

Assumption

- You have knowledge on DBMS
- You have knowledge on SQL (Structured Query Language)
- You have installed MySQL and have the MySQL server running on your system.
- Things in[] are optional in definition.

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Using MySQL Command Line

- Simple commands:
 - use <database>;
 - show tables;
- Create a table:
 - create table users (
 - id varchar(16),
 - name(32),
 - studentno int(6),
 - phone char(8),
 - form char(1),
 - primary key (id));
- You can check the tables by
 - describe users

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Creating a booking database

- create table booking (
 - bookid int(11) not null auto_increment,
 - booktime datetime,
 - userid varchar(16),
 - primary key (bookid));

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Column Data Types

- MySQL supports 3 column types: text, numeric and date.
- TEXT:
 - char (length)
 - varchar(length) – limited to 255 chars
 - enum(value1, value2, ..)
- NUMERIC
 - int (display_size) [unsigned][zerofill] – add zero on the left up to display size
 - double/float [(display_size[,decimals])] [zerofill]
 - decimal [(display_size[,decimals])[zerofill]

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- Decimal stores floating numbers as strings, one char for each digit, negative sign and decimal point.
- Default display size and decimal for Decimal type is 10 & 0.
- DATE type:
 - date – YYYY-MM-DD format
 - datetime – YYYY-MM-DD HH:MM:SS
 - timestamp – automatically store the last date & time a record was updated.
 - time – HH:MM:SS
 - year[(2|4)] – store year in 2 digit format, from 1970-2069.


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Column Attributes

- **auto_increment** : the first record will be stored with value 1, 2nd 2, etc. The column must be defined as unique or as a primary key.
- **default** – provide a default value
- **not null** – null value is not allowed
- **primary key** – define the column as primary keys.


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Indexes and Primary Keys

- MySQL can create indexes on columns to speed up access.
- Use the following in create table command:
index <index_name> (<column_name>)
- Supplying a name of the index is not mandatory.
- You can also create a primary key, which is a special type of index, acting as a unique key for each row in the table.
- Primary keys need to be unique, you can use an auto_increment column as a key.


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Altering Tables


- **Changing table name**
alter table <table_name> rename <new_table_name>;
- **Adding columns**
alter table <table_name> add column <column_name> <column_type>
<column parameters>
 - Column parameters define where to add the column:
first, last, before <col_name>, after <col_name>.
- **Changing column definition**
alter table <table_name> change <old_column_name>
<new_column_name> <column_attributes>
 - You can specify the same name for old and new column name, if you just want to change the definition of the column, or use MODIFY.

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- Alter table <table_name> modify <column_name>
<column_type> <column attributes>;
- **Dropping columns** – remove a column
alter table <table_name> drop column <column_name>;
- **Changing primary keys and indexes:**
alter table drop index <index_name>;
alter table add index <index_name> (column_name);
alter table add primary key (<column_name>);
- **Dropping tables:**
drop table <table_name>;


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Other information

- Show databases;
show tables;
describe <table_name>;
show index from <table_name>;
show create table <table_name>;
show the command for creating that table,
can be used to duplicate a table.


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MySQL Queries - insert


- The insert query enables you to add data to an existing table.
Insert into <table_name>
(<column_list>) values (<value_list>);
- E.g.
insert into users (id,name,studentno,phone)
values ('kpchan', 'Kwok-Ping Chan', 123456,
'28592185');
- You can add more rows into the database using the insert command.

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- Strings in MySQL are enclosed using ' '.
- You can use \" if data contain single quote.
- MySQL also support \"\", but SQL standard uses \".
- The order you supplies the column names can be in any order.
- Alternatively, you can use:
insert into <table> set <column1>=<value1>,
<column2>=<value2>, ...;
- If values not specified, NULL values will be assumed.


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MySQL Query - select

- Select data from the database and display or parse it accordingly.
- Basic form:
select <column_list> from <table_name>;
e.g. select id, names from users;
select * from users;
- You can select with restriction
select <column_list> from <table_name>
where <condition>;
e.g. select id,name from users where form=5;


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Operators in where


- =, != (<>), >, <, >=, <=
- Can use a between operator:
E.g. Select id, name from users where form between 1 and 3;
- Using wildcard chars with like:
% - matches 0 or more chars
_ - matches one char
- E.g. select id,name from users where name like 'd%';

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- Use can use AND, OR etc to construct more complex query:
Select id, name from users where name like 'd%' and form=3;
- You can order the query result according to a particular column, default is ascending, or desc for descending order:
Select id,name from users where name like 'd%' order by studentno desc;
- You can add a limit to limit the number of rows to be displayed:
Select id,name from users where name like 'd%' order by studentno desc limit 5;


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Selecting from multiple tables

- For example, you want to check all bookings from students in form 3.
- First, find all students in form 3:
select id from users where form=3;
- From the result, then select one by one
select date from booking where userid=' ';
to find out all bookings from all students in form 3.

