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_yminterval('1-0')
FROM DUAL;
```

See http://download.oracle.com/docs/cd/B19306_01/server.102/b14200/functions001.htm#i88891

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 *value*	to specify default value
PRIMARY KEY	for single-attribute p.k.
UNIQUE	for unique field
CHECK (*condition*)	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 <= age <= 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