INSTITUTION OF TECHNOLOGY

SCHOOL OF COMPUTING

DEPARTMENT OF SOFTWARE ENGINEERING

Course Title: Advanced Database Systems

Course code: SEng2041

Group Project

Project Title: Online Course Registeration and Learning Management System

Phase 1

SECTION 1

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Phase 1.1: Requirements Analysis & Scoping

Project Overview

The Online Course Registration and Learning Management System is a sophisticated, enterprise-level platform designed to revolutionize the educational experience in academic institutions. This comprehensive system serves as a centralized hub that seamlessly integrates course registration, content delivery, assessment management, and academic progress tracking. In today's digital education landscape, institutions face significant challenges in managing growing student populations, diverse course offerings, and the increasing demand for flexible learning options. This system addresses these challenges by providing a robust, scalable, and user-friendly platform that bridges the gap between students, instructors, and administrative staff.

The system's primary purpose is to streamline the entire academic lifecycle, from initial course discovery and registration through content delivery, assignment submission, grading, and final performance evaluation. It eliminates traditional bottlenecks associated with manual registration processes, paper-based assignments, and disconnected communication channels between stakeholders. By digitalizing these core educational processes, the platform enhances operational efficiency, improves data accuracy, and provides valuable insights through comprehensive reporting capabilities.

Beyond basic functionality, the system incorporates advanced features such as real-time capacity monitoring, automated prerequisite validation, intelligent conflict detection, and progressive learning path tracking. It supports various learning modalities including traditional classroom settings, hybrid models, and fully online courses, making it adaptable to evolving educational trends. The platform also emphasizes data security and privacy, ensuring that sensitive student information and academic records are protected through robust encryption and access control mechanisms.

Main Entities and Attributes

1. Student

· student_id (Primary Key)
· first_name
· last_name
· email
· phone_number

· date_of_birth
· address
· enrollment_date
· major_department_id (Foreign Key)
· academic_status (Active, Suspended, Graduated, Withdrawn)
· total_credits_earned
· cumulative_gpa
· emergency_contact_name
· emergency_contact_phone

2. Instructor

· instructor_id (Primary Key)
· first_name
· last_name
· email
· office_location
· office_hours
· phone_extension
· hire_date
· department_id (Foreign Key)
· specialization
· academic_rank (Professor, Associate Professor, Assistant Professor, Lecturer)
· employment_status (Full-time, Part-time, Adjunct)

3. Course

· course_id (Primary Key)
· course_code
· course_name
· description
· credits
· department_id (Foreign Key)
· instructor_id (Foreign Key)
· prerequisite_course_id (Foreign Key, self-referencing)
· max_capacity
· current_enrollment
· semester (Fall, Spring, Summer)
· academic_year
· course_level (Undergraduate, Graduate)
· delivery_mode (In-person, Online, Hybrid)
· schedule_info (Days, Time, Location)
· course_status (Active, Archived, Cancelled)

4. Department

· department_id (Primary Key)
· department_name
· department_code
· head_instructor_id (Foreign Key)
· office_location
· contact_emailrollment_date
· enrollment_status (Registered, Waitlisted, Dropped, Completed)
· final_grade
· grade_points
· completion_date
· attendance_percentage

5. Enrollment

· enrollment_id (Primary Key)
· student_id (Foreign Key)
· course_id (Foreign Key)
· enrollment_date
· enrollment_status (Registered, Waitlisted, Dropped, Completed)
· final_grade
· grade_points
· completion_date
· attendance_percentage

6. Assignment

· assignment_id (Primary Key)
· course_id (Foreign Key)
· title
· description
· assignment_type (Homework, Quiz, Project, Exam, Presentation)
· max_points

7. Submission

· submission_id (Primary Key)

· assignment_id (Foreign Key)
· student_id (Foreign Key)
· submission_date
· submission_status (Submitted, Late, Resubmitted)

8. Grade

· grade_id (Primary Key)
· submission_id (Foreign Key)
· points_earned
· grader_id (Foreign Key to Instructor)
· grade_status (Graded, Regrade Requested, Finalized)

9. Announcement

· announcement_id (Primary Key)
· course_id (Foreign Key)
· instructor_id (Foreign Key)
· title
· content
· post_date
· expiry_date

10. LearningMaterial

· material_id (Primary Key)
· course_id (Foreign Key)
· title
· description
· material_type (Lecture Notes, Video, Reading, Slide Deck, Reference)

Business Rules

Enrollment Rules:

I. **Prerequisite Enforcement**: Students cannot enroll in a course without completing all prerequisite courses with a minimum grade of 'D'

II. **Capacity Limits**: Course enrollment cannot exceed the maximum capacity defined for each course
III. **Time Conflict Prevention**: Students cannot enroll in courses with overlapping schedules
IV. **Credit Limit**: Undergraduate students cannot exceed 34 credits per semester without special approval
V. **Academic Standing**: Students on academic probation cannot enroll in more than 12 credits
VI. **Major Restrictions**: Some courses are restricted to students within specific majors until a designated date

Grading Rules:

I. **Grade Validation**: Final grades must be within the defined grading scale (A, B, C, D, F)
II. **Submission Deadline**: Assignments submitted after the due date receive penalties according to description
III. **Grade Finalization**: Grades cannot be modified after the grade submission deadline without department chair approval
IV. **Incomplete Policy**: 'I' (Incomplete) grades must be resolved within one academic year

Administrative Rules:

I. **Course Creation:** New courses require department approval and curriculum committee review
II. **Instructor Assignment:** Courses must have assigned instructors before the registration period begins
III. **Department Hierarchy:** Each department must have one head instructor who oversees course offerings
IV. **Data Retention:** Student records must be maintained for 7 years after graduation or last enrollment

System Rules:

I. **Unique Constraints:** Email addresses must be unique across all user types
II. **Data Validation:** Phone numbers must follow standard formatting rules
III. **Access Control:** Users can only access data relevant to their roles and permissions
IV. **Audit Trail:** All grade modifications and enrollment changes must be logged

Functional Requirements

Student Management Module:

1. Student Registration
- · Capture comprehensive student demographic information
- · Validate email format and uniqueness
- · Generate unique student identification numbers
- · Set initial academic status and track changes

2. Profile Management
- · Allow students to update personal contact information
- · Enable password changes and security preferences
- · Display academic progress and standing
- · Provide transcript and grade history access

Course Management Module:

1. Course Catalog
- · Display available courses with search and filter capabilities
- · Show real-time enrollment numbers and capacity
- · Provide detailed course descriptions and requirements
- · Display instructor profiles and ratings

2. Course Creation and Maintenance
- · Allow authorized staff to create new course offerings
- · Enable course information updates and modifications
- · Manage course prerequisites and corequisites
- · Handle course cancellation and archival processes

Enrollment Module:

1. Registration System
- · Provide intuitive course search and selection interface
- · Implement shopping cart functionality for course planning
- · Validate enrollment against business rules in real-time
- · Handle waitlist management and automatic promotion

2. Schedule Management
- · Generate conflict-free student schedules
- · Display timetable with visual calendar representation

· Allow schedule adjustments during add/drop periods
· Provide calendar export functionality

Learning Management Module:

1. Content Delivery
· Support multiple content types (documents, videos, links)
· Organize materials by week or topic
· Track student access and engagement with materials
· Provide mobile-friendly content viewing
2. Assignment Management
· Facilitate assignment creation with detailed rubrics
· Support multiple submission types (file upload, text entry)
· Implement submission deadline enforcement
· Provide plagiarism detection integration
3. Gradebook
· Calculate running course grades based on weighted assignments
· Allow instructors to enter and modify grades
· Provide students with real-time grade visibility
· Generate grade distribution analytics

Communication Module:

1. Announcement System
· Enable targeted announcements to specific courses or user groups
· Support rich text formatting and file attachments
· Provide read receipt tracking
· Implement announcement scheduling
2. Discussion Forums
· Facilitate course-specific discussion threads
· Support moderated and unmoderated discussions
· Enable file sharing within discussions
· Provide notification of new posts

Use Case Diagrams and Descriptions

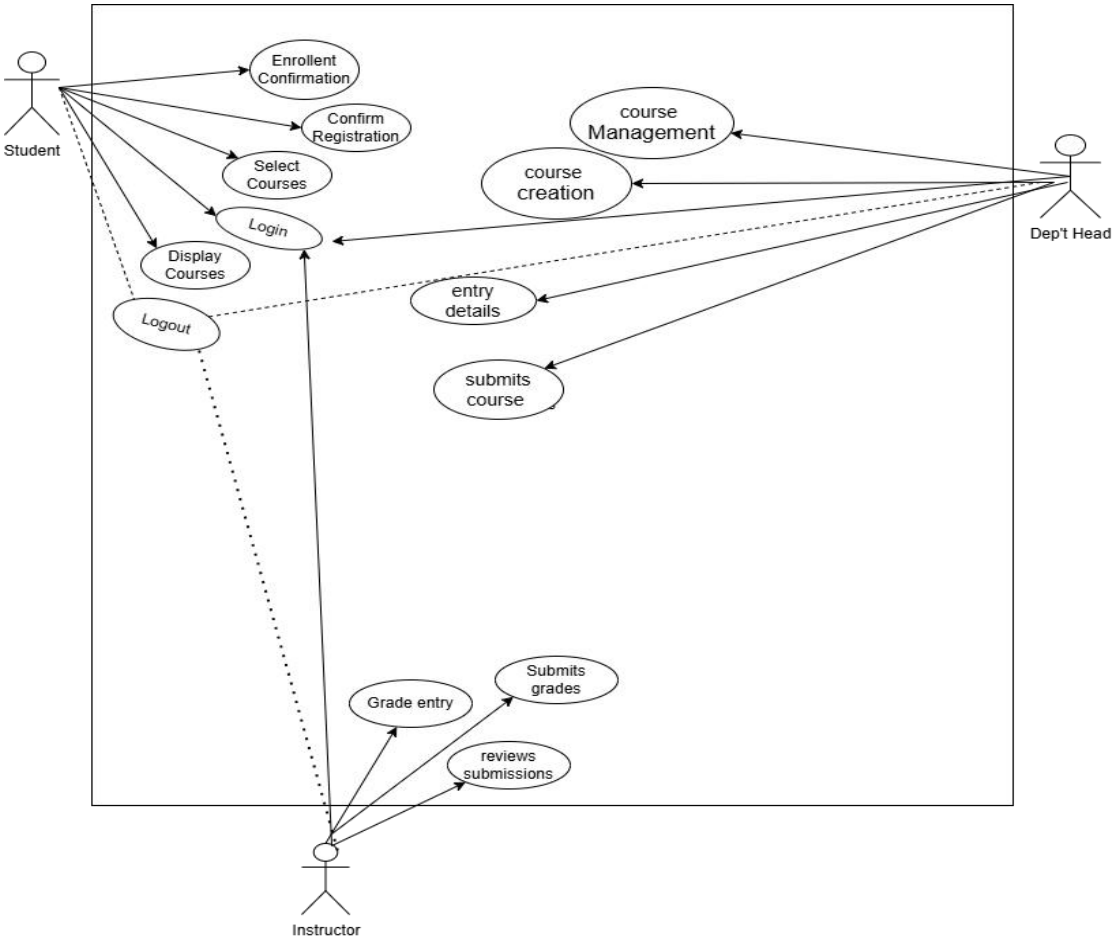


Fig. Use Case

Use cases are typically represented using UML Use Case Diagrams, which visually depict the interactions between actors (users) and the system. Below are the detailed use cases:

Primary Use Case Diagram Components:

Actors:

· Student
· Instructor
· Administrator
· Department Head
· System (automated processes)

Key Use Cases:

1. Student Registration Use Case

· Primary Actor: Student
· Preconditions: Student has valid institutional credentials
· Main Flow:
  1. Student accesses registration system
  2. System displays available courses
  3. Student selects desired courses
  4. System validates selections against business rules
  5. System confirms successful registration
  6. System generates enrollment confirmation
· Alternative Flows: Waitlist handling, prerequisite errors, time conflicts
· Postconditions: Student is registered for selected courses

2. Grade Submission Use Case

· Primary Actor: Instructor
· Secondary Actor: System
· Preconditions: Assignment submission period has ended
· Main Flow:
  1. Instructor accesses grade entry interface
  2. System displays student submissions
  3. Instructor reviews submissions and enters grades
  4. System validates grade format and ranges
  5. Instructor submits grades
  6. System updates student records and calculates overall grades
· Alternative Flows: Late submissions, regrade requests
· Postconditions: Grades are recorded in student transcripts

3. Course Creation Use Case

· Primary Actor: Department Head
· Preconditions: Department head is authenticated and authorized
· Main Flow:
  1. Department head accesses course management
  2. System displays course creation form
  3. Department head enters course details and requirements
  4. System validates course information
  5. Department head submits course for approval
  6. System routes course for curriculum committee review
· Alternative Flows: Course modification, course cancellation
· Postconditions: New course is available in catalog (pending approval)

User Roles

1. Student

Responsibilities:

· Register for courses and manage schedule
· Access course materials and learning resources
· Submit assignments and view grades
· Participate in discussions and communication
· Track academic progress and performance
· Update personal information and preferences

Permissions:

· Read access to own records and courses
· Write access to own submissions and profile
· Limited access to peer information (directory only)
· No access to administrative functions or other student records

2. Instructor

Responsibilities:

· Create and manage course content
· Develop assignments and assessments
· Grade student submissions and provide feedback
· Communicate with students via announcements
· Monitor student progress and engagement
· Submit final grades

Permissions:

· Full read/write access to assigned courses
· Access to enrolled student information and performance
· Ability to generate course analytics and reports
· No access to student records outside assigned courses

3. Department Head

Responsibilities:

· Oversee course offerings and curriculum
· Approve new courses and modifications
· Assign instructors to courses
· Monitor department enrollment and performance
· Handle student appeals and exceptions
· Manage department resources

Permissions:

· Access to all courses within department
· Ability to override certain system restrictions
· Access to comprehensive department reports
· Approval authority for special requests

4. Administrator

Responsibilities:

