Database Design of Vocational University

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Data Engineering Batch 2024

Overview of the project

Why there is need for the design of Database?

- Data is duplicated or outdated across campuses
- Difficult to track consultants, coordinators, and classes
- Need for a centralized, scalable solution

Project Goals

- Replace manual spreadsheets with a relational database
- Centralize data about students, employees, programs, and locations
- Handle consultants, coordinators, and course enrollments
- Support future expansion (e.g., new campuses)
- Ensure secure handling of sensitive information

Conceptual Model

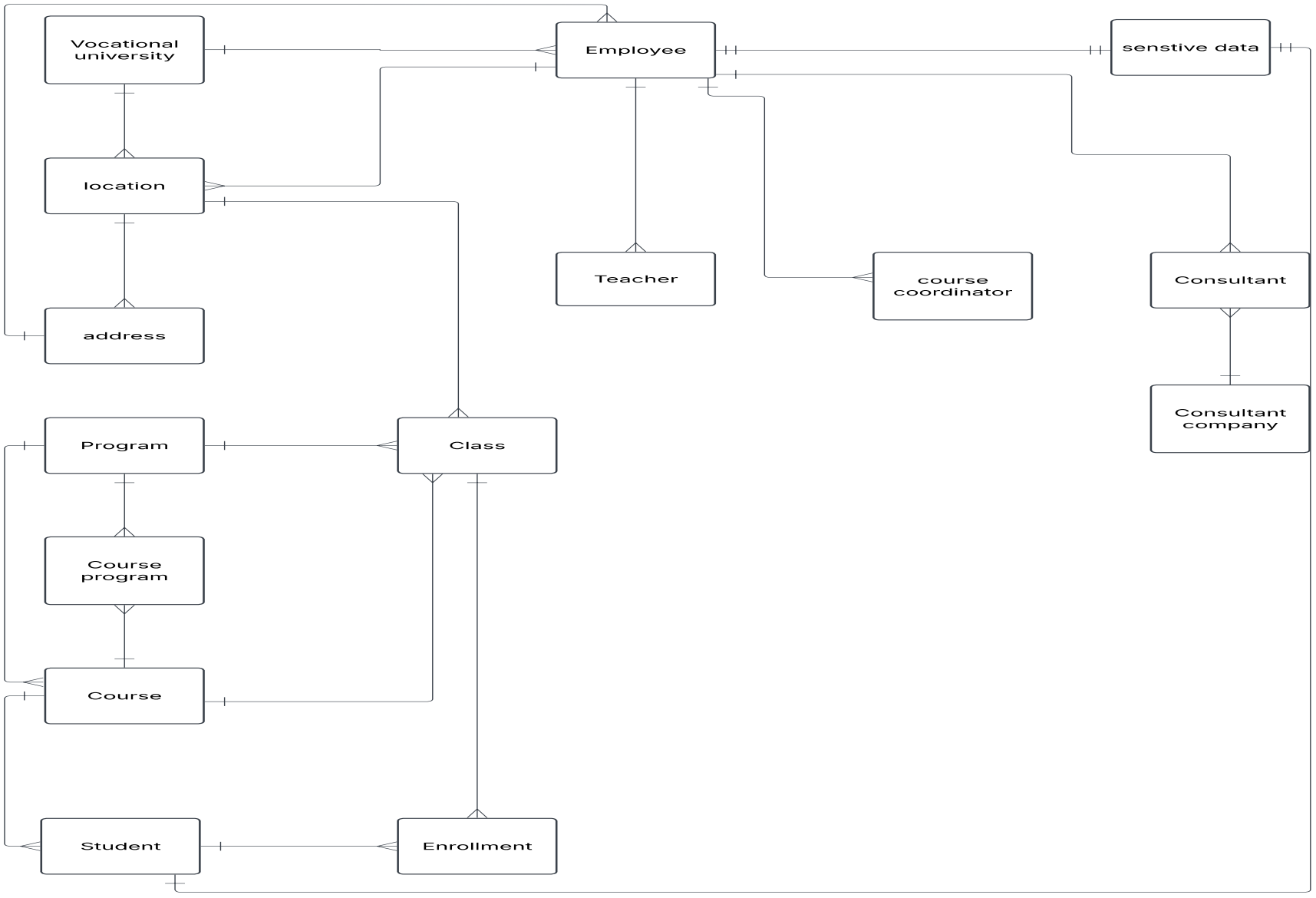
Title: Core Entities

- Students, Employees (Teachers/Coordinators)
- Courses, Programs, Classes
- Enrollment, CourseProgram (many-to-many link)
- Locations and Addresses
- Consultants and Consultant Companies

