

## 基本概念

- **关系数据库**，基于关系模型，使用关系（表）存储数据，同时定义了完整性约束。常见的关系数据库系统包括：Oracle、MySQL/MariaDB、SQL Server、PostgreSQL 等等。
- **SQL**，结构化查询语言，访问和操作关系数据库的标准语言。SQL 具有声明性，是一种面向集合的编程语言。

## 单表查询

```
SELECT col1, col2 AS c2      -- 列别名
FROM t;                      -- 基本查询

SELECT * FROM t;             -- 查询所有字段

SELECT col1, col2, ...
FROM t
WHERE conditions;            -- 过滤条件

SELECT col1, col2, ...
FROM t
ORDER BY col1 ASC, col2 DESC; -- 排序

SELECT col1, col2, ...
FROM t
ORDER BY col1 ASC, col2 DESC
OFFSET m ROWS
FETCH FIRST n ROWS ONLY;     -- 限定数量
-- LIMIT n OFFSET m;         -- 非标准实现

SELECT col1, col2, agg_fun() -- 聚合函数
FROM t
GROUP BY col1, col2          -- 分组汇总
HAVING conditions;           -- 分组后过滤
```

## 多表连接

```
SELECT t1.col1, t2.col2, ...
FROM t1
INNER JOIN t2 ON conditions; -- 内连接

SELECT t1.col1, t2.col2, ...
FROM t1
LEFT JOIN t2 ON conditions;  -- 左连接

SELECT t1.col1, t2.col2, ...
FROM t1
RIGHT JOIN t2 ON conditions; -- 右连接

SELECT t1.col1, t2.col2, ...
FROM t1
FULL JOIN t2 ON conditions;  -- 全连接

SELECT t1.col1, t2.col2, ...
FROM t1
CROSS JOIN t2 ON conditions; -- 交叉连接

SELECT a.col1, b.col2, ...
FROM t1 a
JOIN t1 b ON conditions;     -- 表别名
                             -- 自连接
```

## 集合运算

```
SELECT col1, col2, ...
FROM t1
UNION [ALL]
SELECT c1, c2, ...
FROM t2;                      -- 并集运算

SELECT col1, col2, ...
FROM t1
INTERSECT
SELECT c1, c2, ...
FROM t2;                      -- 交集运算

SELECT col1, col2, ...
FROM t1
EXCEPT -- MINUS
SELECT c1, c2, ...
FROM t2;                      -- 差集运算
```

## 子查询

```
SELECT col1,
      (subquery) AS c2      -- 标量子查询
FROM t;

SELECT col1, col2, ...      -- 行子查询
FROM t
WHERE (col1, col2) = (subquery);

SELECT t1.col1, t2.c2, ...
FROM t1
JOIN (subquery) t2          -- 表子查询
ON conditions;

SELECT t1.col1, t1.col2, ...
FROM t1
WHERE EXISTS (              -- 关联子查询
      SELECT 1
      FROM t2
      WHERE t2.c1 = t1.col1);
```

## 数据操作

```
INSERT INTO t(col1, col2, ...)
VALUES (val1, val2, ...);    -- 插入单条数据

INSERT INTO t(col1, col2, ...)
SELECT ...;                  -- 插入查询结果

UPDATE t
  SET col1 = val1,
      col2 = val2
  WHERE conditions;          -- 更新数据

DELETE
  FROM t
  WHERE conditions;          -- 删除数据

MERGE INTO t1                -- 合并数据
USING t2 ON (condition)
  WHEN MATCHED THEN
    UPDATE SET col1 = val1,
               col2 = val2,
               ...
  WHEN NOT MATCHED THEN
    INSERT (col1, col2, ...)
    VALUES (val1, val2, ...);
```

## 数据定义

```
CREATE TABLE t              -- 创建表
(
  col1 INT NOT NULL PRIMARY KEY,
  col2 VARCHAR(50) NOT NULL,
  col3 DATE
);

CREATE TABLE t(col1, col2, ...)
SELECT ... ;                 -- 基于查询结果创建表

ALTER TABLE t ADD col3 INT;  -- 增加字段
ALTER TABLE t RENAME COLUMN col1 TO c1;
ALTER TABLE t DROP COLUMN col1;

DROP TABLE t;               -- 删除表

TRUNCATE TABLE t;           -- 删除表中所有数据

CREATE VIEW v AS SELECT ...;  -- 创建视图
DROP VIEW v;                  -- 删除视图

CREATE [UNIQUE] INDEX idx     -- 创建索引
ON t(col1, col2);
DROP INDEX idx;               -- 删除索引
```

## 扩展内容

- 查询条件包括：=、!=、<>、<、<=、>、>=、BETWEEN、IN、EXISTS、LIKE、AND、OR、NOT、IS [NOT] NULL、ANY、ALL
- 完整性约束包括：PRIMARY KEY、NOT NULL、FOREIGN KEY、CHECK、UNIQUE、DEFAULT。
- 常见聚合函数：AVG、COUNT、SUM、MIN、MAX。