· System configuration and maintenance
· User account management and security
· Data backup and recovery operations
· System performance monitoring
· Generate institutional reports
· Handle technical support issues

Permissions:

· Full system access with oversight capabilities
· Ability to modify all data (with audit trail)
· System configuration and parameter settings
· User role and permission management

Non-Functional Requirements

Performance Requirements:

1. Response Time
- Page load times: ≤ 2 seconds for 95% of requests
- Search operations: ≤ 3 seconds for complex queries
- Grade calculation: ≤ 5 seconds for classes of 100 students
- Report generation: ≤ 30 seconds for standard reports

2. Throughput
- Support 10,000 concurrent users during peak registration
- Handle 1,000 simultaneous course enrollments per minute
- Process 500 assignment submissions simultaneously
- Support 200 concurrent video streams for course content

3. Scalability
- Horizontal scaling to support 50% user growth without architecture changes
- Database capable of storing 100,000 student records
- Support for 1000 active courses annually
- Ability to handle 1TB of course materials and submissions

Reliability Requirements:

1. Availability
- 99.5% uptime during academic terms
- Maximum of 4 hours scheduled downtime per month
- Zero data loss for committed transactions
- 15-minute recovery time for critical failures

2. Error Handling
- Graceful degradation during partial system failures
- Comprehensive error logging and monitoring
- Automated alerting for system errors
- User-friendly error messages without technical details

Security Requirements:

1. Data Protection
- Encryption of all sensitive data at rest (AES-256)
- SSL/TLS encryption for all data in transit
- Secure storage of passwords with salted hashing
- Regular security patches and vulnerability assessments

2. Access Control
- Role-based access control (RBAC) with minimum privileges
- Multi-factor authentication for administrative access
- Session timeout after 30 minutes of inactivity
- Comprehensive audit trails for sensitive operations

3. Compliance

· FERPA compliance for student record protection
· GDPR compliance for international students
· WCAG 2.1 AA accessibility standards
· Institutional data governance policies

Usability Requirements:

1. User Experience
· Intuitive navigation with maximum 3 clicks to key functions
· Consistent interface across all modules
· Responsive design for mobile and tablet devices
· Accessibility for users with disabilities
2. Learning Curve
· New students able to register for courses within 10 minutes
· Instructors able to create basic course within 30 minutes
· Comprehensive online help and documentation
· Context-sensitive guidance and tooltips

Maintainability Requirements:

1. System Architecture
· Modular design with clear separation of concerns
· Comprehensive API documentation
· Database schema version control
· Automated deployment pipelines
2. Supportability
· Detailed logging for troubleshooting
· Performance monitoring and alerting
· Backup and restore procedures
· Disaster recovery documentation

Data Management Requirements:

1. Data Integrity
· Referential integrity enforced at database level
· Validation rules for all user inputs
· Atomic transactions for critical operations
· Data consistency across distributed components
2. Backup and Recovery
· Daily automated full backups
· Hourly transaction log backups

· 7-year retention for student records
· Tested restore procedures with 4-hour RTO

Phase 1.2: Conceptual Design – ER Diagram

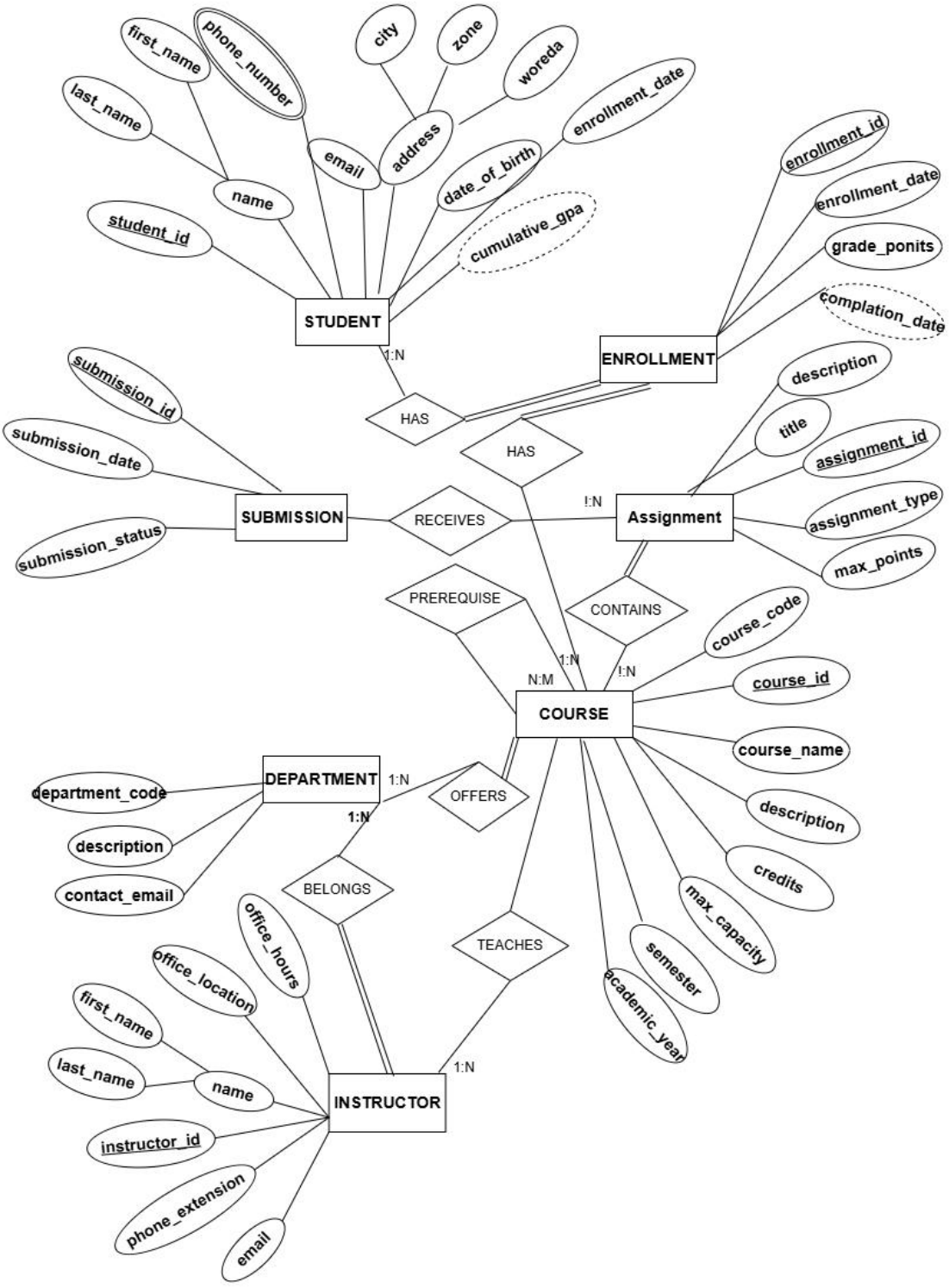


Fig. ER-Diagram

Total Participation:

- ✓ Every Enrollment must be associated with exactly one Student and one Course
- ✓ Every Instructor must belong to exactly one Department
- ✓ Every Course must belong to exactly one Department

Partial Participation:

- ✓ A Student may have zero or more Enrollments
- ✓ An Instructor may teach zero or more Courses
- ✓ · A Course may have zero or more Assignments

Key Constraints

Primary Keys:

- ❖ All entities use surrogate keys (ID fields) as primary keys
- ❖ Composite keys used in associative entities where appropriate

Foreign Keys:

· Department → Instructor (head_instructor_id)
· Student → Department (major_department_id)
· Instructor → Department (department_id)
· Course → Department (department_id)
· Course → Instructor (instructor_id)
· Enrollment → Student (student_id)
· Enrollment → Course (course_id)
· Assignment → Course (course_id)
· Submission → Assignment (assignment_id)
· Submission → Student (student_id)

Business Rules Validation through ERD

The ER diagram ensures:

1. Data Integrity: Foreign key constraints maintain referential integrity
2. Cardinality Enforcement: Relationships reflect real-world constraints
3. Normalization Foundation: Proper entity separation reduces redundancy

4. Scalability: Structure supports future enhancements
5. Query Efficiency: Clear relationships enable optimized database design

This comprehensive ER diagram serves as the blueprint for the relational database schema and will guide the implementation of tables, constraints, and relationships in the subsequent phases.

Phase 1.3: Relational Schema

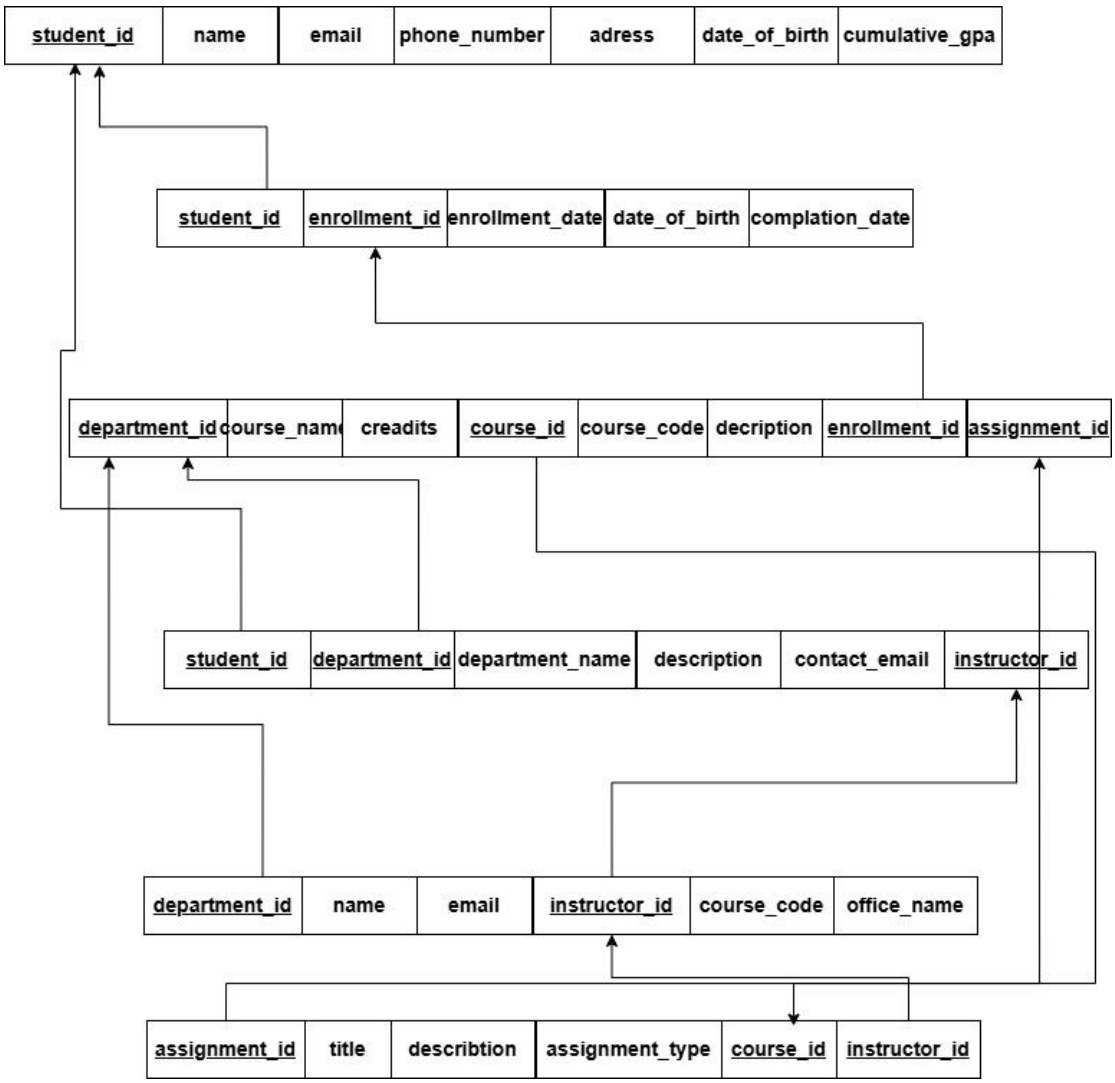


Fig. Relational Schema

Phase 1.4: Normalization

Initial Unnormalized Form (UNF)

student_id	first_name	Last_name	Phone_number	email	Date_of_birth

```

| department_id | department_name | department_code | office_location | contact_email | description |
|---|---|---|---|---|---|

```

instructor_id	first_name	Last_name	office_location	email

```

| address | Enrollment_date | Cumlative_gpa |
|---|---|---|

```

course_id	course_name	Course_code	description	credits

```

| max_capacity | academic_year | semester |
|---|---|---|

```

enrollment_id	enrollment_date	Compllletion_date

```

| description | title | assignment_type | assignment_id | max_points |
|---|---|---|---|---|

```

submission_status	submission_date	submission_id

Problems with UNF:

· Repeated student information for each course
· Repeated course information for each student
· Mixed entity attributes
· Update anomalies
· Insertion anomalies
· Deletion anomalies

First Normal Form (1NF)

Rule: Eliminate repeating groups and ensure atomic values

We separate into distinct tables with atomic values:

1. DEPARTMENT Table

department_id	department_name	department_code	office_location	contact_email	description

2. INSTRUCTOR Table

instructor_id	first_name	Last_name	office_location	email	Department_id

3. STUDENT Table

student_id	first_name	Last_name	Phone_number	email	Date_of_birth

```

| address | Department_id | Enrollment_date | Cumlative_gpa | demartment_name |
|---|---|---|---|---|
| | | | | |

4. COURSE Table

| course_id | course_name | Course_code | description | credits | Department_id |
|---|---|---|---|---|---|
| | | | | | |

```

max_capacity	instructor_id	academic_year	semester

5. ENROLLMENT Table

enrollment_id	Course_id	student_id	enrollment_date	Compllletion_date

6. ASSIGNMENT Table

description	title	assignment_type	assignment_id	max_points	course_id

7. SUBMISSION Table

course_id	submission_status	submission_date	submission_id

1NF Achieved:

- ✓ All attributes are atomic
- ✓ No repeating groups
- ✓ Each table has a primary key

Second Normal Form (2NF)

Rule: Remove partial dependencies (all non-key attributes must depend on the entire primary key)

Checking Partial Dependencies:

ENROLLMENT Table Analysis:

Primary Key: enrollment_id
student_id + course_id → enrollment_date, enrollment_status, etc.

