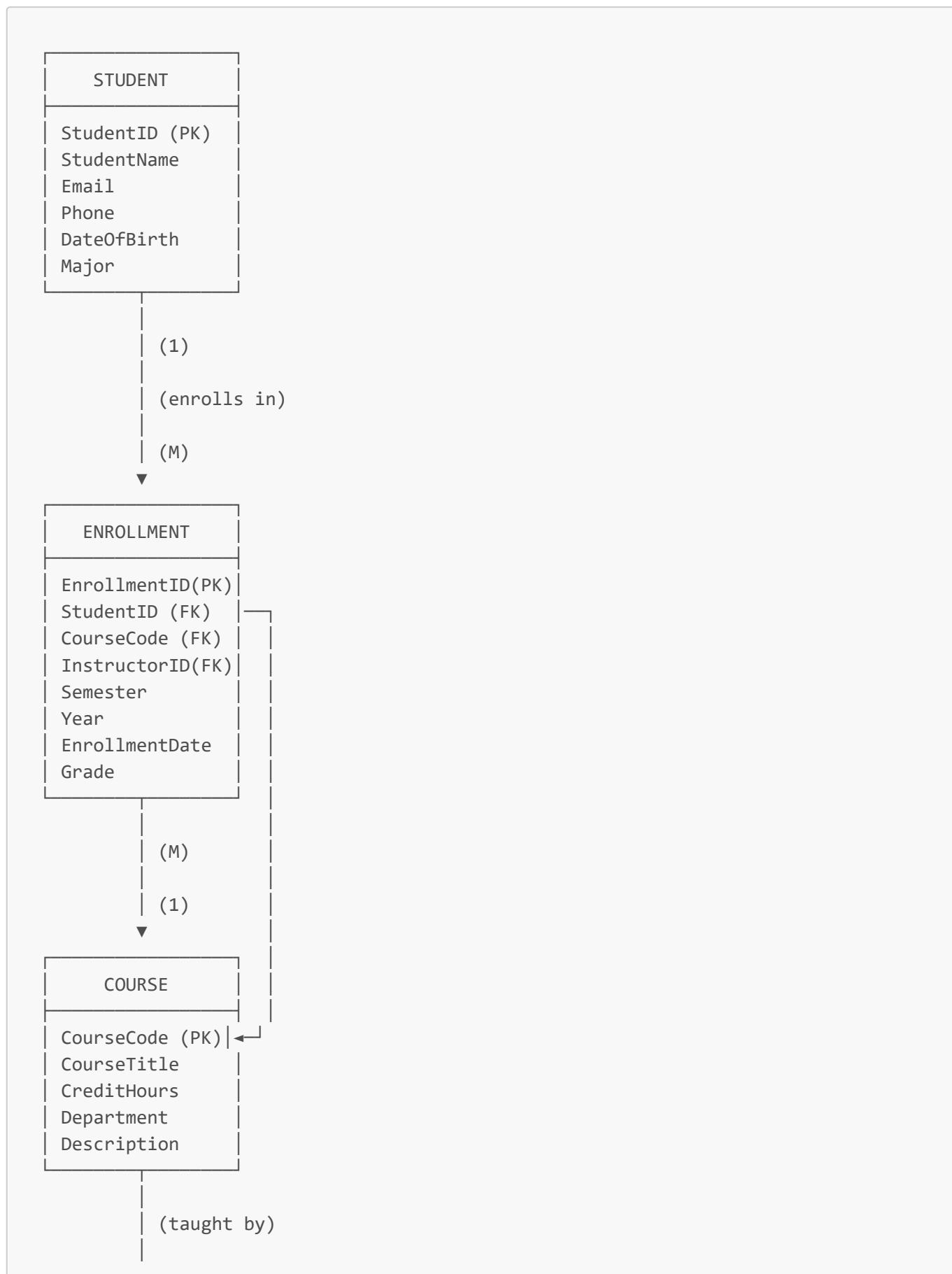
