CS122 Using Relational Databases and SQL
DDL and DML

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Queries vs. Updates

- Queries – statements that do not change the data
- *Updates*
  - Create, delete, and change tables
  - Create, delete, and change data in the tables

SQL

- Data Definition Language (DDL)
  - `CREATE`, `DROP`, `ALTER`
- Data Manipulation Language (DML)
  - `SELECT`, `INSERT`, `DELETE`, `UPDATE`
- Data Control Language (DCL)
  - `GRANT`, `REVOKE`
  - `COMMIT`, `ROLLBACK`, `SAVEPOINT`

Create a Table

```
create table table_name (
    column_name    column_type,
    column_name    column_type,
    …
    column_name    column_type
);
```

Create the `Products` Table

```
create table products (
        id              integer,
        category        char(3),
        description     varchar(4096),
        price           decimal(10,2)
);
```

Delete a Table

```
drop table table_name;
```

MySQL only:

```
drop table if exists table_name;
```

Naming Conventions

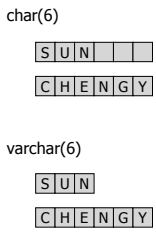
- Use plural form for table names
- Use singular form for column names
- Use underscore to concatenate multiple words, e.g. `employee_id`
  - Do not use mixed cases in names (e.g. `ArtistName`) because many DBMS treat names as case-insensitive

Data Type

- Determines the storage required for a field
- Common data types
  - String types
  - Numeric types
  - Date and time types
  - Other types

String Types

- `char(n)`
  - Fixed-length strings
  - Max length n
- `varchar(n)`
  - Variable-length strings
  - Max length n
- text
  - For articles, essays, …



Numeric Types

- Integer types
  - `integer`, `int`
  - Variations: `smallint`, `bigint`, `long`, …
- Floating-point types
  - `real`
  - Variations: `float`, `double`, …
- Arbitrary precision number
  - `decimal(m,n)`
  - `numeric(m,n)`
- Boolean
  - `boolean`, `bool`

Date and Time Types

- `date` – YYYY-MM-DD
- `time` – HH:MM:SS
- `datetime` – YYYY-MM-DD HH:MM:SS
- `timestamp` – YYYY-MM-DD HH:MM:SS

MySQL Storage Engines

- MyISAM
  - *Default*
  - Does *not* support transactions and some integrity constraints
- InnoDB
  - Supports transactions and integrity constraints
- Memory, BDB, NDB, …

```
create table products (
        id              integer,
        category        char(3),
        description     varchar(4096),
        price           decimal(10,2)
) Engine=InnoDB;
```

Data Integrity Constraints

- Not NULL
- Default
- Unique
- Primary key
  - Unique + Not NULL
  - Only one primary key per table
- Check

Column Constraint Syntax

```
create table products (
        id              integer primary key,
        category        char(3) not null,
        description     varchar(4096) default 'Some product',
        price           decimal(10,2) not null check(price > 0)
);
```

Table Constraint Syntax

```
create table products (
        id              integer,
        category        char(3) not null,
        description     varchar(4096) default 'Some product',
        price           decimal(10,2) not null,
    primary key (id),
    check (price > 0)
);
```

Named Constraints

```
create table products (
        id              integer,
        category        char(3) not null,
        description     varchar(4096) default 'Some product',
        price           decimal(10,2) not null,
    constraint products_pk primary key (id),
    constraint products_price_gt0 check (price > 0)
);
```

Foreign Key Constraints

orders

id	customer_id	date_ordered	date_shipped

order_details

order_id	product_id	quantity

- Ensure that the value of `order_id` is valid, i.e. the value appears in the `id` column of the `orders` table

Foreign Key Constraint Example

```
create table order_details (
        order_id        integer not null references orders(id),
        product_id      integer not null,
        quantity        integer not null check(quantity>0),
    foreign key (product_id) references products(id),
    primary key (order_id, product_id)
);
```

Modify a Table

alter table *table_name operation*;

- Common operations
  - Add, remove, rename, retype columns
  - Add, remove constraints
- *Exactly what operation are supported depends on the DBMS*
  - *http://dev.mysql.com/doc/refman/5.0/en/alter-table.html*

Alter Table Example

- Split the `address` column in the `customers` table into four columns: `street`, `city`, `state`, `zip`

Populate Tables with Data

insert into table values (value1, value2, …);

insert into table (field, …) values (value, …);

- Example: insert the following data into the `Products` table
  - WD 500G Hard drive for $100.00
  - Nvidia 7600GS video card for $104.99

Insert the Results of a Query

insert into table *select_query*;

insert into table (field, …) *select_query*;

Delete Data

delete from table [where condition(s)];

- Examples:
  - Delete the product with id=2
  - Delete all CPU products
  - Delete all products

Update Data

update table set field=value [, …] where condition(s);

- Examples:
  - Change the price of Intel Core 2 Duo to $149.99
  - Change the last name of Jane from DOE to Doe
  - Raise the price of all CPU products by 10%

Summary

- Remember what can be done
  - Create, alter, drop tables
    - Data types
    - Data integrity constraints
  - Insert, update, delete data
- Look up DBMS manual for the syntax