- ✓ All attributes depend on the entire primary key

COURSE Table Analysis:

Primary Key: course_id

course_id → course_name, credits, department_id, instructor_id, etc.

- ✓ All attributes depend on the entire primary key

STUDENT Table Analysis:

Primary Key: student_id
student_id → first_name, last_name, email, major_department_id, etc.

- ✓ All attributes depend on the entire primary key

No partial dependencies found. Our schema is already in 2NF because:

- ✓ All tables have single-column primary keys
- ✓ No composite primary keys that could cause partial dependencies

Third Normal Form (3NF)

Rule: Remove transitive dependencies (no non-key attribute should depend on another non-key attribute)

Checking Transitive Dependencies:

One Transitive Dependency Found

STUDENT Table:

student_id → major_department_id → department_name
Problem: department_name in STUDENT table, it transitively depend on department_id
Solution: Remove department_name and get it by joining with Department table.

DEPARTMENT Table

department_id	department_name	department_code	office_location	contact_email	description

STUDENT Table

student_id	first_name	Last_name	Phone_number	email	Date_of_birth

```

| address | Department_id | Enrollment_date | Cumlative_gpa |
|---|---|---|---|

INSTRUCTOR Table:

· instructor_id → department_id → department_name?
· Problem: If we had department_name in INSTRUCTOR table, it would be transitive
  ✓ Solution: We correctly have only department_id as FK

COURSE Table:

· course_id → department_id → department_name?
· course_id → instructor_id → instructor_name?
  ✓ Solution: We correctly have only foreign keys, not the actual names

**Final 3NF Schema**

1. DEPARTMENT Table

| department_id | department_name | department_code | office_location | contact_email | description |
|---|---|---|---|---|---|

3. INSTRUCTOR Table

| __ instructor_id | first_name | Last_name | office_location | email | Department_id |
|---|---|---|---|---|---|

3. STUDENT Table

| __student_id | first_name | Last_name | Phone_number | email | Date_of_birth |
|---|---|---|---|---|---|

```

address	Department_id	Enrollment_date	Cumlative_gpa

4. COURSE Table

__course_id	course_name	Course_code	description	credits	Department_id

```

| max_capacity | instructor_id | academic_year | semester |
|---|---|---|---|

8. ENROLLMENT Table

| enrollment_id | Course_id | student_id | enrollment_date | Compllletion_date |
|---|---|---|---|---|

9. ASSIGNMENT Table

| description | title | assignment_type | assignment_id | max_points | course_id |
|---|---|---|---|---|---|

10. SUBMISSION Table

| course_id | submission_status | submission_date | submission_id |
|---|---|---|---|

## Normalization Verification

**All Normal Forms Achieved:**

✓ 1NF

· All tables have primary keys
· All attributes are atomic
· No repeating groups

✓ 2NF

· All tables have single-column primary keys
· No partial dependencies possible

✓ 3NF

· No transitive dependencies
· All non-key attributes depend only on the primary key
· Non-key attributes are independent of each other
```

Advantages of Normalization

1. Reduced Data Redundancy
   · Student information stored once, not repeated for each course
   · Course information stored once, not repeated for each student
2. Improved Data Integrity
   · Updates to student email affect only one record
   · Changes to course details propagate automatically
3. Easier Maintenance
   · Modify department information in one place
   · Add new courses without duplicating instructor data
4. Better Query Performance
   · Smaller tables for specific queries
   · Efficient joins when needed
5. Prevention of Anomalies
   · Update Anomaly: Changing a student's phone number updates all their enrollments
   · Insertion Anomaly: Can add a new department without needing courses or students
   · Deletion Anomaly: Deleting a course doesn't delete student information

Disadvantages of Normalization

1. Increased Complexity
   · More tables to manage
   · More joins required for comprehensive queries
2. Performance Overhead
   · Multiple table joins for student course history
   · Additional foreign key constraints
3. Design Complexity
   · Need to understand relationships between tables
   · More complex application logic

For an educational system where data accuracy is critical and read operations outnumber writes, the benefits of normalization outweigh the disadvantages. The simplified 7-table structure maintains efficiency while ensuring data integrity.

Normalized Schema Ready for Implementation

The database design is now fully normalized to 3NF with:

· 7 well-structured tables
· Proper primary and foreign keys
· No redundancy or anomalies
· Efficient relationship management

This normalized design provides a solid foundation for the physical implementation in the next phase while maintaining all business rules and requirements from Phase 1.1.

Phase 1.5: Physical Design & Indexing

Data Types and Constraints

1. ENROLLMENT Table
Primary key: enrollment_ id
Foreign key: student_ id→ STUDENT. student_ id, course_ id→ COURSE. course_ id

column	Data type	Constraints	Description
Enrollment_ id	INT	PRIMARY KEY, IDENTITY (1,1)	Unique enrollment ID
Student_ id	INT	NOT NULL , FORELGN KEY	Student reference
Course_ id	INT	NOT NULL, FORELGN KEY	Course reference
Enrollment_ date	DATETIME2	DEFAULT GETDATE ()	Enrollment date
Enrollment_ status	VARCHER (20)	DEFAULT 'registered' , CHECK (valid Statuses)	Enrollment status
Final_ grade	VARCHER (2)	CHEKED (valid grades)	Final course grade
Grade_ point	DECIMAL (4,2)	CHEKED (0.00-4.00)	Grade point
Completion_ date	DATE	NULL , CHEKED (>= enrollment_ date)	Completion date
Attendance_ persentage	DECIMAL (5,2)	CHEKED (0.00-100.00)	Attendance percentage

2. ASSLGNMENT TABLE

Primary key: assignment _ id

Foreign keys : course _ id→ COURSE. course _ id

Column	Date Type	Constraints	description
Assigniment _ id	INT	PRIMARY KEY, IDENTITY (1,1)	Unique assignment ID
Course _id	INT	NOT NULL , FORELGN KEY	Course reference
Title	VARCHER (200)	NOT NULL	Assignment title
Description	VARCHER (1000)	NULL	Assignment description
Assigniment _type	VARCHER (50)	CHECK(valid types)	Type of assignment
Due _date	DATETIME2	NOT NULL	Due date
Max _points	DECIMAL (5,2)	NOT NULL CHEKD (>0)	Maximum points
Submission _ format	VARCHER (20)	CHEKED (file/Text/both)	Submission format
Allowed _ film _ types	VARCHER (100)	NULL	Allowed file types
Late _ submission _ policy	VARCHER (200)	NULL	Late policy
instruction	VARCHER (MAX)	NULL	Detailed instruction
Weight _ in_ course	DECIMAL (5,2)	CHEKED 0.00-100.00)	Weight in course %

3. INSTRUCTION Table

Primary key : instruction _ id

Foreign keys : department _ id→ department _ id

column	Data type	Constraints	description
Instruction_id	INT	PRAMARY KEY,IDENTITY(1,1)	Unique instruction identifier
First_name	VARCHAR(50)	NOT NULL	First name
Last_ name	VARCHAR(50)	NOT NULL	Last name
Email	VARCHAR(255)	UNLQE,NOT NULL CHECK(email format)	Email address
Office_location	VARCHAR(200)	NULL	Office location

Offic _hours	VARCHAR(100)	NULL	Office hours
Phone_extesion	VARCHAR(10)	NULL	Phone extension
Hire_date	DATE	NOT NULL,CHECK(past date)	Hire date
Department_id	INT	NOT NULL,FOREIGE KEY	Department affiliation
Academic_rank	VARCHAR(50)	CHECK(valid ranks)	Academic rank
Employment_status	VARCHAR(20)	CHECK(employment type)	Employment status

4. DEPARTMENT TABLE

Primary key : department_id

Foreign keys :head_instructor_ id→ INSTRUCTOR.instroctor_ id

column	Data Type	Constraints	description
Department_id	INT	PRAMARY KEY,IDENTITY(1,1)	Unique department identifier
Department_name	VARCHER(100)	NOT NULL	Department name
Department_code	VARCHAR(10)	NOT NULL UNIQUE	Short department code
Head_instructor_id	INT	NULL,FOREGN KEY	Department head
Office_location	VARCHAR(200)	NULL	Physical location
Contact_email	VARCHAR(255)	CHECK(email format)	Contact email
Contact_phone	VARCHAR(20)	NULL	Contact phone
description	VARCHAR(500)	NULL	Department description

5. COURSE TABLE

Primary key:course_id

Foreign keys: department_id→DEPARTMENT_id, instractor _id→INSTRACTOR_.instractor_id

Column	Date type	constraints	Description
Course_id	INT	PRIMARY KEY,IDENTITY(1,1)	Unique course identifier
Course_code	VARCHAR(20)	NOT NULL	Course code
Course_name	VARCHAR(100)	NOT NULL	Course name
Description	VARCHAR(1000)	NULL	Course description
Credits	INT	NOT NULL,CHECK(1-6)	Credit hours
Department_id	INT	NOT NULL,FOREGN KEY	Offering department
instructor_id	INT	NULL,FORELGN KEY	Primary instructor
Max_capacity	INT	DEFALT 0 CHECK(10.500)	Maximum student
Current_enrollment	INT	DEFALT 0 CHECK(0-	Current enrollment

		max_capacity)	
Semester	VARCHAR(20)	CHECK(valid semesters)	Semester offered
Academic_year	INT	CHECK(2000-2030)	Academic year
Course_level	VARCHAR(20)	CHECK(UG/Grad/doctoral)	Course level
Delivery_mode	VARCHAR(20)	CHECK(in-person/online/hybrid)	Delivery method
Schedule_info	VARCHAR(200)	NULL	Schedule details
Course_status	VARCHAR(20)	DEFAULT'active'CHEKD(valid statuses)	Course status

6. STUDENT TABLE

Primary key: student_id

Foreign keys:major_department_id →DEPARTMENT.department_id

Column	Data Type	constraints	description
Student_id	INT	PRAMARY KEY,IDENTITY(1,1)	Unique student identifier
First_name	VARCHAR(50)	NOT NULL	First name
Lasr_name	VARCHAR(50)	NOT NULL	Last name
Email	VARCHAR(255)	UNIQUE,NOT NULL CHECK(email format)	Email address
Phone_number	VARCHAR(20)	NULL	Phone number
Date_of_birth	DATE	NOT NULL CHECK(AGE>=16)	Date of birth
Address	VARCHAR(500)	NULL	Physical address
Enrollment_date	DATE	NOT NULL,DEFAULT GETDATE()	Enrollment date
Major_department_id	INT	NULL,FOREIGN KEY	Major department
Academic_status	VARCHAR	DEFAULT'active',CHECK(valid statuses)	Academic standing
Total_credits_earned	INT	DEFAULT 0,CHECK(>=0)	Total credits
Cumulative_gpa	DECIMAL(3,2)	CHECK(0.00-4.00)	Cumulative GPA

7. SUBMISSION TABLE

Primary key: submission_id

Foreign keys:assignment_id →ASSIGNMENT.assignment_id, STUDENT.student_ID

Column	Data type	constraints	description
Submission_id	INT	PRAMARY KEY,IDENTITY(1,1)	Unique submission
Assignment_id	INT	NOT NULL,FOREIGN KEY	Assignment reference
Student_id	INT	NOT NULL,FOREIGN KEY	Student reference
Submission_DATE	DATETIME2	DEFAULT GETDATE()	Submission timestamp
Submission_conte	VARCHAR(MAX	NULL	Text submission

nt	0		
File_path	VARCHAR(500)	NULL	File path for uplodes
File_name	VARCHAR(255)	NULL	Original file name
File_size	BIGINT	NULL CHECK(>=0)	File size in bytes
Submission_status	VARCHAR(20)	CHECK(sublimitted/late/re subitted)	Submission status
Version_number	INT	DEFAULT 1,CHECK(>=1)	Submission version

Indexing Plan

Primary Indexes (Clustered):

- · DEPARTMENT: department_id
- · INSTRUCTOR: instructor_id
- · STUDENT: student_id
- · COURSE: course_id
- · ENROLLMENT: enrollment_id
- · ASSIGNMENT: assignment_id
- · SUBMISSION: submission_id

Secondary Indexes (Non-clustered):

High-Priority Indexes:

1. IX_Enrollment_Student (student_id) - Student course queries
2. IX_Enrollment_Course (course_id) - Course roster queries
3. IX_Student_LastName (last_name, first_name) - Name searches
4. IX_Course_SemesterYear (semester, academic_year, course_status) - Catalog queries
5. IX_Assignment_Course (course_id, due_date) - Course assignment lists
6. IX_Submission_AssignmentStudent (assignment_id, student_id) - Gradebook queries

Medium-Priority Indexes:

1. IX_Instructor_Department (department_id) - Department staff
2. IX_Student_MajorDepartment (major_department_id) - Department majors
3. IX_Submission_Student (student_id, submission_date) - Student submissions
4. IX_Assignment_DueDate (due_date) - Upcoming assignments

Low-Priority Indexes:

1. IX_Student_AcademicStatus (academic_status) - At-risk students
2. IX_Enrollment_Status (enrollment_status) - Registration stats

3. IX_Course_Instructor (instructor_id) - Teaching load

Storage Estimation

Table Size Estimates:

Table Estimated Records Size
DEPARTMENT = 50 100 KB
INSTRUCTOR = 1,000 2 MB
STUDENT 50,000 = 100 MB
COURSE 5,000 = 20 MB
ENROLLMENT 500,000 = 500 MB
ASSIGNMENT 50,000 = 150 MB
SUBMISSION 1,000,000 = 2 GB

Total Storage Requirements:

· Data: ~2.77 GB
· Indexes: ~1.38 GB (50% overhead)
· Total: ~4.15 GB

Performance Expectations

Query Performance Targets:

· Student dashboard loading: < 100ms
· Course registration: < 200ms
· Grade submission: < 150ms
· Assignment submission: < 300ms
· Department reports: < 2 seconds
· Student transcript: < 1 second

