Database Design & SQL

From Basics to Advanced

Prepared By: Ahmed Eladham

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Session 2

From ERD to Tables

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WiFI

Creativa_Portsaid

Password: Cc$01011

Scan to connect:

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Mapping ERD → Relations

- Every Entity → Table
- Attributes → Columns
- Primary Key (PK) → Uniquely identifies row
- Foreign Key (FK) → Connects tables

Translating ERD Example

```
CREATE TABLE students (
    id INTEGER PRIMARY KEY,
    name TEXT NOT NULL,
    age INTEGER,
    major TEXT

CREATE TABLE courses (
    course_id INTEGER PRIMARY KEY,
    course_name TEXT NOT NULL,
    credits INTEGER
```

```
CREATE TABLE enrollments (
    student_id INTEGER,
    course_id INTEGER,
    grade TEXT,
    PRIMARY KEY (student_id, course_id),
    FOREIGN KEY (student_id) REFERENCES students(id),
    FOREIGN KEY (course_id) REFERENCES courses(course_id)
```

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Constraints

- NOT NULL → value required
- UNIQUE → cannot repeat
- DEFAULT → auto value
- CHECK → validate input
- PRIMARY KEY / FOREIGN KEY

Normalization

- 1NF: Atomic values
- 2NF: Remove partial dependency
- 3NF: Remove transitive dependency
- Why normalization? → Less redundancy, more consistency

Unnormalized Table (UNF)

- Example Table:
- | StudentID | StudentName | Courses | Dept | DeptHead |
- |---|---|---|---|---|
- | 1 | Ahmed | Math, CS | CS | Dr. Ali |
- | 2 | Salma | Physics, CS | Physics | Dr. Mona |

- Problems:
- - Multiple values in Courses
- - Redundancy in DeptHead

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First Normal Form (1NF)

StudentID	StudentName	Course	Dept	DeptHead
1	Ahmed	Math	CS	Dr. Ali
1	Ahmed	CS	CS	Dr. Ali
2	Salma	Physics	Physics	Dr. Mona
2	Salma	CS	Physics	Dr. Mona

- ✓ Atomic values, but still redundancy.

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Second Normal Form (2NF)

- Split into two tables:
- Students:
- | StudentID | StudentName | Dept | DeptHead |
- |---|---|---|---|
- | 1 | Ahmed | CS | Dr. Ali |
- | 2 | Salma | Physics | Dr. Mona |

- Enrollments:
- | StudentID | Course |
- |---|---|
- | 1 | Math |
- | 1 | CS |
- | 2 | Physics |
- | 2 | CS |

✓ No partial dependency.

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Third Normal Form (3NF)

- Split further to remove transitive dependency:

- Students:
- | StudentID | StudentName | Dept |
- |---|---|---|
- | 1 | Ahmed | CS |
- | 2 | Salma | Physics |

- Enrollments:
- | StudentID | Course |
- |---|---|
- | 1 | Math |
- | 1 | CS |
- | 2 | Physics |
- | 2 | CS |

- Departments:
- | Dept | DeptHead |
- |---|---|
- | CS | Dr. Ali |
- | Physics | Dr. Mona |

- ✓ No transitive dependency.

Practice Task

👉 Convert Library ERD (Books, Members, Loans) into tables with PKs, FKs.

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Thank You !

Your time and effort make a real difference.

Let’s make this an unforgettable experience for everyone!

“Together, we build for Earth and beyond.”