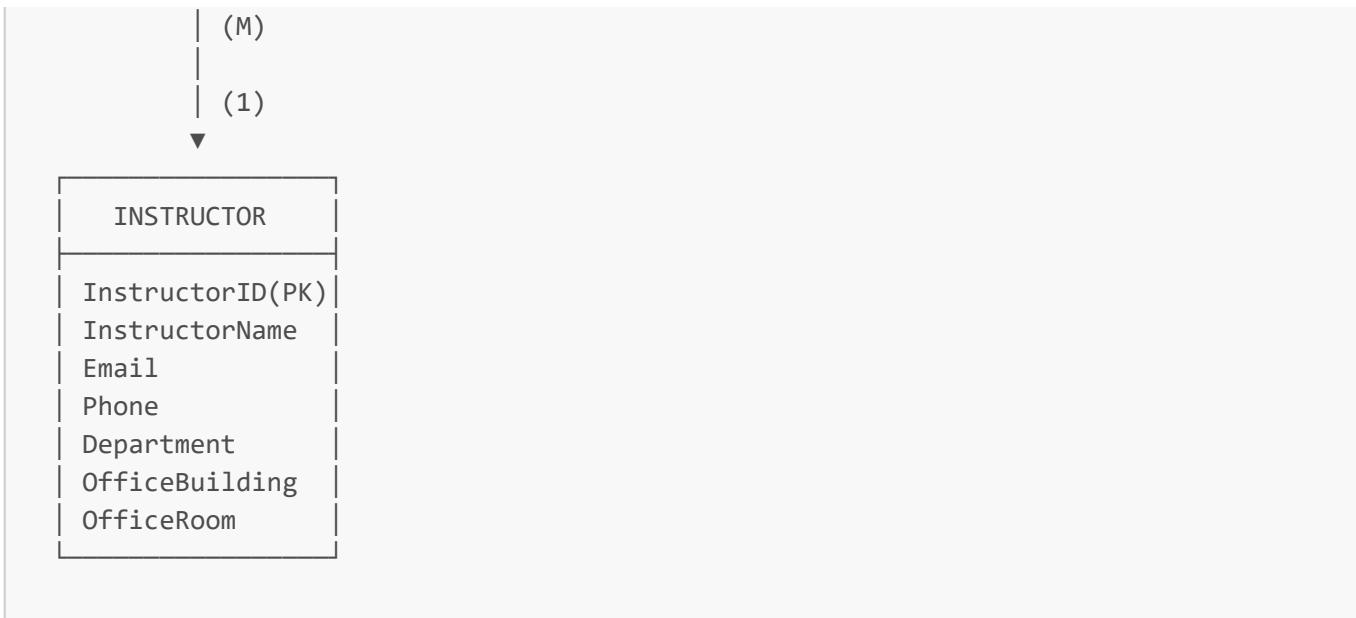