Concurrent User Support:

· Peak registration: 10,000 concurrent users
· Normal operations: 2,000 concurrent users
· Assignment submissions: 500 concurrent submissions

Physical Design Decisions

Data Type Rationale:

· VARCHAR for text fields supporting Unicode
· INT for identifiers and counts
· DECIMAL for grades and percentages requiring precision
· DATETIME2 for timestamps with high precision
· DATE for simple dates without time

Constraint Strategy:

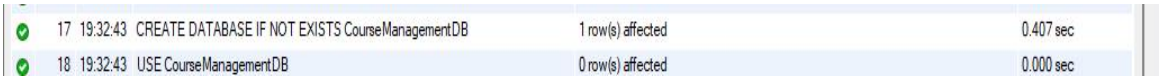
· NOT NULL for essential business data
· CHECK constraints for domain validation
· UNIQUE constraints for business key integrity
· FOREIGN KEY with appropriate cascade rules

Indexing Strategy:

· Covering indexes for frequent query patterns
· Composite indexes for multi-column searches
· Filtered indexes for partial data access
· Balance between read performance and write overhead

Phase 1.6: SQL Server Database Creation (DDL Implementation)

```
-- Create Database
CREATE DATABASE IF NOT EXISTS CourseManagementDB;
USE CourseManagementDB;
```

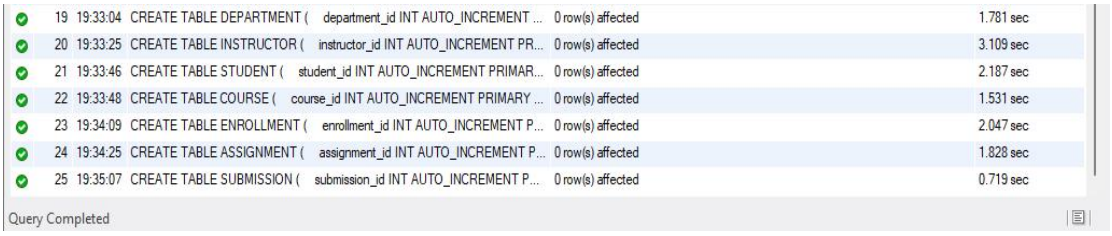



```
-- ============================================
-- Table: DEPARTMENT
-- Description: Stores academic department information
-- ============================================
CREATE TABLE DEPARTMENT (
    department_id INT AUTO_INCREMENT PRIMARY KEY,
    department_name VARCHAR(100) NOT NULL,
    department_code VARCHAR(10) NOT NULL UNIQUE,
    head_instructor_id INT NULL,
    office_location VARCHAR(200),
    contact_email VARCHAR(255),
    contact_phone VARCHAR(20),
```

```
  description TEXT,
  created_date DATETIME DEFAULT CURRENT_TIMESTAMP
);

-- ============================================
-- Table: INSTRUCTOR
-- Description: Stores instructor/faculty information
-- ============================================
CREATE TABLE INSTRUCTOR (
  instructor_id INT AUTO_INCREMENT PRIMARY KEY,
  first_name VARCHAR(50) NOT NULL,
  last_name VARCHAR(50) NOT NULL,
  email VARCHAR(255) UNIQUE NOT NULL,
  office_location VARCHAR(200),
  office_hours VARCHAR(100),
  phone_extension VARCHAR(10),
  hire_date DATE NOT NULL,
  department_id INT NOT NULL,
  academic_rank ENUM('Professor', 'Associate Professor', 'Assistant Professor', 'Lecturer',
'Adjunct'),
  employment_status ENUM('Full-time', 'Part-time', 'Adjunct'),
  created_date DATETIME DEFAULT CURRENT_TIMESTAMP,

  CONSTRAINT FK_Instructor_Department FOREIGN KEY (department_id)
  REFERENCES DEPARTMENT(department_id)
);

-- ============================================
-- Table: STUDENT
-- Description: Stores student information and academic records
-- ============================================
CREATE TABLE STUDENT (
  student_id INT AUTO_INCREMENT PRIMARY KEY,
  first_name VARCHAR(50) NOT NULL,
  last_name VARCHAR(50) NOT NULL,
  email VARCHAR(255) UNIQUE NOT NULL,
  phone_number VARCHAR(20),
  date_of_birth DATE NOT NULL,
  address TEXT,
  enrollment_date DATE DEFAULT (CURRENT_DATE),
  major_department_id INT NULL,
  academic_status ENUM('Active', 'Probation', 'Suspended', 'Graduated', 'Withdrawn')
DEFAULT 'Active',
  total_credits_earned INT DEFAULT 0,
  cumulative_gpa DECIMAL(3,2),
  created_date DATETIME DEFAULT CURRENT_TIMESTAMP,

  CONSTRAINT FK_Student_MajorDepartment FOREIGN KEY (major_department_id)
  REFERENCES DEPARTMENT(department_id)
);

-- ============================================
-- Table: COURSE
-- Description: Stores course offerings and details
-- ============================================
CREATE TABLE COURSE (
  course_id INT AUTO_INCREMENT PRIMARY KEY,
```

```
  course_code VARCHAR(20) NOT NULL,
  course_name VARCHAR(100) NOT NULL,
  description TEXT,
  credits INT NOT NULL,
  department_id INT NOT NULL,
  instructor_id INT NULL,
  max_capacity INT NOT NULL,
  current_enrollment INT DEFAULT 0,
  semester ENUM('Fall', 'Spring', 'Summer', 'Winter'),
  academic_year INT,
  course_level ENUM('Undergraduate', 'Graduate', 'Doctoral'),
  delivery_mode ENUM('In-person', 'Online', 'Hybrid'),
  schedule_info VARCHAR(200),
  course_status ENUM('Active', 'Archived', 'Cancelled') DEFAULT 'Active',
  created_date DATETIME DEFAULT CURRENT_TIMESTAMP,

  CONSTRAINT FK_Course_Department FOREIGN KEY (department_id)
  REFERENCES DEPARTMENT(department_id),

  CONSTRAINT FK_Course_Instructor FOREIGN KEY (instructor_id)
  REFERENCES INSTRUCTOR(instructor_id),

  CONSTRAINT UQ_Course_Code_Semester_Year UNIQUE (course_code, semester,
academic_year)
);

-- ============================================
-- Table: ENROLLMENT
-- Description: Manages student course registrations and grades
-- ============================================
CREATE TABLE ENROLLMENT (
  enrollment_id INT AUTO_INCREMENT PRIMARY KEY,
  student_id INT NOT NULL,
  course_id INT NOT NULL,
  enrollment_date DATETIME DEFAULT CURRENT_TIMESTAMP,
  enrollment_status ENUM('Registered', 'Waitlisted', 'Dropped', 'Completed', 'Withdrawn')
DEFAULT 'Registered',
  final_grade ENUM('A', 'A-', 'B+', 'B', 'B-', 'C+', 'C', 'C-', 'D+', 'D', 'F', 'I', 'W'),
  grade_points DECIMAL(4,2),
  completion_date DATE NULL,
  attendance_percentage DECIMAL(5,2),
  created_date DATETIME DEFAULT CURRENT_TIMESTAMP,

  CONSTRAINT FK_Enrollment_Student FOREIGN KEY (student_id)
  REFERENCES STUDENT(student_id) ON DELETE CASCADE,

  CONSTRAINT FK_Enrollment_Course FOREIGN KEY (course_id)
  REFERENCES COURSE(course_id) ON DELETE CASCADE,

  CONSTRAINT UQ_Student_Course UNIQUE (student_id, course_id)
);

-- ============================================
-- Table: ASSIGNMENT
-- Description: Stores course assignments and assessment details
-- ============================================
CREATE TABLE ASSIGNMENT (
```

```
    assignment_id INT AUTO_INCREMENT PRIMARY KEY,
    course_id INT NOT NULL,
    title VARCHAR(200) NOT NULL,
    description TEXT,
    assignment_type ENUM('Homework', 'Quiz', 'Project', 'Exam', 'Presentation', 'Lab'),
    due_date DATETIME NOT NULL,
    max_points DECIMAL(5,2) NOT NULL,
    submission_format ENUM('File Upload', 'Text Entry', 'Both'),
    allowed_file_types VARCHAR(100),
    late_submission_policy VARCHAR(200),
    instructions TEXT,
    weight_in_course DECIMAL(5,2),
    created_date DATETIME DEFAULT CURRENT_TIMESTAMP,

    CONSTRAINT FK_Assignment_Course FOREIGN KEY (course_id)
    REFERENCES COURSE(course_id) ON DELETE CASCADE
);

-- ============================================
-- Table: SUBMISSION
-- Description: Stores student assignment submissions
-- ============================================
CREATE TABLE SUBMISSION (
    submission_id INT AUTO_INCREMENT PRIMARY KEY,
    assignment_id INT NOT NULL,
    student_id INT NOT NULL,
    submission_date DATETIME DEFAULT CURRENT_TIMESTAMP,
    submission_content TEXT,
    file_path VARCHAR(500),
    file_name VARCHAR(255),
    file_size BIGINT,
    submission_status ENUM('Submitted', 'Late', 'Resubmitted') DEFAULT 'Submitted',
    version_number INT DEFAULT 1,
    created_date DATETIME DEFAULT CURRENT_TIMESTAMP,

    CONSTRAINT FK_Submission_Assignment FOREIGN KEY (assignment_id)
    REFERENCES ASSIGNMENT(assignment_id) ON DELETE CASCADE,

    CONSTRAINT FK_Submission_Student FOREIGN KEY (student_id)
    REFERENCES STUDENT(student_id) ON DELETE CASCADE,

    CONSTRAINT UQ_Assignment_Student UNIQUE (assignment_id, student_id,
version_number)
);
```

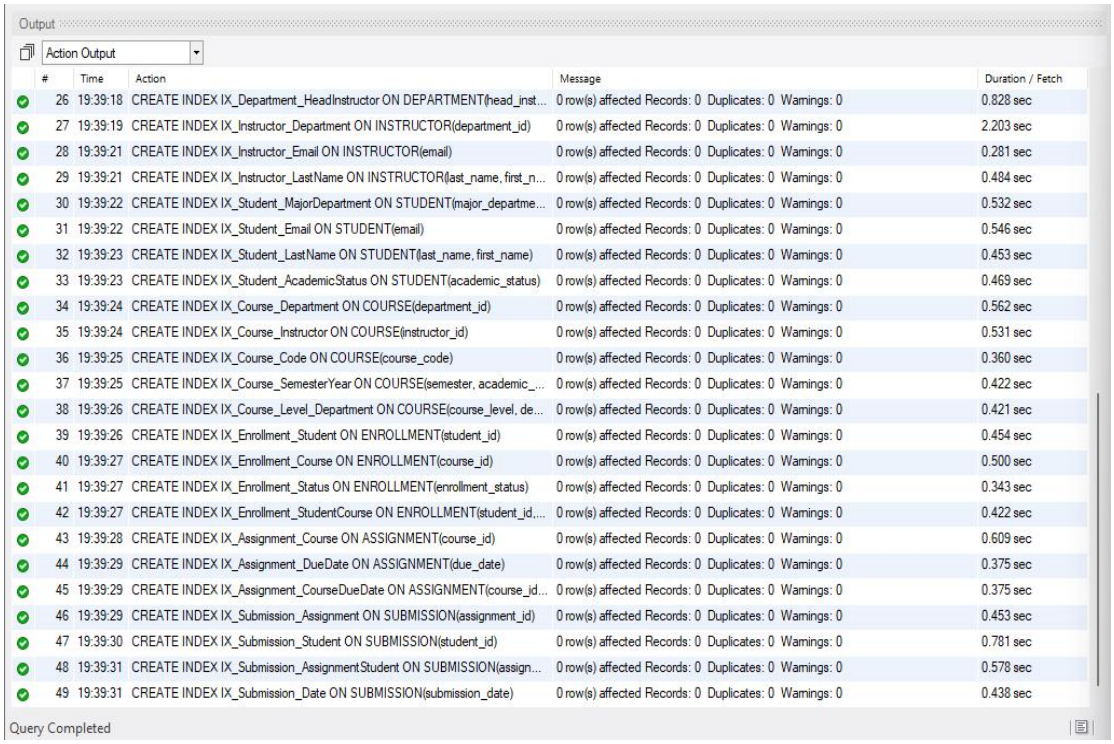


19	19:33:04	CREATE TABLE DEPARTMENT (department_id INT AUTO_INCREMENT ...	0 row(s) affected		1.781 sec
20	19:33:25	CREATE TABLE INSTRUCTOR (instructor_id INT AUTO_INCREMENT PR...	0 row(s) affected		3.109 sec
21	19:33:46	CREATE TABLE STUDENT (student_id INT AUTO_INCREMENT PRIMAR...	0 row(s) affected		2.187 sec
22	19:33:48	CREATE TABLE COURSE (course_id INT AUTO_INCREMENT PRIMARY ...	0 row(s) affected		1.531 sec
23	19:34:09	CREATE TABLE ENROLLMENT (enrollment_id INT AUTO_INCREMENT P...	0 row(s) affected		2.047 sec
24	19:34:25	CREATE TABLE ASSIGNMENT (assignment_id INT AUTO_INCREMENT P...	0 row(s) affected		1.828 sec
25	19:35:07	CREATE TABLE SUBMISSION (submission_id INT AUTO_INCREMENT P...	0 row(s) affected		0.719 sec

