

8 Databases – Part 2

Name: _____ Class: _____ Date: _____

Vocabulary 词汇

Write each word three times. 把每个单词抄写三遍。

English	中文	Write it 3 times (English)		
entity	实体	_____	_____	_____
entity-relationship diagram	实体关系图	_____	_____	_____
cardinality	基数	_____	_____	_____
link table	连接表	_____	_____	_____
normal forms	范式	_____	_____	_____
Data Definition Language	数据定义语言	_____	_____	_____
Data Manipulation Language	数据操纵语言	_____	_____	_____
join	连接	_____	_____	_____
aggregate functions	聚合函数	_____	_____	_____

Recall

In **Part 1** you met the relational model (tables, records, fields, primary and foreign keys), referential integrity, and a simple **SELECT** query. Part 2 adds diagramming a database, tidying it up, and more SQL.

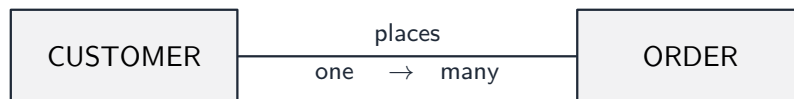
New ideas

Read these first. Each idea has a short worked example. Then do the Practice.

■ 1 Entity-relationship (E-R) diagrams

An **entity** 实体 is a thing we store data about (a **CUSTOMER**). An **entity-relationship diagram** 实体关系图 draws each entity as a box joined by relationship lines, marked with the **cardinality** 基数:

- *one-to-one*, *one-to-many* (one customer has many orders), *many-to-many*.



A many-to-many relationship can't be stored directly — you add a **link table** 连接表 holding the two foreign keys (e.g. an **ENROLMENT** table between **STUDENT** and **COURSE**).

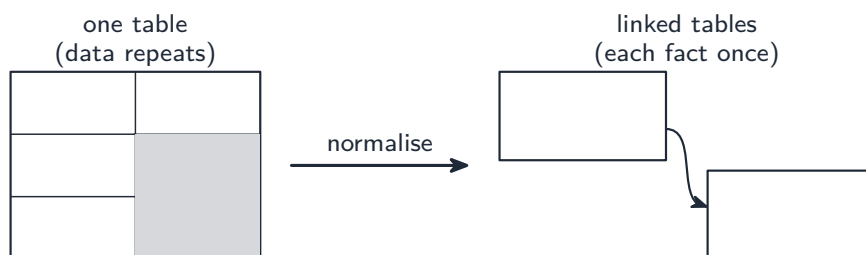
Worked example. **STUDENT** and **COURSE** are many-to-many (a student takes many courses; a course has many students), so an **ENROLMENT** link table holds both keys.

■ 2 Normalisation

Normalisation organises tables into **normal forms** 范式 to remove repeated data:

- **1NF** — every field holds a single value (no repeating groups), with a primary key;
- **2NF** — no field depends on only *part* of a composite key;
- **3NF** — no non-key field depends on another non-key field.

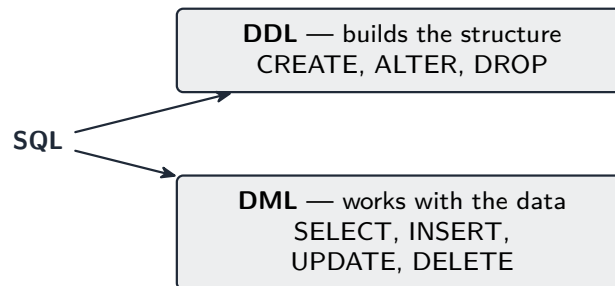
Aim for **3NF**: each fact is stored once, so updates can't make copies disagree.



Worked example. A table that repeats a customer's name beside each of their orders is moved towards 3NF by holding the name once in a **CUSTOMER** table and linking by key.

■ 3 SQL: DDL and DML

SQL has two halves: **Data Definition Language** 数据定义语言 (DDL) builds the *structure*, and **Data Manipulation Language** 数据操纵语言 (DML) works with the *data*. A **join** 连接 combines two tables on a key; **aggregate functions** 聚合函数 (COUNT, SUM, AVG) summarise rows.



```
SELECT Name, Phone
FROM   CUSTOMER
WHERE  City = 'London'
ORDER BY Name;
```

Worked example. CREATE TABLE (DDL) builds an empty table; INSERT INTO (DML) then adds rows of data into it.

Watch out: a JOIN needs a key that appears in *both* tables — with no shared key field you cannot link them.

Practice

8.1 A customer can place many orders, but each order belongs to one customer. State the cardinality of this relationship. [1]

8.2 State whether CREATE TABLE is a DDL or a DML statement. [1]

8.3 State how a many-to-many relationship is stored in a relational database. [1]

8.4 State what it means for a table to be in first normal form (1NF). [2]

8.5 Write a SQL query that selects the **Name** of every row in a table **STUDENT** where the **Grade** is greater than 80. [3]

8.6 Explain *why* aiming for 3NF (each fact stored once) makes a database safer to update. [2]

8.7 Challenge. Write a SQL query that counts how many rows are in a **CUSTOMER** table. [2]