## 十四、Data Types（数据类型）

### 1. CHAR vs VARCHAR

Both CHAR and VARCHAR store text, but they differ in storage, retrieval, and performance.  
CHAR 与 VARCHAR 都用于存储文本，但在存储方式、读取方式和性能上有所不同。  
  
CHAR (Fixed Length):  
- Fixed number of characters, always fills up the declared size.  
- When stored, MySQL pads with spaces; when retrieved, trailing spaces are removed.  
- Faster for fixed-length text (like state abbreviations, zip codes, Y/N fields).  
  
CHAR 固定长度字段，不足长度会自动补空格。适合长度固定的内容，如州缩写、邮政编码、Yes/No 等。  
  
VARCHAR (Variable Length):  
- Stores text dynamically up to a specified limit.  
- Uses only as much storage as needed plus one or two bytes.  
- Better for variable-length text.  
  
VARCHAR 可变长度字段，仅占用实际内容的存储空间，更灵活节省。  
  
If exceeded limit?  
When exceeding defined length, MySQL raises an error unless strict mode is disabled.  
超出上限时，默认会报错（除非关闭严格模式）。

### 2. Numeric Types

INT, TINYINT, BIGINT 用于存储整数。  
  
UNSIGNED prevents negative values.  
UNSIGNED 限制为非负数（不允许负号）。  
  
TINYINT UNSIGNED -- 0 to 255  
INT UNSIGNED -- 0 to 4,294,967,295

### 3. DECIMAL(p, s)

Precise fixed-point numbers.  
DECIMAL 精确存储，适合金钱金额等。  
  
p = total digits, s = digits after decimal point.  
DECIMAL(5,2):  
999.99 ✅  
9999.1 ❌ Error  
1.227 ✅ Stored as 1.23 (rounded)

### 4. FLOAT vs DOUBLE

FLOAT vs DOUBLE comparison:  
FLOAT uses 4 bytes (~7 digits), DOUBLE uses 8 bytes (~15 digits).  
FLOAT 小数点后约 7 位，DOUBLE 更精确但占用更多内存。  
用于科学计算或不需完全精确的场景。

### 5. Date & Time Types

| Type | Description | Example |  
|------|--------------|----------|  
| DATE | Date only | '2000-12-25' |  
| TIME | Time only | '11:00:00' |  
| DATETIME | Both date and time | '2000-12-25 11:00:00' |  
  
CREATE TABLE people (  
 name VARCHAR(100),  
 birthdate DATE,  
 birthtime TIME,  
 birthdt DATETIME  
);  
  
INSERT INTO people (name, birthdate, birthtime, birthdt)  
VALUES ('Elton', '2000-12-25', '11:00:00', '2000-12-25 11:00:00');

### 6. Built-in Date/Time Functions

CURDATE(), CURTIME(), NOW() return current date/time.  
CURDATE() 返回当前日期，CURTIME() 返回当前时间，NOW() 返回完整日期时间。  
  
SELECT CURDATE();  
SELECT CURTIME();  
SELECT NOW();  
  
INSERT INTO people (name, birthdate, birthtime, birthdt)  
VALUES ('Hazel', CURDATE(), CURTIME(), NOW());

### 7. Extracting Date Components

Use DAY(), DAYOFWEEK(), MONTHNAME(), YEAR().  
DAY()、MONTHNAME()、YEAR() 等函数可提取日期中的具体部分。  
  
SELECT birthdate, DAY(birthdate), DAYOFWEEK(birthdate), DAYOFYEAR(birthdate) FROM people;  
SELECT birthdate, MONTHNAME(birthdate), YEAR(birthdate) FROM people;

### 8. Time Functions

HOUR() and MINUTE() extract time parts.  
HOUR()、MINUTE() 等函数可提取时间中的小时和分钟。  
  
SELECT birthtime, HOUR(birthtime), MINUTE(birthtime) FROM people;  
SELECT birthdt, MONTH(birthdt), DAY(birthdt), HOUR(birthdt), MINUTE(birthdt) FROM people;

### 9. Formatting Dates

DATE\_FORMAT(date, format\_string) formats dates into readable patterns.  
DATE\_FORMAT 用于格式化日期输出，例如显示为 “May 2nd, 1999” 等格式。  
  
SELECT birthdate, DATE\_FORMAT(birthdate, '%a %b %D') FROM people;  
SELECT birthdt, DATE\_FORMAT(birthdt, '%H:%i') FROM people;  
SELECT birthdt, DATE\_FORMAT(birthdt, 'BORN ON: %r') FROM people;

### 10. Date Math Functions

Calculate date differences and intervals.  
DATEDIFF 计算两个日期的间隔天数；DATE\_ADD / DATE\_SUB 可做日期加减运算。  
  
SELECT DATEDIFF('2025-12-31', '2025-10-30');  
SELECT DATE\_ADD('2025-10-30', INTERVAL 10 DAY);  
SELECT DATE\_SUB('2025-10-30', INTERVAL 5 DAY);

### 11. TIMESTAMP

TIMESTAMP stores date + time and updates automatically.  
TIMESTAMP 存储日期与时间，常用于记录创建或更新时间。  
  
CREATE TABLE captions (  
 text VARCHAR(150),  
 created\_at TIMESTAMP DEFAULT CURRENT\_TIMESTAMP  
);  
  
CREATE TABLE captions2 (  
 text VARCHAR(150),  
 created\_at TIMESTAMP DEFAULT CURRENT\_TIMESTAMP,  
 updated\_at TIMESTAMP ON UPDATE CURRENT\_TIMESTAMP  
);  
  
TIMESTAMP 自动记录创建或更新时间，占用更少内存。