Query Completed

```
-- ============================================
-- Create Indexes for Performance
-- ============================================
```

```
-- DEPARTMENT indexes
CREATE INDEX IX_Department_HeadInstructor ON DEPARTMENT(head_instructor_id);

-- INSTRUCTOR indexes
CREATE INDEX IX_Instructor_Department ON INSTRUCTOR(department_id);
CREATE INDEX IX_Instructor_Email ON INSTRUCTOR(email);
CREATE INDEX IX_Instructor_LastName ON INSTRUCTOR(last_name, first_name);

-- STUDENT indexes
CREATE INDEX IX_Student_MajorDepartment ON STUDENT(major_department_id);
CREATE INDEX IX_Student_Email ON STUDENT(email);
CREATE INDEX IX_Student_LastName ON STUDENT(last_name, first_name);
CREATE INDEX IX_Student_AcademicStatus ON STUDENT(academic_status);

-- COURSE indexes
CREATE INDEX IX_Course_Department ON COURSE(department_id);
CREATE INDEX IX_Course_Instructor ON COURSE(instructor_id);
CREATE INDEX IX_Course_Code ON COURSE(course_code);
CREATE INDEX IX_Course_SemesterYear ON COURSE(semester, academic_year, course_status);
CREATE INDEX IX_Course_Level_Department ON COURSE(course_level, department_id);

-- ENROLLMENT indexes
CREATE INDEX IX_Enrollment_Student ON ENROLLMENT(student_id);
CREATE INDEX IX_Enrollment_Course ON ENROLLMENT(course_id);
CREATE INDEX IX_Enrollment_Status ON ENROLLMENT(enrollment_status);
CREATE INDEX IX_Enrollment_StudentCourse ON ENROLLMENT(student_id, course_id);

-- ASSIGNMENT indexes
CREATE INDEX IX_Assignment_Course ON ASSIGNMENT(course_id);
CREATE INDEX IX_Assignment_DueDate ON ASSIGNMENT(due_date);
CREATE INDEX IX_Assignment_CourseDueDate ON ASSIGNMENT(course_id, due_date);

-- SUBMISSION indexes
CREATE INDEX IX_Submission_Assignment ON SUBMISSION(assignment_id);
CREATE INDEX IX_Submission_Student ON SUBMISSION(student_id);
CREATE INDEX IX_Submission_AssignmentStudent ON SUBMISSION(assignment_id, student_id);
CREATE INDEX IX_Submission_Date ON SUBMISSION(submission_date);

-- ============================================
-- Update DEPARTMENT foreign key constraint (circular reference)
-- Must be added after INSTRUCTOR table exists
-- ============================================
ALTER TABLE DEPARTMENT
ADD CONSTRAINT FK_Department_HeadInstructor
FOREIGN KEY (head_instructor_id) REFERENCES INSTRUCTOR(instructor_id);

-- ============================================
-- Create composite indexes for common queries
-- ============================================
CREATE INDEX IX_Enrollment_StudentHistory ON ENROLLMENT(student_id, enrollment_status);
CREATE INDEX IX_Course_DepartmentEnrollment ON COURSE(department_id, semester,
academic_year);
CREATE INDEX IX_Submission_StudentHistory ON SUBMISSION(student_id, submission_date);
```



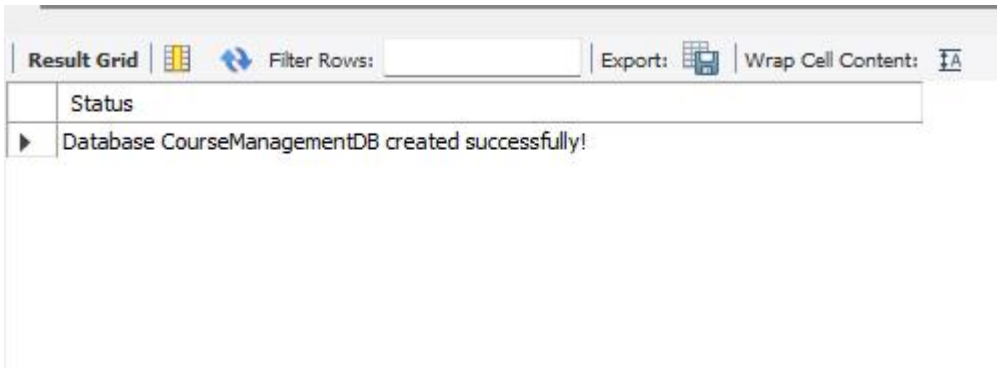
Output

Action Output

#	Time	Action	Message	Duration / Fetch
26	19:39:18	CREATE INDEX IX_Department_HeadInstructor ON DEPARTMENT(head_inst...	0 row(s) affected Records: 0 Duplicates: 0 Warnings: 0	0.828 sec
27	19:39:19	CREATE INDEX IX_Instructor_Department ON INSTRUCTOR(department_id)	0 row(s) affected Records: 0 Duplicates: 0 Warnings: 0	2.203 sec
28	19:39:21	CREATE INDEX IX_Instructor_Email ON INSTRUCTOR(email)	0 row(s) affected Records: 0 Duplicates: 0 Warnings: 0	0.281 sec
29	19:39:21	CREATE INDEX IX_Instructor_LastName ON INSTRUCTOR(last_name, first_n...	0 row(s) affected Records: 0 Duplicates: 0 Warnings: 0	0.484 sec
30	19:39:22	CREATE INDEX IX_Student_MajorDepartment ON STUDENT(major_departme...	0 row(s) affected Records: 0 Duplicates: 0 Warnings: 0	0.532 sec
31	19:39:22	CREATE INDEX IX_Student_Email ON STUDENT(email)	0 row(s) affected Records: 0 Duplicates: 0 Warnings: 0	0.546 sec
32	19:39:23	CREATE INDEX IX_Student_LastName ON STUDENT(last_name, first_name)	0 row(s) affected Records: 0 Duplicates: 0 Warnings: 0	0.453 sec
33	19:39:23	CREATE INDEX IX_Student_AcademicStatus ON STUDENT(academic_status)	0 row(s) affected Records: 0 Duplicates: 0 Warnings: 0	0.469 sec
34	19:39:24	CREATE INDEX IX_Course_Department ON COURSE(department_id)	0 row(s) affected Records: 0 Duplicates: 0 Warnings: 0	0.562 sec
35	19:39:24	CREATE INDEX IX_Course_Instructor ON COURSE(instructor_id)	0 row(s) affected Records: 0 Duplicates: 0 Warnings: 0	0.531 sec
36	19:39:25	CREATE INDEX IX_Course_Code ON COURSE(course_code)	0 row(s) affected Records: 0 Duplicates: 0 Warnings: 0	0.360 sec
37	19:39:25	CREATE INDEX IX_Course_SemesterYear ON COURSE(semester, academic_...	0 row(s) affected Records: 0 Duplicates: 0 Warnings: 0	0.422 sec
38	19:39:26	CREATE INDEX IX_Course_Level_Department ON COURSE(course_level, de...	0 row(s) affected Records: 0 Duplicates: 0 Warnings: 0	0.421 sec
39	19:39:26	CREATE INDEX IX_Enrollment_Student ON ENROLLMENT(student_id)	0 row(s) affected Records: 0 Duplicates: 0 Warnings: 0	0.454 sec
40	19:39:27	CREATE INDEX IX_Enrollment_Course ON ENROLLMENT(course_id)	0 row(s) affected Records: 0 Duplicates: 0 Warnings: 0	0.500 sec
41	19:39:27	CREATE INDEX IX_Enrollment_Status ON ENROLLMENT(enrollment_status)	0 row(s) affected Records: 0 Duplicates: 0 Warnings: 0	0.343 sec
42	19:39:27	CREATE INDEX IX_Enrollment_StudentCourse ON ENROLLMENT(student_id,...	0 row(s) affected Records: 0 Duplicates: 0 Warnings: 0	0.422 sec
43	19:39:28	CREATE INDEX IX_Assignment_Course ON ASSIGNMENT(course_id)	0 row(s) affected Records: 0 Duplicates: 0 Warnings: 0	0.609 sec
44	19:39:29	CREATE INDEX IX_Assignment_DueDate ON ASSIGNMENT(due_date)	0 row(s) affected Records: 0 Duplicates: 0 Warnings: 0	0.375 sec
45	19:39:29	CREATE INDEX IX_Assignment_CourseDueDate ON ASSIGNMENT(course_id...	0 row(s) affected Records: 0 Duplicates: 0 Warnings: 0	0.375 sec
46	19:39:29	CREATE INDEX IX_Submission_Assignment ON SUBMISSION(assignment_id)	0 row(s) affected Records: 0 Duplicates: 0 Warnings: 0	0.453 sec
47	19:39:30	CREATE INDEX IX_Submission_Student ON SUBMISSION(student_id)	0 row(s) affected Records: 0 Duplicates: 0 Warnings: 0	0.781 sec
48	19:39:31	CREATE INDEX IX_Submission_AssignmentStudent ON SUBMISSION(assign...	0 row(s) affected Records: 0 Duplicates: 0 Warnings: 0	0.578 sec
49	19:39:31	CREATE INDEX IX_Submission_Date ON SUBMISSION(submission_date)	0 row(s) affected Records: 0 Duplicates: 0 Warnings: 0	0.438 sec

Query Completed

```
-- ============================================
-- Verification Queries
-- ============================================
SELECT 'Database CourseManagementDB created successfully!' AS Status;
```



Result Grid | Filter Rows: | Export: | Wrap Cell Content:

Status
Database CourseManagementDB created successfully!

```
-- Verify table creation
SELECT
    TABLE_NAME AS 'Table Name',
    TABLE_TYPE AS 'Type'
FROM INFORMATION_SCHEMA.TABLES
WHERE TABLE_SCHEMA = 'CourseManagementDB'
ORDER BY TABLE_NAME;
```

Result Grid | Filter Rows:

Table Name	Type
assignment	BASE TABLE
course	BASE TABLE
department	BASE TABLE
enrollment	BASE TABLE
instructor	BASE TABLE
student	BASE TABLE
submission	BASE TABLE

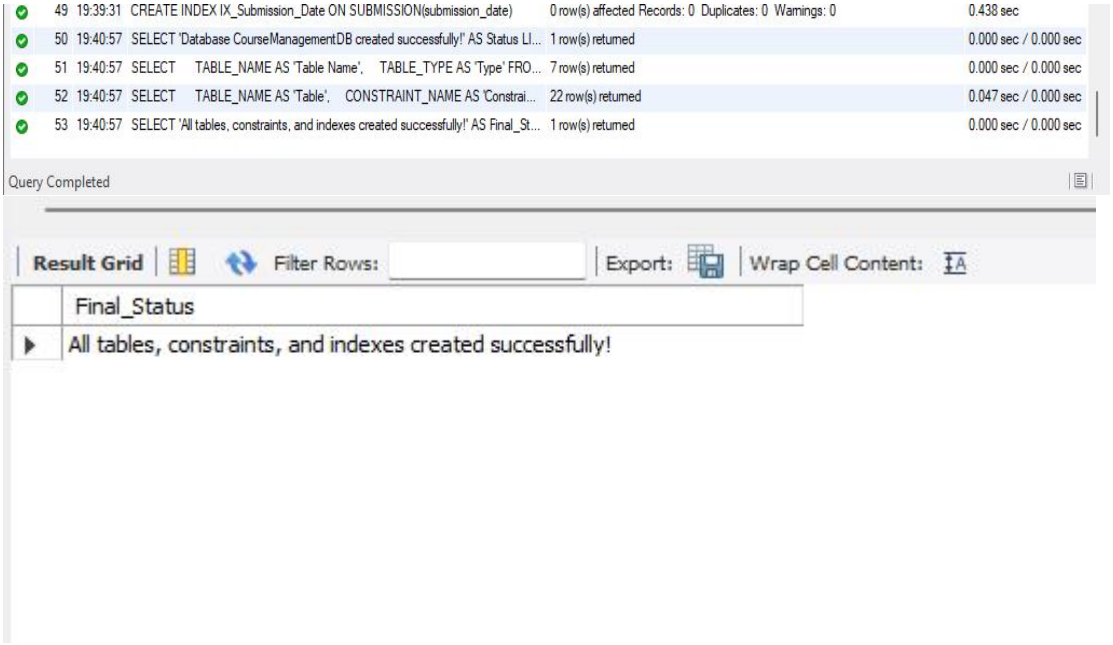
```
-- Verify constraints
SELECT
   TABLE_NAME AS 'Table',
   CONSTRAINT_NAME AS 'Constraint',
   CONSTRAINT_TYPE AS 'Type'
FROM INFORMATION_SCHEMA.TABLE_CONSTRAINTS
WHERE TABLE_SCHEMA = 'CourseManagementDB'
ORDER BY TABLE_NAME, CONSTRAINT_TYPE;
```

Result Grid | Filter Rows: | Export: | Wrap Cell Content:

Table	Constraint	Type
assignment	FK_Assignment_Course	FOREIGN KEY
assignment	PRIMARY	PRIMARY KEY
course	FK_Course_Department	FOREIGN KEY
course	FK_Course_Instructor	FOREIGN KEY
course	PRIMARY	PRIMARY KEY
course	UQ_Course_Code_Semester_Year	UNIQUE
department	PRIMARY	PRIMARY KEY
department	department_code	UNIQUE
enrollment	FK_Enrollment_Course	FOREIGN KEY
enrollment	FK_Enrollment_Student	FOREIGN KEY
enrollment	PRIMARY	PRIMARY KEY
enrollment	UQ_Student_Course	UNIQUE
instructor	FK_Instructor_Department	FOREIGN KEY
instructor	PRIMARY	PRIMARY KEY
instructor	email	UNIQUE
student	FK_Student_MajorDepartment	FOREIGN KEY
student	PRIMARY	PRIMARY KEY
student	email	UNIQUE
submission	FK_Submission_Assignment	FOREIGN KEY
submission	FK_Submission_Student	FOREIGN KEY
submission	PRIMARY	PRIMARY KEY
submission	UQ_Assignment_Student	UNIQUE

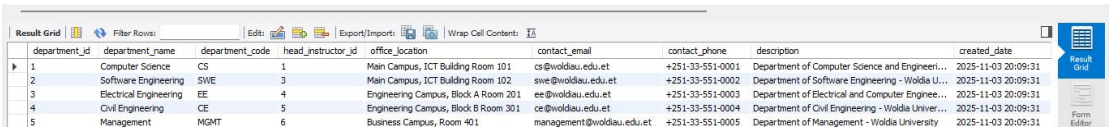
TABLE_CONSTRAINTS 2 ×

```
SELECT 'All tables, constraints, and indexes created successfully!' AS Final_Status;
```



Phase 1.7: Populate Realistic Sample Data (DML Implementation)

