



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 entity integrity constraints (NOT NULL)
- declare primary key (PRIMARY KEY)
- declare foreign keys (FOREIGN KEY)
- declare candidate keys (UNIQUE)
- Storage information



CREATE TABLE Example

```
CREATE TABLE enrolled (  
  StudentID  number(5),  
  CourseID   number(4),  
  Quarter    varchar(6),  
  Year        number(4),  
  
  primary key (StudentID, CourseID),  
  foreign key (StudentID) references student(SID),  
  foreign key (CourseID) references course(CID)  
);
```

from university.sql example



CREATE TABLE Syntax

```
CREATE TABLE table_name
(
  attribute_name datatype[(length)]
    [NULL|NOT NULL]
    [DEFAULT (value)]
    [CHECK (condition)],
  ...,
  PRIMARY KEY(attribute_name(s)),
  [FOREIGN KEY(attribute_name(s))
    REFERENCES table_name(attribute_name(s)), ...]
  [UNIQUE(attribute_name(s)), ...]
);
```



Data Types (SQL2)

Numeric:
 integer
 integer(n)
 decimal(p,s)

Character:
 char(n)
 varchar(n)

Other:
 date
 time

p: precision (total #digits)
 s: scale (#digits after .)



Numeric Data Types (Oracle)

number(p,s) ← p: precision (total # significant digits)
 s: scale (#digits after .)

number (p) = number(p,0) (integers)

number (maximum range floating point)

float(n) (ANSI floating point)

Operators, relations, functions:
 +, -, *, /
 <, >, =, <=, >=
 abs, sin, exp, power, floor, log, mod

Example: SELECT power(2,8) FROM dual;



Character Data Types (Oracle)

char(n) fixed length string of n characters

char = char(1)

varchar(n) = varchar2(n) variable length string of n characters

Operators, relations, functions:

|| concatenation
concat, trim, replace, regexp_replace, least, greatest

Example: SELECT least('Huey', 'Dewey', 'Louie')
 FROM dual;



Date Data Types (Oracle)

date year, month, day, hour, minute, seconds

timestamp year, month, day, fractional seconds
(also: interval types)

Operators, relations, functions:

+, - add/subtract integers (days)
sysdate current date (on computer)
current_date current date (in session time-zone)
to_date(date, format), to_char (date)

Examples:
SELECT to_date('2011-01-07', 'YYYY-MM-DD') - 10 FROM dual;
SELECT to_date('29-FEB-2008', 'DD-MON-YYYY') + to_ymininterval('1-0')
FROM DUAL;

See http://download.oracle.com/docs/ed/B19306_01/server.102/b14200/functions001.htm#88891



CREATE DOMAIN

CREATE DOMAIN *attribute_name* AS *datatype*;
(not in Oracle, but: user-defined types)

Example (SQL2):

CREATE DOMAIN ssn_type AS char(9);

CREATE DOMAIN name_type AS varchar(15);

CREATE TABLE employee
(fname name_type NOT NULL,
 minit char,
 lname name_type NOT NULL,
 ssn ssn_type, ...);



Constraints and Default Values

For each attribute:

NOT NULL	to force non-null values
DEFAULT <i>value</i>	to specify default value
PRIMARY KEY	for single-attribute p.k.
UNIQUE	for unique field
CHECK (<i>condition</i>)	checks condition

For table:

PRIMARY KEY	(primary key)
UNIQUE	(candidate/secondary keys)
FOREIGN KEY ... REFERENCES ...	(foreign keys)

In Oracle: Default values before Constraints



Constraints and Default Values

Example (Oracle):

```
CREATE TABLE student (
  LastName    varchar(40),
  FirstName   varchar(40),
  SID         number(5),
  SSN        number(9),
  Career     varchar(4) CHECK (Career in ('GRD', 'UGRD')),
  Program    varchar(10) DEFAULT ('COMP-SCI') NOT NULL,
  City       varchar(40),
  Started    number(4),
```

```
    primary key (SID),
    unique(SSN)
);
```



Constraints Naming

Constraints can be named for later reference:

- to be dropped
- to be altered

```
CREATE TABLE studentgroup (
  GID         number(5),
  Name       varchar(40),
  PresidentID number(5),
  Founded    number(4)
    CONSTRAINT cstr_sg_fd_nn not null ,
```

```
    primary key (GID),
    unique (Name),
    foreign key (PresidentID) references student(SID)
);
```



Dropping Tables

Drop behaviors: cascade and restrict

```
DROP TABLE Dependent RESTRICT;
```

only drops if no
element of table
is referenced

```
DROP TABLE Dependent CASCADE;
```

drops table and
f.k. constraints
which would be
violated

In Oracle restrict is default, cascade is specified
CASCADE CONSTRAINTS



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 student
  ADD age number(3,0);
```

Exercise: Add a (named) constraint that $0 \leq \text{age} \leq 120$

```
ALTER TABLE studentgroup
  ADD FOREIGN KEY(PresidentID) REFERENCES
  Student(SID);
```

```
ALTER TABLE studentgroup
  ADD CONSTRAINT fk_sg
  FOREIGN KEY(PresidentID) REFERENCES
  Student(SID);
```

```
ALTER TABLE studentgroup
  DROP fk_sg;
```



Dependencies between Tables

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

Two solutions:

if no cyclical dependencies:

create tables in right order
(Example: university.sql)

in case of cyclical dependencies:

create tables without f.k. constraints,
and use ALTER TABLE to add
these later