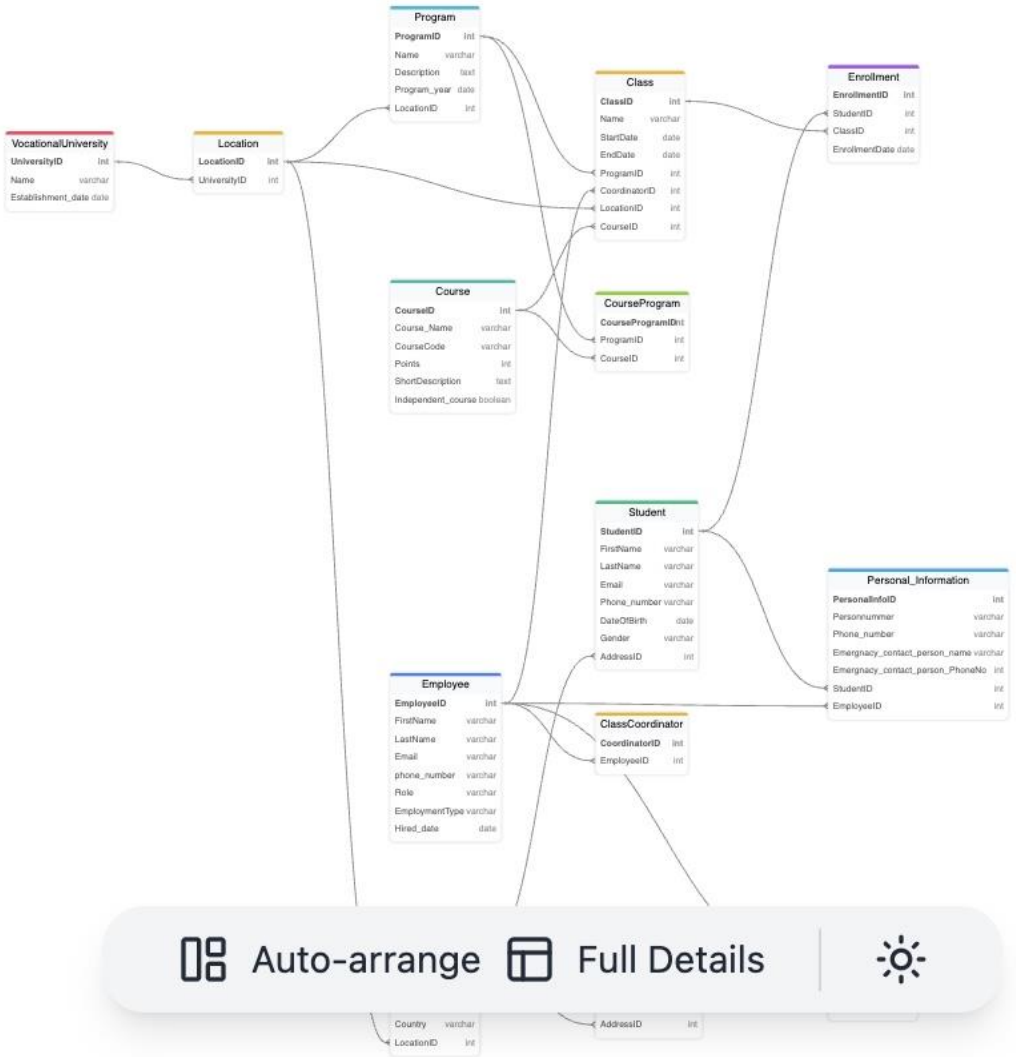
Relationship

- **One Vocational University** can have **many Locations**.
- **One Location** belongs to **one Address**.
- **One Program** is offered at **one Location**, but a **Location** can host **many Programs**.
- **One Program** can have **many Classes** over the years.
- **One Program** can include **many Courses**, and one **Course** can belong to **many Programs**.
  ➤ Many-to-Many via CourseProgram
- **One Class** belongs to **one Program**, is held at **one Location**, and is coordinated by **one Employee** (a Coordinator).
- **One Student** can enroll in **many Classes**, and each **Class** can have **many Students**.