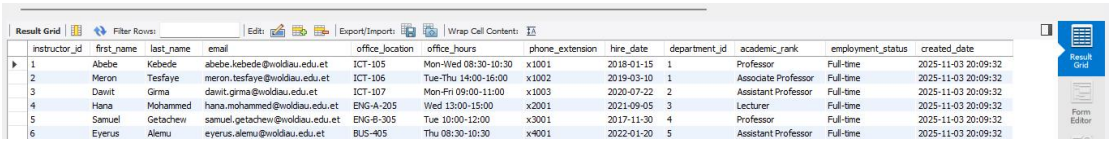
```
USE CourseManagementDB;

-- Insert Departments (Woldia University Structure)
INSERT INTO DEPARTMENT (department_name, department_code, office_location, contact_email,
contact_phone, description) VALUES
('Computer Science', 'CS', 'Main Campus, ICT Building Room 101', 'cs@woldiau.edu.et', '+251-33-
551-0001', 'Department of Computer Science and Engineering - Woldia University'),
('Software Engineering', 'SWE', 'Main Campus, ICT Building Room 102', 'swe@woldiau.edu.et',
'+251-33-551-0002', 'Department of Software Engineering - Woldia University'),
('Electrical Engineering', 'EE', 'Engineering Campus, Block A Room 201', 'ee@woldiau.edu.et', '+251-
33-551-0003', 'Department of Electrical and Computer Engineering - Woldia University'),
('Civil Engineering', 'CE', 'Engineering Campus, Block B Room 301', 'ce@woldiau.edu.et', '+251-33-
551-0004', 'Department of Civil Engineering - Woldia University'),
('Management', 'MGMT', 'Business Campus, Room 401', 'management@woldiau.edu.et', '+251-33-
551-0005', 'Department of Management - Woldia University');
```



department_id	department_name	department_code	head_instructor_id	office_location	contact_email	contact_phone	description	created_date
1	Computer Science	CS	1	Main Campus, ICT Building Room 101	cs@woldiau.edu.et	+251-33-551-0001	Department of Computer Science and Engineeri...	2025-11-03 20:09:31
2	Software Engineering	SWE	3	Main Campus, ICT Building Room 102	swe@woldiau.edu.et	+251-33-551-0002	Department of Software Engineering - Woldia U...	2025-11-03 20:09:31
3	Electrical Engineering	EE	4	Engineering Campus, Block A Room 201	ee@woldiau.edu.et	+251-33-551-0003	Department of Electrical and Computer Enginee...	2025-11-03 20:09:31
4	Civil Engineering	CE	5	Engineering Campus, Block B Room 301	ce@woldiau.edu.et	+251-33-551-0004	Department of Civil Engineering - Woldia Univer...	2025-11-03 20:09:31
5	Management	MGMT	6	Business Campus, Room 401	management@woldiau.edu.et	+251-33-551-0005	Department of Management - Woldia University	2025-11-03 20:09:31

```
-- Insert Instructors (Ethiopian Academic Staff)
INSERT INTO INSTRUCTOR (first_name, last_name, email, office_location, office_hours,
phone_extension, hire_date, department_id, academic_rank, employment_status) VALUES
('Abebe', 'Kebede', 'abebe.kebede@woldiau.edu.et', 'ICT-105', 'Mon-Wed 08:30-10:30', 'x1001',
'2018-01-15', 1, 'Professor', 'Full-time'),
('Meron', 'Tesfaye', 'meron.tesfaye@woldiau.edu.et', 'ICT-106', 'Tue-Thu 14:00-16:00', 'x1002',
'2019-03-10', 1, 'Associate Professor', 'Full-time'),
```

('Dawit', 'Girma', 'dawit.girma@woldiau.edu.et', 'ICT-107', 'Mon-Fri 09:00-11:00', 'x1003', '2020-07-22', 2, 'Assistant Professor', 'Full-time'),
('Hana', 'Mohammed', 'hana.mohammed@woldiau.edu.et', 'ENG-A-205', 'Wed 13:00-15:00', 'x2001', '2021-09-05', 3, 'Lecturer', 'Full-time'),
('Samuel', 'Getachew', 'samuel.getachew@woldiau.edu.et', 'ENG-B-305', 'Tue 10:00-12:00', 'x3001', '2017-11-30', 4, 'Professor', 'Full-time'),
('Eyerus', 'Alemu', 'eyerus.alemu@woldiau.edu.et', 'BUS-405', 'Thu 08:30-10:30', 'x4001', '2022-01-20', 5, 'Assistant Professor', 'Full-time');



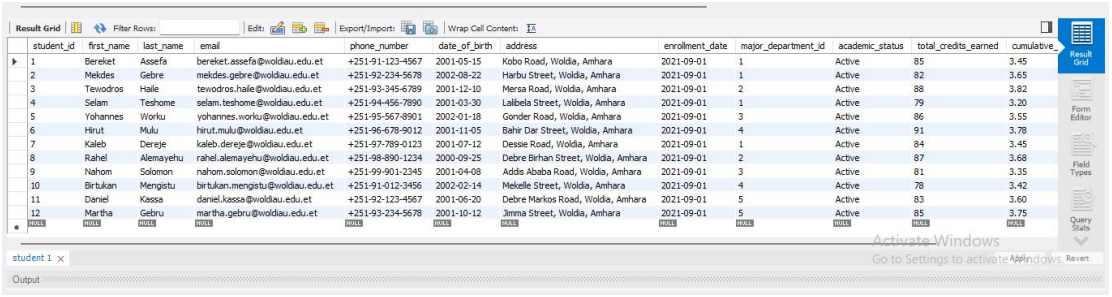
Result Grid | Filter Rows: | Edit: | Export/Import: | Wrap Cell Content:

instructor_id	first_name	last_name	email	office_location	office_hours	phone_extension	hire_date	department_id	academic_rank	employment_status	created_date
1	Abebe	Kebede	abebe.kebede@woldiau.edu.et	ICT-105	Mon-Wed 08:30-10:30	x1001	2018-01-15	1	Professor	Full-time	2025-11-03 20:09:32
2	Meron	Tesfaye	meron.tesfaye@woldiau.edu.et	ICT-106	Tue-Thu 14:00-16:00	x1002	2019-03-10	1	Associate Professor	Full-time	2025-11-03 20:09:32
3	Dawit	Girma	dawit.girma@woldiau.edu.et	ICT-107	Mon-Fri 09:00-11:00	x1003	2020-07-22	2	Assistant Professor	Full-time	2025-11-03 20:09:32
4	Hana	Mohammed	hana.mohammed@woldiau.edu.et	ENG-A-205	Wed 13:00-15:00	x2001	2021-09-05	3	Lecturer	Full-time	2025-11-03 20:09:32
5	Samuel	Getachew	samuel.getachew@woldiau.edu.et	ENG-B-305	Tue 10:00-12:00	x3001	2017-11-30	4	Professor	Full-time	2025-11-03 20:09:32
6	Eyerus	Alemu	eyerus.alemu@woldiau.edu.et	BUS-405	Thu 08:30-10:30	x4001	2022-01-20	5	Assistant Professor	Full-time	2025-11-03 20:09:32

Result Grid | Form Editor

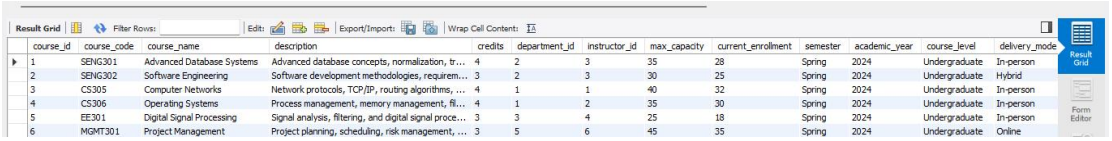
-- Update Department Heads
UPDATE DEPARTMENT SET head_instructor_id = 1 WHERE department_id = 1;
UPDATE DEPARTMENT SET head_instructor_id = 3 WHERE department_id = 2;
UPDATE DEPARTMENT SET head_instructor_id = 4 WHERE department_id = 3;
UPDATE DEPARTMENT SET head_instructor_id = 5 WHERE department_id = 4;
UPDATE DEPARTMENT SET head_instructor_id = 6 WHERE department_id = 5;

-- Insert Students (3rd Year Woldia University Students - Ethiopian Names)
INSERT INTO STUDENT (first_name, last_name, email, phone_number, date_of_birth, address, enrollment_date, major_department_id, academic_status, total_credits_earned, cumulative_gpa)
VALUES
('Bereket', 'Assefa', 'bereket.assefa@woldiau.edu.et', '+251-91-123-4567', '2001-05-15', 'Kobo Road, Woldia, Amhara', '2021-09-01', 1, 'Active', 85, 3.45),
('Mekdes', 'Gebre', 'mekdes.gebre@woldiau.edu.et', '+251-92-234-5678', '2002-08-22', 'Harbu Street, Woldia, Amhara', '2021-09-01', 1, 'Active', 82, 3.65),
('Tewodros', 'Haile', 'tewodros.haile@woldiau.edu.et', '+251-93-345-6789', '2001-12-10', 'Mersa Road, Woldia, Amhara', '2021-09-01', 2, 'Active', 88, 3.82),
('Selam', 'Teshome', 'selam.teshome@woldiau.edu.et', '+251-94-456-7890', '2001-03-30', 'Lalibela Street, Woldia, Amhara', '2021-09-01', 1, 'Active', 79, 3.20),
('Yohannes', 'Worku', 'yohannes.worku@woldiau.edu.et', '+251-95-567-8901', '2002-01-18', 'Gonder Road, Woldia, Amhara', '2021-09-01', 3, 'Active', 86, 3.55),
('Hirut', 'Mulu', 'hirut.mulu@woldiau.edu.et', '+251-96-678-9012', '2001-11-05', 'Bahir Dar Street, Woldia, Amhara', '2021-09-01', 4, 'Active', 91, 3.78),
('Kaleb', 'Dereje', 'kaleb.dereje@woldiau.edu.et', '+251-97-789-0123', '2001-07-12', 'Dessie Road, Woldia, Amhara', '2021-09-01', 1, 'Active', 84, 3.45),
('Rahel', 'Alemayehu', 'rahel.alemayehu@woldiau.edu.et', '+251-98-890-1234', '2000-09-25', 'Debre Birhan Street, Woldia, Amhara', '2021-09-01', 2, 'Active', 87, 3.68),
('Nahom', 'Solomon', 'nahom.solomon@woldiau.edu.et', '+251-99-901-2345', '2001-04-08', 'Addis Ababa Road, Woldia, Amhara', '2021-09-01', 3, 'Active', 81, 3.35),
('Birtukan', 'Mengistu', 'birtukan.mengistu@woldiau.edu.et', '+251-91-012-3456', '2002-02-14', 'Mekelle Street, Woldia, Amhara', '2021-09-01', 4, 'Active', 78, 3.42),
('Daniel', 'Kassa', 'daniel.kassa@woldiau.edu.et', '+251-92-123-4567', '2001-06-20', 'Debre Markos Road, Woldia, Amhara', '2021-09-01', 5, 'Active', 83, 3.60),
('Martha', 'Gebru', 'martha.gebru@woldiau.edu.et', '+251-93-234-5678', '2001-10-12', 'Jimma Street, Woldia, Amhara', '2021-09-01', 5, 'Active', 85, 3.75);



student_id	first_name	last_name	email	phone_number	date_of_birth	address	enrollment_date	major_department_id	academic_status	total_credits_earned	cumulative_
1	Bereket	Assefa	bereket.assefa@woldiau.edu.et	+251-91-123-4567	2001-05-15	Kobo Road, Woldia, Amhara	2021-09-01	1	Active	85	3.45
2	Mekides	Gebre	mekides.gebre@woldiau.edu.et	+251-92-234-5678	2002-08-22	Harbu Street, Woldia, Amhara	2021-09-01	1	Active	82	3.65
3	Tewodros	Haile	tewodros.haile@woldiau.edu.et	+251-93-345-6789	2001-12-10	Mersa Road, Woldia, Amhara	2021-09-01	2	Active	88	3.82
4	Selam	Teshome	selam.teshome@woldiau.edu.et	+251-94-456-7890	2001-03-30	Lalibela Street, Woldia, Amhara	2021-09-01	1	Active	79	3.20
5	Yohannes	Worku	yohannes.worku@woldiau.edu.et	+251-95-567-8901	2002-01-18	Gonder Road, Woldia, Amhara	2021-09-01	3	Active	86	3.55
6	Hirut	Mulu	hirut.mulu@woldiau.edu.et	+251-96-678-9012	2001-11-05	Bahir Dar Street, Woldia, Amhara	2021-09-01	4	Active	91	3.78
7	Kaleb	Dereje	kaleb.dereje@woldiau.edu.et	+251-97-789-0123	2001-07-12	Dessie Road, Woldia, Amhara	2021-09-01	1	Active	84	3.45
8	Rahel	Alemayehu	rahel.alemayehu@woldiau.edu.et	+251-98-890-1234	2000-09-25	Debre Birhan Street, Woldia, Amhara	2021-09-01	2	Active	87	3.68
9	Nahom	Solomon	nahom.solomon@woldiau.edu.et	+251-99-901-2345	2001-04-08	Addis Ababa Road, Woldia, Amhara	2021-09-01	3	Active	81	3.35
10	Birtukan	Mengistu	birtukan.mengistu@woldiau.edu.et	+251-91-012-3456	2002-02-14	Mekelle Street, Woldia, Amhara	2021-09-01	4	Active	78	3.42
11	Daniel	Kassa	daniel.kassa@woldiau.edu.et	+251-92-123-4567	2001-06-20	Debre Markos Road, Woldia, Amhara	2021-09-01	5	Active	83	3.60
12	Martha	Gebru	martha.gebru@woldiau.edu.et	+251-93-234-5678	2001-10-12	Jimma Street, Woldia, Amhara	2021-09-01	5	Active	85	3.75