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- You can use
select booking.date from booking, users
where users.form=3 and
users.id=booking.userid;
- Use "." to define the fields from a particular table, e.g. booking.date and the date field from table booking.
- You may have same column names in different tables
- Joins in database

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Inner Join

- Select data based on two columns, each from a separate table, being equal.
- MySQL supports using inner join keyword
- Select booking.date, booking.userid from booking inner join users on booking.userid=users.id where users.id=kpchan

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Left Outer Join

- If the on clause matches 0 records in the 2nd table, a row in the result will still be returned but with NULL values for each column for the 2nd table.
- E.g. select booking.date, booking.userid from booking left outer join users on booking.userid=users.id;
- Note that if a booking.userid if not found in users, the row is still returned, with NULL entries in the columns of users.

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Counting result sets

- Use count() function to count the number of rows in the result set.
- select count(*) from users.
- Select form, count(*) from users where form=7 group by form;

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Deleting records

- delete from <table_name> [where <condition>];
- Condition is optional, it means you will delete all.
- E.g. delete from users where form=7;
- Note that delete cannot be undone!

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Updating records

- To update a record, use:
update <table_name> set
 <colname>=<value>,
 <colname>=<value>, ...
where <condition>
- E.g. update users set form=7 where form=6;
- Update users set form=form+1 where form!=7;

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Backing up/Restoring MySQL

- Use the program mysqldump to dump the database
- mysqldump -u root -p test will dump the database test
- The output is commands that can be used to restore the database.
- You can save it to a file using output redirection.

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- To restore, use
mysql -u root -p < dumpfile
on the command line.


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Designing your database


- Some guideline for database design
 - Think about the real world objects you are modeling.
 - Each class of real-world object will require its own table, e.g. users and booking in previous examples.
 - If you have different courts, then you also need another database for the courts.

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- Avoid storing redundant data
 - Why don't we store the users info in the same table as booking?
 - We have to store this information multiple times.
 - May lead to update anomalies.
 - Modification anomalies
 - Insertion anomalies
 - Deletion anomalies (e.g. loss of customer information once all rows involving that customers are deleted)


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- Use Atomic Column Values
 - Each attribute in each row store only one thing.
 - For example, if a customer ordered multiple items, do not store all items in one single row.
 - It would be difficult for further processing.
 - E.g. a customers order two books, and the following is stored:


orderid	custid	amount	date	books
1	3	102.5	1/10/06	Book1,Book2
2	4	32.6	11/11/06	Book2, Book3
 - Then querying the number of copies of Book2 sold can be very troublesome.

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- Choose Sensible Keys
 - Keys chosen should be unique
 - E.g. unique user-id, cust-id, Book-id (ISBN) etc.
- Think about the Questions you want to ask the database
 - Make sure database contains all data required.
 - Appropriate link exists between tables

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- Avoid designs with many NULL attributes
 - Waste storage
 - When a user sees a NULL in a table, they don't know if the value is irrelevant, or there is a mistake, or data not yet entered.
 - Use alternate design, e.g. add additional tables.
 - E.g. a book company want to add a book review section to book entries. Since this book review may be sparse, try to use a separate table for book reviews, rather than adding a column for every records.


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First Normal Form

- Database are in 1NF if it observes the following rules:
 - Ensure that each table has a primary key
 - Eliminate repeating groups
 - Each attribute must contain a single value, not a set of values.
- In the book order example, we have to separate each book order into different rows.


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Second Normal Form

- The database meet all requirements of the 1NF
- Data which is redundantly duplicated across multiple rows of a table is moved out to a separate table.
- E.g. for a book database, you can move the author, publishers to a different table.

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Third Normal Form

- 3NF requires that data stored in a table be dependent only on the primary key, and not on any other field in the table.
 - The database must meet all the requirements of 2NF
 - Any field that is dependent not only on the primary key but also on another field is moved out to a separate table.

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