1 Relational ER Model Description

1.1 Introduction

This database system models the academic, administrative, and examination processes of a university. The ER diagram includes all major entities such as faculties, departments, professors, students, courses, enrollments, exams, exam results, classrooms, users, and roles. Each relationship is represented with correct cardinalities, and foreign keys are placed on the many side of each 1:N relationship.

1.2 Entity Descriptions

1.2.1 Faculties

Represents academic faculties within the university. Attributes: **faculty_id (PK)**, faculty_name, dean_name, phone.

1.2.2 Departments

Each department belongs to one faculty. Attributes: **department_id (PK)**, department_name, office_room, faculty_id (FK).

1.2.3 Professors

Academic staff assigned to departments. Attributes: **professor_id (PK)**, first_name, last_name, title, email, phone, department_id (FK).

1.2.4 Students

Stores information about students. Attributes: **student_id (PK)**, student_no, first_name, last_name, birth_date, gender, email, phone, department_id (FK), enrollment_year.

1.2.5 Courses

Courses belong to departments and are taught by professors. Attributes: **course_id (PK)**, course_code, course_name, credits, semester_hours, department_id (FK), professor_id (FK).

1.2.6 Classrooms

Rooms where exams take place. Attributes: **classroom_id (PK)**, building, room_number, capacity.

1.2.7 Semesters

Represents academic terms. Attributes: **semester_id (PK)**, semester_name, start_date, end_date.

1.2.8 Enrollments

Represents the association between students and courses per semester. Attributes: **enrollment_id (PK)**, student_id (FK), course_id (FK), semester_id (FK), enroll_date, status.

1.2.9 Exams

Each exam is linked to a course, a semester, and a classroom. Attributes: **exam_id (PK)**, exam_type, exam_date, max_score, course_id (FK), semester_id (FK), classroom_id (FK).

1.2.10 Exam Results

Contains student exam scores. Attributes: **result_id (PK)**, score, grade_letter, grade_created_at, student_id (FK), exam_id (FK).

1.2.11 Roles

System roles for authorization. Attributes: **role_id (PK)**, role_name.

1.2.12 Users

Users of the system, including students, professors, and admins. Attributes: **user_id (PK)**, username, password, is_active, student_id (FK), professor_id (FK), role_id (FK).

1.3 Relationship Descriptions

1.3.1 Faculties – Departments (1:N)

One faculty has many departments. Foreign key: departments.faculty_id.

1.3.2 Departments – Courses (1:N)

One department offers many courses. Foreign key: courses.department_id.

1.3.3 Professors – Courses (1:N)

One professor teaches many courses. Foreign key: courses.professor_id.

1.3.4 Courses – Exams (1:N)

One course contains many exams. Foreign key: exams.course_id.

1.3.5 Classrooms – Exams (1:N)

One classroom hosts many exams. Foreign key: exams.classroom_id.

1.3.6 Students – Enrollments (1:N)

A student can have many enrollments. Foreign key: enrollments.student_id.

1.3.7 Courses – Enrollments (1:N)

A course can appear in many enrollment records. Foreign key: enrollments.course_id.

1.3.8 Semesters – Enrollments (1:N)

Each semester contains many enrollments. Foreign key: enrollments.semester_id.

1.3.9 Exams – Exam Results (1:N)

Each exam produces many exam results. Foreign key: exam_results.exam_id.

1.3.10 Students – Exam Results (1:N)

One student has many exam results. Foreign key: exam_results.student_id.

1.3.11 Roles – Users (1:N)

One role is assigned to many users. Foreign key: users.role_id.

1.4 Conclusion

The ER model accurately represents the academic and administrative structure of the university. All entities satisfy Third Normal Form (3NF), and bridge tables correctly resolve many-to-many relationships. The model supports referential integrity and provides a solid relational schema for implementation in MySQL.