-- Insert Courses (3rd Year Computer Science/Software Engineering Courses)
INSERT INTO COURSE (course_code, course_name, description, credits, department_id, instructor_id, max_capacity, current_enrollment, semester, academic_year, course_level, delivery_mode, schedule_info) VALUES
('SENG301', 'Advanced Database Systems', 'Advanced database concepts, normalization, transactions, and distributed databases', 4, 2, 3, 35, 28, 'Spring', 2024, 'Undergraduate', 'In-person', 'Mon-Wed 08:30-10:00, ICT Building Room 201'),
('SENG302', 'Software Engineering', 'Software development methodologies, requirements engineering, and design patterns', 3, 2, 3, 30, 25, 'Spring', 2024, 'Undergraduate', 'Hybrid', 'Tue-Thu 10:30-12:00, ICT Building Room 202'),
('CS305', 'Computer Networks', 'Network protocols, TCP/IP, routing algorithms, and network security', 4, 1, 1, 40, 32, 'Spring', 2024, 'Undergraduate', 'In-person', 'Mon-Wed-Fri 14:00-15:00, ICT Building Room 101'),
('CS306', 'Operating Systems', 'Process management, memory management, file systems, and virtualization', 4, 1, 2, 35, 30, 'Spring', 2024, 'Undergraduate', 'In-person', 'Tue-Thu 08:30-10:00, ICT Building Room 102'),
('EE301', 'Digital Signal Processing', 'Signal analysis, filtering, and digital signal processing techniques', 3, 3, 4, 25, 18, 'Spring', 2024, 'Undergraduate', 'In-person', 'Mon-Wed 16:00-17:30, Engineering Building Room 201'),
('MGMT301', 'Project Management', 'Project planning, scheduling, risk management, and team leadership', 3, 5, 6, 45, 35, 'Spring', 2024, 'Undergraduate', 'Online', 'Asynchronous with bi-weekly meetings');



course_id	course_code	course_name	description	credits	department_id	instructor_id	max_capacity	current_enrollment	semester	academic_year	course_level	delivery_mode
1	SENG301	Advanced Database Systems	Advanced database concepts, normalization, tr...	4	2	3	35	28	Spring	2024	Undergraduate	In-person
2	SENG302	Software Engineering	Software development methodologies, requirem...	3	2	3	30	25	Spring	2024	Undergraduate	Hybrid
3	CS305	Computer Networks	Network protocols, TCP/IP, routing algorithms, ...	4	1	1	40	32	Spring	2024	Undergraduate	In-person
4	CS306	Operating Systems	Process management, memory management, fi...	4	1	2	35	30	Spring	2024	Undergraduate	In-person
5	EE301	Digital Signal Processing	Signal analysis, filtering, and digital signal proce...	3	3	4	25	18	Spring	2024	Undergraduate	In-person
6	MGMT301	Project Management	Project planning, scheduling, risk management, ...	3	5	6	45	35	Spring	2024	Undergraduate	Online

-- Insert Enrollments (3rd Year Student Course Registrations)
INSERT INTO ENROLLMENT (student_id, course_id, enrollment_status, final_grade, grade_points, attendance_percentage) VALUES
-- SENG301 - Advanced Database Systems
(1, 1, 'Registered', NULL, NULL, 92.5),
(2, 1, 'Registered', NULL, NULL, 88.2),
(3, 1, 'Registered', NULL, NULL, 95.0),
(4, 1, 'Registered', NULL, NULL, 90.1),
(8, 1, 'Registered', NULL, NULL, 87.8),

-- SENG302 - Software Engineering
(1, 2, 'Registered', NULL, NULL, 91.3),
(3, 2, 'Registered', NULL, NULL, 89.7),
(8, 2, 'Registered', NULL, NULL, 93.2),

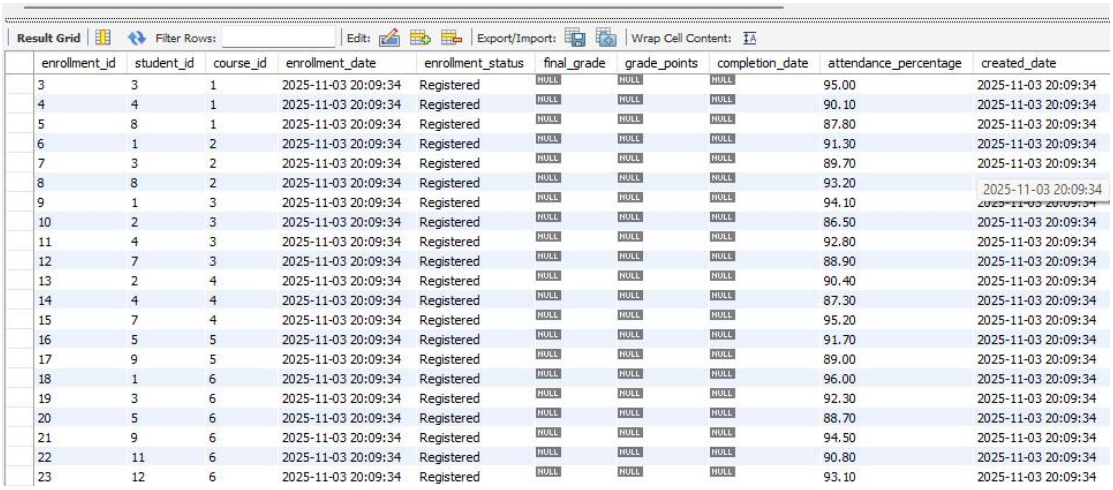
-- CS305 - Computer Networks
(1, 3, 'Registered', NULL, NULL, 94.1),
(2, 3, 'Registered', NULL, NULL, 86.5),

(4, 3, 'Registered', NULL, NULL, 92.8),
(7, 3, 'Registered', NULL, NULL, 88.9),

-- CS306 - Operating Systems
(2, 4, 'Registered', NULL, NULL, 90.4),
(4, 4, 'Registered', NULL, NULL, 87.3),
(7, 4, 'Registered', NULL, NULL, 95.2),

-- EE301 - Digital Signal Processing
(5, 5, 'Registered', NULL, NULL, 91.7),
(9, 5, 'Registered', NULL, NULL, 89.0),

-- MGMT301 - Project Management
(1, 6, 'Registered', NULL, NULL, 96.0),
(3, 6, 'Registered', NULL, NULL, 92.3),
(5, 6, 'Registered', NULL, NULL, 88.7),
(9, 6, 'Registered', NULL, NULL, 94.5),
(11, 6, 'Registered', NULL, NULL, 90.8),
(12, 6, 'Registered', NULL, NULL, 93.1);



Result Grid | Filter Rows: | Edit: | Export/Import: | Wrap Cell Content:

enrollment_id	student_id	course_id	enrollment_date	enrollment_status	final_grade	grade_points	completion_date	attendance_percentage	created_date
3	3	1	2025-11-03 20:09:34	Registered	NULL	NULL	NULL	95.00	2025-11-03 20:09:34
4	4	1	2025-11-03 20:09:34	Registered	NULL	NULL	NULL	90.10	2025-11-03 20:09:34
5	8	1	2025-11-03 20:09:34	Registered	NULL	NULL	NULL	87.80	2025-11-03 20:09:34
6	1	2	2025-11-03 20:09:34	Registered	NULL	NULL	NULL	91.30	2025-11-03 20:09:34
7	3	2	2025-11-03 20:09:34	Registered	NULL	NULL	NULL	89.70	2025-11-03 20:09:34
8	8	2	2025-11-03 20:09:34	Registered	NULL	NULL	NULL	93.20	2025-11-03 20:09:34
9	1	3	2025-11-03 20:09:34	Registered	NULL	NULL	NULL	94.10	2025-11-03 20:09:34
10	2	3	2025-11-03 20:09:34	Registered	NULL	NULL	NULL	86.50	2025-11-03 20:09:34
11	4	3	2025-11-03 20:09:34	Registered	NULL	NULL	NULL	92.80	2025-11-03 20:09:34
12	7	3	2025-11-03 20:09:34	Registered	NULL	NULL	NULL	88.90	2025-11-03 20:09:34
13	2	4	2025-11-03 20:09:34	Registered	NULL	NULL	NULL	90.40	2025-11-03 20:09:34
14	4	4	2025-11-03 20:09:34	Registered	NULL	NULL	NULL	87.30	2025-11-03 20:09:34
15	7	4	2025-11-03 20:09:34	Registered	NULL	NULL	NULL	95.20	2025-11-03 20:09:34
16	5	5	2025-11-03 20:09:34	Registered	NULL	NULL	NULL	91.70	2025-11-03 20:09:34
17	9	5	2025-11-03 20:09:34	Registered	NULL	NULL	NULL	89.00	2025-11-03 20:09:34
18	1	6	2025-11-03 20:09:34	Registered	NULL	NULL	NULL	96.00	2025-11-03 20:09:34
19	3	6	2025-11-03 20:09:34	Registered	NULL	NULL	NULL	92.30	2025-11-03 20:09:34
20	5	6	2025-11-03 20:09:34	Registered	NULL	NULL	NULL	88.70	2025-11-03 20:09:34
21	9	6	2025-11-03 20:09:34	Registered	NULL	NULL	NULL	94.50	2025-11-03 20:09:34
22	11	6	2025-11-03 20:09:34	Registered	NULL	NULL	NULL	90.80	2025-11-03 20:09:34
23	12	6	2025-11-03 20:09:34	Registered	NULL	NULL	NULL	93.10	2025-11-03 20:09:34

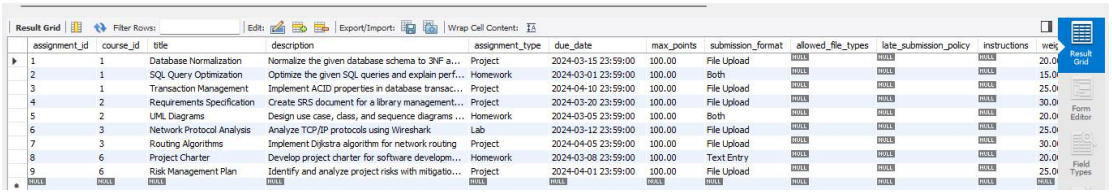
-- Insert Assignments (3rd Year Course Assignments)
INSERT INTO ASSIGNMENT (course_id, title, description, assignment_type, due_date, max_points, submission_format, weight_in_course) VALUES
-- SENG301 Assignments
(1, 'Database Normalization', 'Normalize the given database schema to 3NF and justify your design', 'Project', '2024-03-15 23:59:00', 100, 'File Upload', 20.00),
(1, 'SQL Query Optimization', 'Optimize the given SQL queries and explain performance improvements', 'Homework', '2024-03-01 23:59:00', 100, 'Both', 15.00),
(1, 'Transaction Management', 'Implement ACID properties in database transactions', 'Project', '2024-04-10 23:59:00', 100, 'File Upload', 25.00),

-- SENG302 Assignments
(2, 'Requirements Specification', 'Create SRS document for a library management system', 'Project', '2024-03-20 23:59:00', 100, 'File Upload', 30.00),
(2, 'UML Diagrams', 'Design use case, class, and sequence diagrams for given system', 'Homework', '2024-03-05 23:59:00', 100, 'Both', 20.00),

-- CS305 Assignments
(3, 'Network Protocol Analysis', 'Analyze TCP/IP protocols using Wireshark', 'Lab', '2024-03-12 23:59:00', 100, 'File Upload', 25.00),

(3, 'Routing Algorithms', 'Implement Dijkstra algorithm for network routing', 'Project', '2024-04-05 23:59:00', 100, 'File Upload', 30.00),

-- MGMT301 Assignments
(6, 'Project Charter', 'Develop project charter for software development project', 'Homework', '2024-03-08 23:59:00', 100, 'Text Entry', 20.00),
(6, 'Risk Management Plan', 'Identify and analyze project risks with mitigation strategies', 'Project', '2024-04-01 23:59:00', 100, 'File Upload', 25.00);



assignment_id	course_id	title	description	assignment_type	due_date	max_points	submission_format	allowed_file_types	late_submission_policy	instructions	weig
1	1	Database Normalization	Normalize the given database schema to 3NF a…	Project	2024-03-15 23:59:00	100.00	File Upload	NULL	NULL	NULL	20.0
2	1	SQL Query Optimization	Optimize the given SQL queries and explain perf…	Homework	2024-03-01 23:59:00	100.00	Both	NULL	NULL	NULL	15.0
3	1	Transaction Management	Implement ACID properties in database transac…	Project	2024-04-10 23:59:00	100.00	File Upload	NULL	NULL	NULL	25.0
4	2	Requirements Specification	Create SRS document for a library management…	Project	2024-03-20 23:59:00	100.00	File Upload	NULL	NULL	NULL	30.0
5	2	UML Diagrams	Design use case, class, and sequence diagrams …	Homework	2024-03-05 23:59:00	100.00	Both	NULL	NULL	NULL	20.0
6	3	Network Protocol Analysis	Analyze TCP/IP protocols using Wireshark	Lab	2024-03-12 23:59:00	100.00	File Upload	NULL	NULL	NULL	25.0
7	3	Routing Algorithms	Implement Dijkstra algorithm for network routing	Project	2024-04-05 23:59:00	100.00	File Upload	NULL	NULL	NULL	30.0
8	6	Project Charter	Develop project charter for software developm…	Homework	2024-03-08 23:59:00	100.00	Text Entry	NULL	NULL	NULL	20.0
9	6	Risk Management Plan	Identify and analyze project risks with mitigatio…	Project	2024-04-01 23:59:00	100.00	File Upload	NULL	NULL	NULL	25.0

-- Insert Submissions (Student Work Submissions)
INSERT INTO SUBMISSION (assignment_id, student_id, submission_content, file_path, file_name, file_size, submission_status) VALUES
-- Database Normalization Submissions
(1, 1, 'Normalized schema to 3NF with proper justification', '/uploads/bereket_normalization.pdf', 'normalization_report.pdf', 2048, 'Submitted'),
(1, 3, 'Completed normalization with ER diagrams and schema', '/uploads/tewodros_normalization.docx', 'database_design.docx', 3072, 'Submitted'),

