Database Systems Laboratory Work — Full Solutions with ER Diagrams

Part 1: Key Identification (Detailed explanations)

Task 1.1 — Employee

Superkeys: any combination of attributes that uniquely identify a row. Examples: {EmpID}, {SSN}, {Email}, {Phone}, {EmpID, Name}, {SSN, Department}.
Candidate keys: minimal superkeys with no extra attributes. Here: {EmpID}, {SSN}, {Email} (and {Phone} only if business rule guarantees uniqueness).
Primary key: choose *EmpID* because it is a stable artificial identifier; IDs are easier to manage than natural keys that can change.
Phone uniqueness: in real systems two employees could share a phone (e.g. office line). Unless the requirement says 'phone is unique', do not assume it.

Task 1.1 — Course Registration

Business rules summary: a student may take the same course in different semesters, a student cannot register for the same course section in the same semester; course section credit is fixed.
Primary key: {StudentID, CourseCode, Section, Semester, Year} — this combination uniquely identifies a single registration record.

Task 1.2 — Foreign Keys

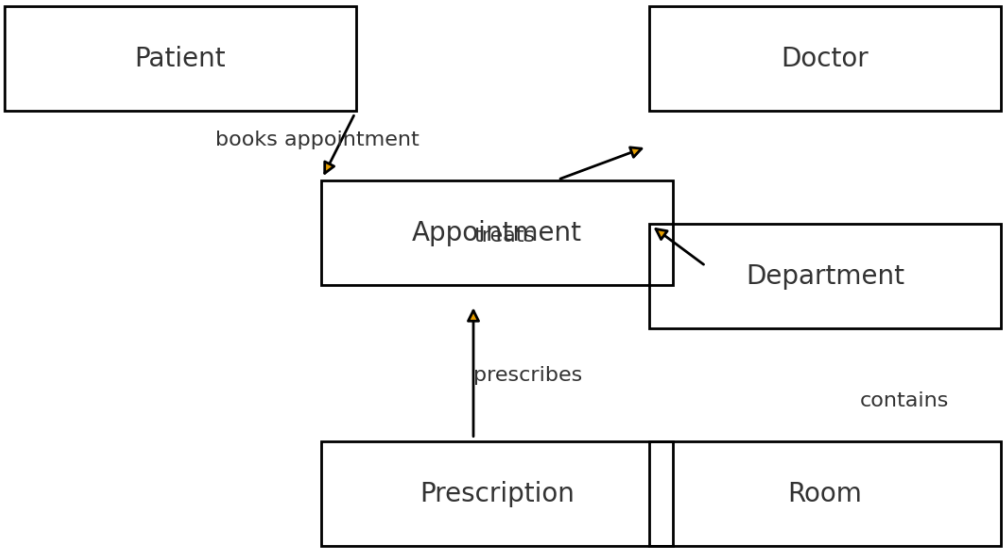
Identify foreign key relationships in the university schema:
• Student(AdvisorID) → Professor(ProfID) • Course(DepartmentCode) → Department(DeptCode) • Department(ChairID) → Professor(ProfID) • Enrollment(StudentID) → Student(StudentID) • Enrollment(CourseID) → Course(CourseID)

Part 2: ER Diagram Construction

Task 2.1 — Hospital Management System

Entities (brief): Patient, Doctor, Department, Room (weak), Appointment, Prescription. Attributes and PK/FK are listed in the report.

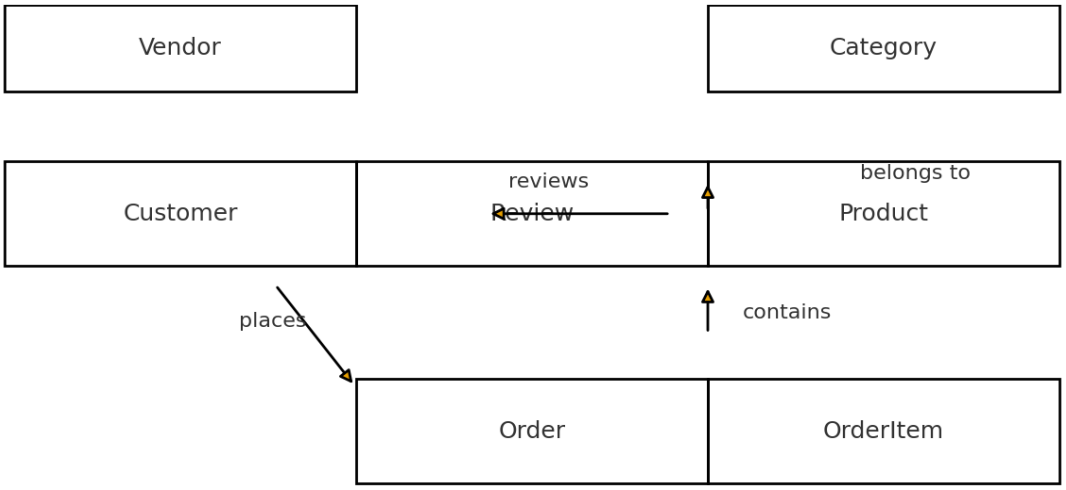
ER Diagram (Hospital):



Task 2.2 — E-commerce Platform

Entities (brief): Customer, Order, Product, Category, Vendor, OrderItem (weak), Review.