- **One Employee** can be a **Coordinator** or a **Teacher**, distinguished by the Role attribute.
- **One Employee** can also be a **Consultant**, and each Consultant works for **one Consultant Company**.
- **One Coordinator** manages one or more Classes, and each Coordinator is represented uniquely.
- **Personal Information** is uniquely linked to **either one Student or one Employee**, but never both.

Conceptual Model



Logical Model

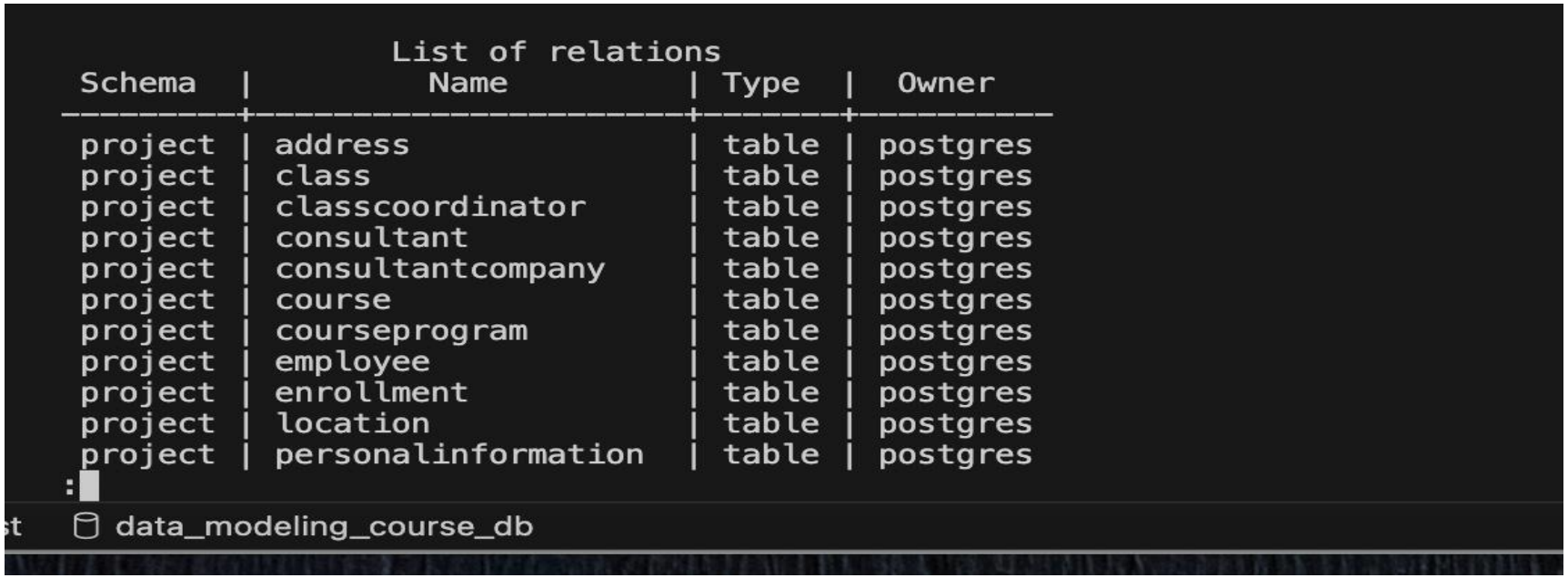


Bonus Tasks

- Independent courses (fristående kurser)
- Future location: Malmö campus
- Permanent teachers vs Consultants (with hourly rate)
- ConsultantCompany info including org number & F-skatt