# Entity-Relationship (ER) Diagram

## Textual ER Diagram Description





## Mermaid ER Diagram

```
erDiagram
    STUDENT ||--o{ ENROLLMENT : "enrolls in"
    COURSE ||--o{ ENROLLMENT : "has enrollments"
    INSTRUCTOR ||--o{ ENROLLMENT : "teaches"
    INSTRUCTOR ||--o{ COURSE : "teaches"

    STUDENT {
        string StudentID PK
        string StudentName
        string Email
        string Phone
        date DateOfBirth
        string Major
    }

    INSTRUCTOR {
        string InstructorID PK
        string InstructorName
        string Email
        string Phone
        string Department
        string OfficeBuilding
        string OfficeRoom
    }

    COURSE {
        string CourseCode PK
        string CourseTitle
        int CreditHours
        string Department
        string Description
    }
```

```
ENROLLMENT {
    int EnrollmentID PK
    string StudentID FK
    string CourseCode FK
    string InstructorID FK
    string Semester
    int Year
    date EnrollmentDate
    string Grade
}
```

## PlantUML ER Diagram

```
@startuml University Course Management ER Diagram

!define PK_COLOR #FFE6E6
!define FK_COLOR #E6F3FF
!define ATTRIBUTE_COLOR #F0F0F0

skinparam linetype ortho
skinparam roundcorner 10
skinparam shadowing false

entity "STUDENT" as student {
    * **StudentID** <<PK>> : VARCHAR(10)
    --
    StudentName : VARCHAR(100)
    Email : VARCHAR(100)
    Phone : VARCHAR(20)
    DateOfBirth : DATE
    Major : VARCHAR(50)
}

entity "ENROLLMENT" as enrollment {
    * **EnrollmentID** <<PK>> : INT
    --
    * StudentID <<FK>> : VARCHAR(10)
    * CourseCode <<FK>> : VARCHAR(10)
    * InstructorID <<FK>> : VARCHAR(10)
    Semester : VARCHAR(20)
    Year : INT
    EnrollmentDate : DATE
    Grade : VARCHAR(2)
}

entity "COURSE" as course {
    * **CourseCode** <<PK>> : VARCHAR(10)
    --
    CourseTitle : VARCHAR(200)
    CreditHours : INT
    Department : VARCHAR(50)
```

```

        Description : TEXT
    }

entity "INSTRUCTOR" as instructor {
    * **InstructorID** <>PK>> : VARCHAR(10)
    --
    InstructorName : VARCHAR(100)
    Email : VARCHAR(100)
    Phone : VARCHAR(20)
    Department : VARCHAR(50)
    OfficeBuilding : VARCHAR(50)
    OfficeRoom : VARCHAR(20)
}

' Relationships
student ||--o{ enrollment : "enrolls in"
course ||--o{ enrollment : "has enrollments"
instructor ||--o{ enrollment : "teaches"

' Styling
student PK_COLOR
course PK_COLOR
instructor PK_COLOR
enrollment PK_COLOR

@enduml

```

## PlantUML Usage Instructions

1. **Online:** Copy the PlantUML code above and paste it at <http://www.plantuml.com/plantuml/uml/>
2. **VS Code:** Install the "PlantUML" extension, create a `.puml` file, paste the code, and preview
3. **Command Line:** Install PlantUML and run:

```
plantuml er_diagram.puml
```

4. **IntelliJ IDEA:** Install PlantUML plugin, create `.puml` file, and preview

## Alternative PlantUML Format (Simpler)

```

@startuml University Course Management ER Diagram (Simple)

entity STUDENT {
    * StudentID <>PK>>
    --
    StudentName
    Email
    Phone

```

```
DateOfBirth
Major
}

entity ENROLLMENT {
    * EnrollmentID <<PK>>
    --
    * StudentID <<FK>>
    * CourseCode <<FK>>
    * InstructorID <<FK>>
    Semester
    Year
    EnrollmentDate
    Grade
}

entity COURSE {
    * CourseCode <<PK>>
    --
    CourseTitle
    CreditHours
    Department
    Description
}

entity INSTRUCTOR {
    * InstructorID <<PK>>
    --
    InstructorName
    Email
    Phone
    Department
    OfficeBuilding
    OfficeRoom
}

STUDENT ||--o{ ENROLLMENT
COURSE ||--o{ ENROLLMENT
INSTRUCTOR ||--o{ ENROLLMENT

@enduml
```

## Relationship Cardinalities

### 1. STUDENT ↔ ENROLLMENT

- One STUDENT can have many ENROLLMENTS (1:M)
- Each ENROLLMENT belongs to exactly one STUDENT

### 2. COURSE ↔ ENROLLMENT

- One COURSE can have many ENROLLMENTS (1:M)

- Each ENROLLMENT is for exactly one COURSE

### 3. INSTRUCTOR ↔ ENROLLMENT

- One INSTRUCTOR can have many ENROLLMENTS (1:M)
- Each ENROLLMENT is taught by exactly one INSTRUCTOR

### 4. INSTRUCTOR ↔ COURSE

- One INSTRUCTOR can teach many COURSES (1:M)
- Each COURSE is taught by exactly one INSTRUCTOR (per offering)

## Notes

- **Primary Keys (PK):** Uniquely identify each entity instance
- **Foreign Keys (FK):** Reference primary keys in related entities
- **Cardinality:** Shows how many instances of one entity relate to instances of another entity
- The ENROLLMENT entity is a **junction/associative entity** that connects STUDENT, COURSE, and INSTRUCTOR