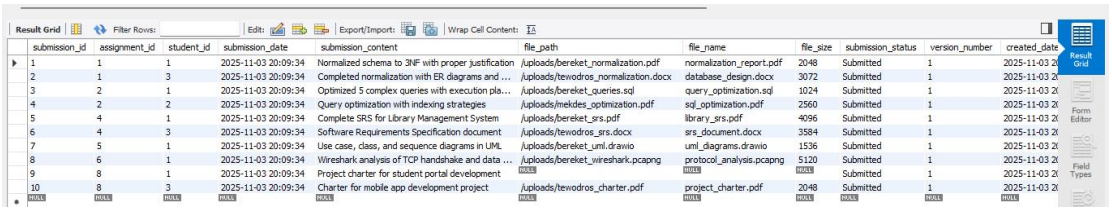
-- SQL Query Optimization Submissions
(2, 1, 'Optimized 5 complex queries with execution plan analysis', '/uploads/bereket_queries.sql', 'query_optimization.sql', 1024, 'Submitted'),
(2, 2, 'Query optimization with indexing strategies', '/uploads/mekdes_optimization.pdf', 'sql_optimization.pdf', 2560, 'Submitted'),

-- Requirements Specification Submissions
(4, 1, 'Complete SRS for Library Management System', '/uploads/bereket_srs.pdf', 'library_srs.pdf', 4096, 'Submitted'),
(4, 3, 'Software Requirements Specification document', '/uploads/tewodros_srs.docx', 'srs_document.docx', 3584, 'Submitted'),

-- UML Diagrams Submissions
(5, 1, 'Use case, class, and sequence diagrams in UML', '/uploads/bereket_uml.drawio', 'uml_diagrams.drawio', 1536, 'Submitted'),

-- Network Protocol Analysis
(6, 1, 'Wireshark analysis of TCP handshake and data transfer', '/uploads/bereket_wireshark.pcapng', 'protocol_analysis.pcapng', 5120, 'Submitted'),

-- Project Charter Submissions
(8, 1, 'Project charter for student portal development', NULL, NULL, NULL, 'Submitted'),
(8, 3, 'Charter for mobile app development project', '/uploads/tewodros_charter.pdf', 'project_charter.pdf', 2048, 'Submitted');



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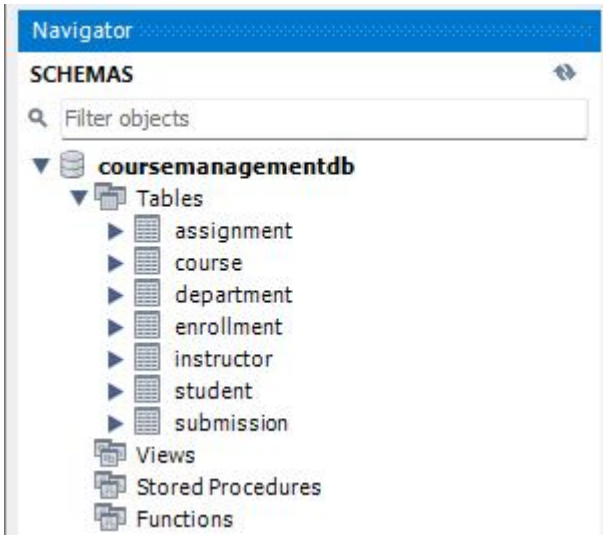
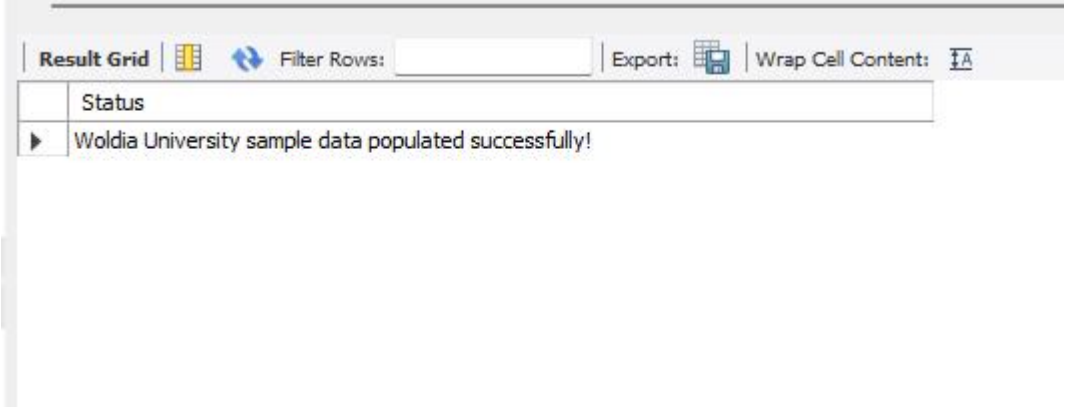
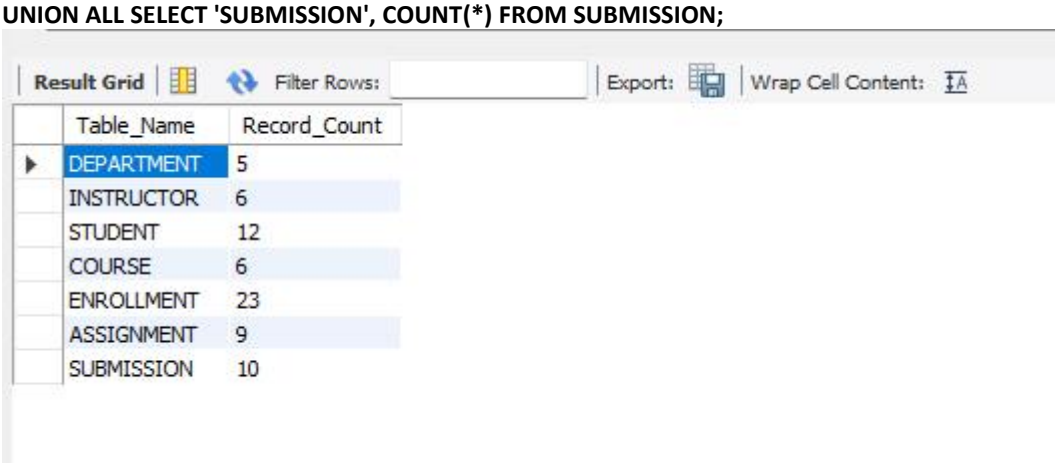
1	1	1	2025-11-03 20:09:34	Normalized schema to 3NF with proper justification	/uploads/bereket_normalization.pdf	normalization_report.pdf	2048	Submitted	1	2025-11-03 2(
2	1	3	2025-11-03 20:09:34	Completed normalization with ER diagrams and …	/uploads/tewodros_normalization.docx	database_design.docx	3072	Submitted	1	2025-11-03 2(
3	2	1	2025-11-03 20:09:34	Optimized 5 complex queries with execution pla…	/uploads/bereket_queries.sql	query_optimization.sql	1024	Submitted	1	2025-11-03 2(
4	2	2	2025-11-03 20:09:34	Query optimization with indexing strategies	/uploads/mekdes_optimization.pdf	sql_optimization.pdf	2560	Submitted	1	2025-11-03 2(
5	4	1	2025-11-03 20:09:34	Complete SRS for Library Management System	/uploads/bereket_srs.pdf	library_srs.pdf	4096	Submitted	1	2025-11-03 2(
6	4	3	2025-11-03 20:09:34	Software Requirements Specification document	/uploads/tewodros_srs.docx	srs_document.docx	3584	Submitted	1	2025-11-03 2(
7	5	1	2025-11-03 20:09:34	Use case, class, and sequence diagrams in UML	/uploads/bereket_uml.drawio	uml_diagrams.drawio	1536	Submitted	1	2025-11-03 2(
8	6	1	2025-11-03 20:09:34	Wireshark analysis of TCP handshake and data …	/uploads/bereket_wireshark.pcapng	protocol_analysis.pcapng	5120	Submitted	1	2025-11-03 2(
9	8	1	2025-11-03 20:09:34	Project charter for student portal development	NULL	NULL	NULL	Submitted	1	2025-11-03 2(
10	8	3	2025-11-03 20:09:34	Charter for mobile app development project	/uploads/tewodros_charter.pdf	project_charter.pdf	2048	Submitted	1	2025-11-03 2(




```
-- Verification Query
SELECT 'Woldia University sample data populated successfully!' AS Status;
```

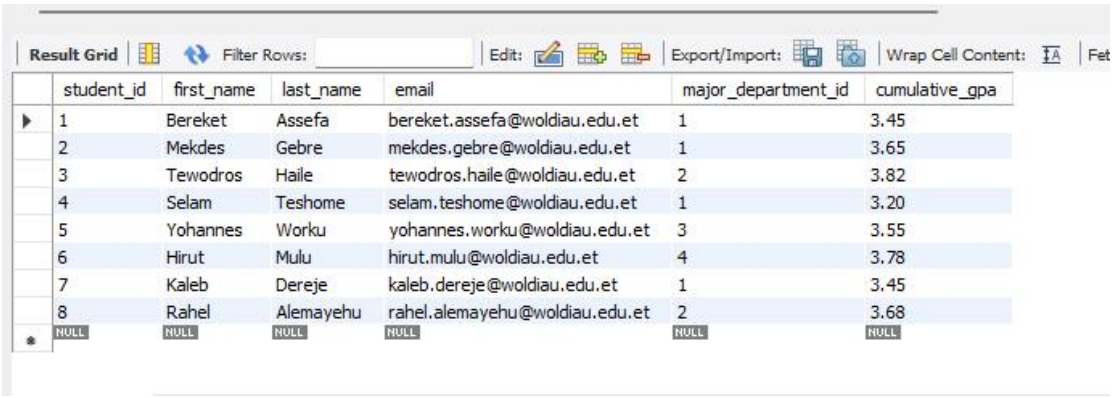



```
-- Count records in each table
SELECT
   'DEPARTMENT' AS Table_Name, COUNT(*) AS Record_Count FROM DEPARTMENT
UNION ALL SELECT 'INSTRUCTOR', COUNT(*) FROM INSTRUCTOR
UNION ALL SELECT 'STUDENT', COUNT(*) FROM STUDENT
UNION ALL SELECT 'COURSE', COUNT(*) FROM COURSE
UNION ALL SELECT 'ENROLLMENT', COUNT(*) FROM ENROLLMENT
UNION ALL SELECT 'ASSIGNMENT', COUNT(*) FROM ASSIGNMENT
UNION ALL SELECT 'SUBMISSION', COUNT(*) FROM SUBMISSION;
```



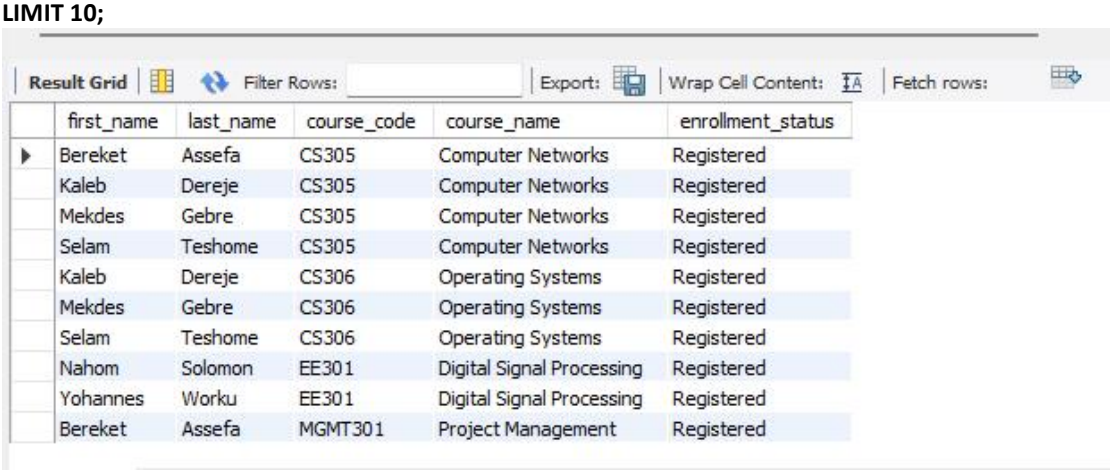

```
-- Display sample student data
```

```
SELECT student_id, first_name, last_name, email, major_department_id, cumulative_gpa
FROM STUDENT
ORDER BY student_id
LIMIT 8;
```



student_id	first_name	last_name	email	major_department_id	cumulative_gpa
1	Bereket	Assefa	bereket.assefa@woldiau.edu.et	1	3.45
2	Mekdes	Gebre	mekdes.gebre@woldiau.edu.et	1	3.65
3	Tewodros	Haile	tewodros.haile@woldiau.edu.et	2	3.82
4	Selam	Teshome	selam.teshome@woldiau.edu.et	1	3.20
5	Yohannes	Worku	yohannes.worku@woldiau.edu.et	3	3.55
6	Hirut	Mulu	hirut.mulu@woldiau.edu.et	4	3.78
7	Kaleb	Dereje	kaleb.dereje@woldiau.edu.et	1	3.45
8	Rahel	Alemayehu	rahel.alemayehu@woldiau.edu.et	2	3.68
NULL	NULL	NULL	NULL	NULL	NULL

```
-- Display course enrollments
SELECT s.first_name, s.last_name, c.course_code, c.course_name, e.enrollment_status
FROM STUDENT s
JOIN ENROLLMENT e ON s.student_id = e.student_id
JOIN COURSE c ON e.course_id = c.course_id
ORDER BY c.course_code, s.first_name
LIMIT 10;
```



first_name	last_name	course_code	course_name	enrollment_status
Bereket	Assefa	CS305	Computer Networks	Registered
Kaleb	Dereje	CS305	Computer Networks	Registered
Mekdes	Gebre	CS305	Computer Networks	Registered
Selam	Teshome	CS305	Computer Networks	Registered
Kaleb	Dereje	CS306	Operating Systems	Registered
Mekdes	Gebre	CS306	Operating Systems	Registered
Selam	Teshome	CS306	Operating Systems	Registered
Nahom	Solomon	EE301	Digital Signal Processing	Registered
Yohannes	Worku	EE301	Digital Signal Processing	Registered
Bereket	Assefa	MGMT301	Project Management	Registered