

CHAPTER 2 — THE RELATIONAL MODEL

2.1 Introduction to Relational Data Model

The relational model represents data as relations (tables), which consist of rows (tuples) and columns (attributes).

2.2 Components of a Relation

- Relation Name
- Attributes
- Domains
- Tuples

2.3 Keys in a Relation

- Primary Key: Uniquely identifies a record.
- Composite Key: Combination of two or more attributes.
- Foreign Key: Attribute that references a primary key in another table.
- Candidate Key: Possible key options for primary key.

2.4 Integrity Constraints

- Entity Integrity: Primary key cannot be null.
- Referential Integrity: Foreign key values must match existing primary key values.

2.5 Relational Algebra Operations

- SELECT (σ): Filters rows.
- PROJECT (π): Selects attributes.
- JOIN: Combines data from multiple tables.
- UNION, INTERSECT, DIFFERENCE: Set operations.
- CARTESIAN PRODUCT: Combines tuples from two relations.

2.6 Example Schema

STUDENTS(StudentID, Name, Major)

COURSES(CourseID, Title, Credits)

ENROLLS(StudentID, CourseID, Semester)

2.7 Relational Algebra Example

$\sigma_{\text{Major} = \text{'CS'}}(\text{STUDENTS})$

2.8 Summary

The relational model is the most widely used approach in database design, offering simplicity and strong theoretical foundations.