDATE/DELETE**
- **SET NULL/SET DEFAULT/CASCADE**

Referential Triggered Action II

Example (CASCADE)
- `CREATE TABLE dependent ( ... FOREIGN KEY (essn) REFERENCES employee ON DELETE CASCADE, ...)`

Example (SET NULL)
- `CREATE TABLE employee ( FOREIGN KEY (dno) REFERENCES department ON DELETE SET NULL, ...)`

Example (SET DEFAULT)
- `CREATE TABLE employee (... dno INT NOT NULL DEFAULT 1,... FOREIGN KEY (dno) REFERENCES department, ON DELETE SET DEFAULT ...)`
Referential Triggered Action III

Find further examples for
ON UPDATE CASCADE
ON DELETE CASCADE
ON DELETE SET NULL
ON DELETE SET DEFAULT

Find strategies for foreign keys in company database

Dropping Tables

Drop behaviors: cascade and restrict

DROP TABLE Dependent CASCADE;

only drops if no
element of table
is referenced

DROP TABLE Dependent RESTRICT;

Altering Tables

ALTER TABLE table_name
 ADD attribute;
 ADD constraint;
 DROP attribute [CASCADE|RESTRICT]
 DROP constraint_name [CASCADE|RESTRICT]
 ALTER attribute [DROP DEFAULT]
 SET DEFAULT value]
**Altering Tables Examples**

ALTER TABLE employees
   ADD Age   Number;

ALTER TABLE employees
   ADD FOREIGN KEY dno REFERENCES Department(dnumber);

ALTER TABLE employees
   DROP empsuperfk;

**Dependencies between Tables**

Some systems do not allow references to tables that do not exist yet.

Two solutions:
- if no cyclical dependencies:
  create tables in right order
- in case of cyclical dependencies:
  create tables without f.k. constraints,
  and use ALTER TABLE to add these later
  (Example: companyaccess.sql)

**Views**

A view is a virtual table based on one or more defining tables; in SQL it is created as the result of a select query.

CREATE VIEW view_name
   AS SELECT … ;

Or (to name columns)

CREATE VIEW view_name(column names)
   AS SELECT … ;
Views in Access

Access considers views identical to stored queries.
You can store a query, and use it by name in another query.

Views Examples

- Create a department info view with: name of department, number of employees, and total salary
- Create a project info view with: name of project, number of employees working on it, and total hours spent on the project
- Create an employee info view with: name of employee, age, salary, and write a query that lists all employees older than an age entered by the user that make less than $35,000.

View Implementation

- Query modification
- View materialization (incremental update)
View Updates

Updating views can be problematic:

• Changing views on single tables without aggregates usually works (view should contain primary key).

• What does it mean to increase the number of employees in the depts_info view? (Problem: aggregate functions)