ER Diagram (E-commerce):



Part 4: Normalization Workshop

Task 4.1 — StudentProject

Given table columns: StudentID, StudentName, StudentMajor, ProjectID, ProjectTitle, ProjectType, SupervisorID, SupervisorName, SupervisorDept, Role, HoursWorked, StartDate, EndDate.
Functional dependencies: • StudentID → StudentName, StudentMajor • ProjectID → ProjectTitle, ProjectType • SupervisorID → SupervisorName, SupervisorDept • {StudentID, ProjectID} → Role, HoursWorked, StartDate, EndDate
2NF decomposition (remove partial dependencies): Student, Project, Supervisor, StudentProject associative table.

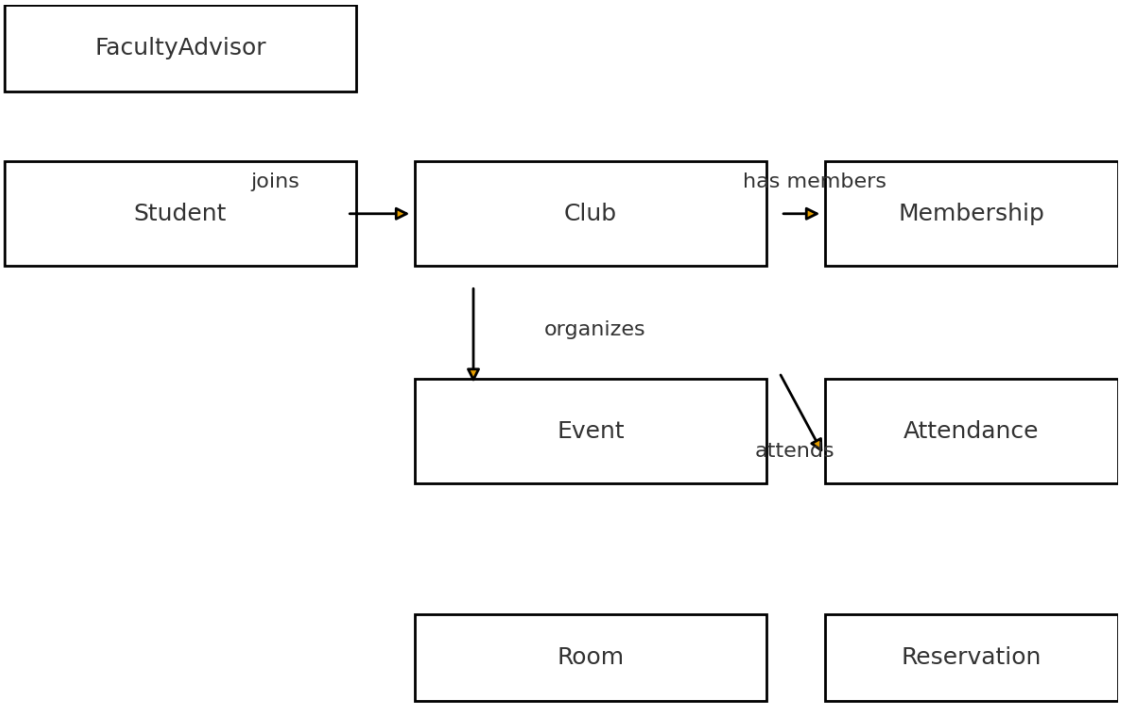
Task 4.2 — CourseSchedule

Given table columns: StudentID, StudentMajor, CourseID, CourseName, InstructorID, InstructorName, TimeSlot, Room, Building.
FDs: • StudentID → StudentMajor • CourseID → CourseName • InstructorID → InstructorName • Room → Building • {CourseID, TimeSlot} → InstructorID, Room
BCNF decomposition suggestion: Student, Course, Instructor, Room, CourseSchedule.

Part 5: Design Challenge — Student Clubs

Entities (brief): Student, Club, Membership, Event, Attendance, FacultyAdvisor, ClubAdvisor, Room, Reservation, Expense.

ER Diagram (Clubs):



Example queries (English): 1. Find all students who are officers in the Computer Science Club. 2. List all events scheduled for next week with their room reservations. 3. Show total expenses per club for the current semester.