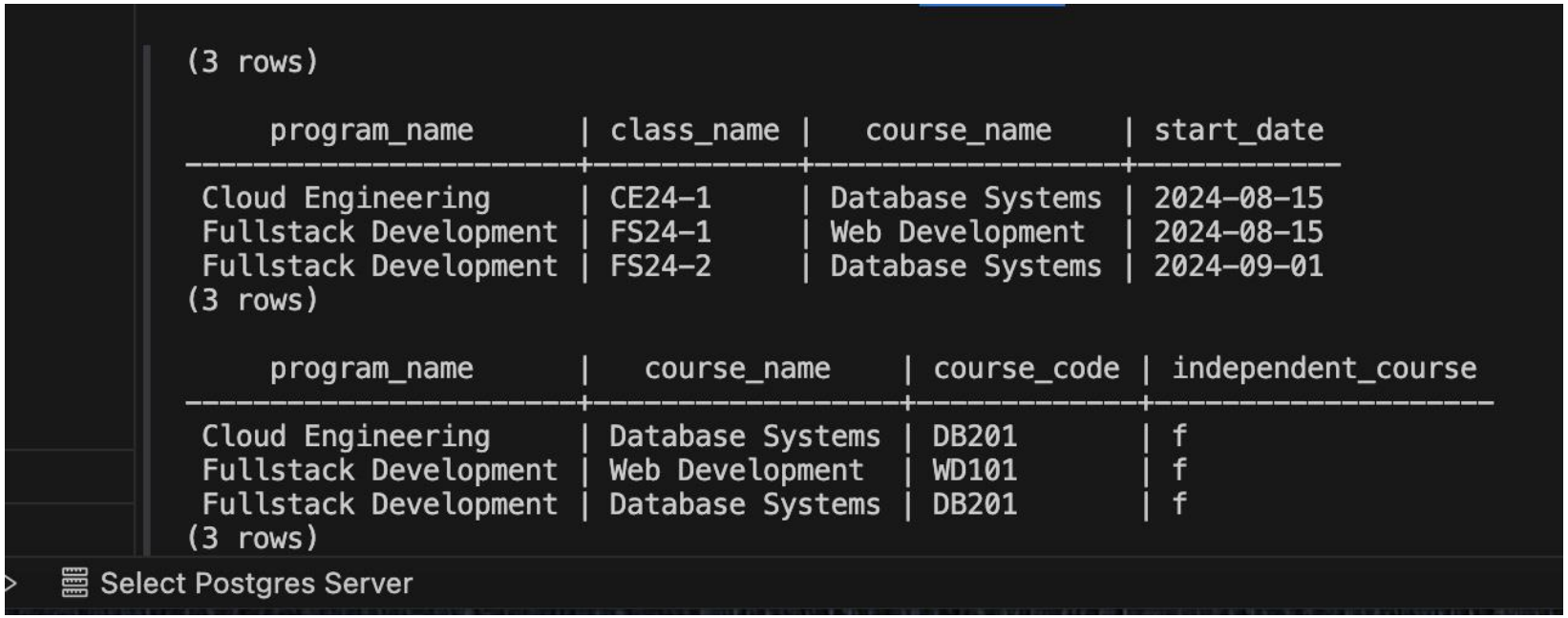
Technical Implementation

- All tables created in PostgreSQL
- Inserted realistic test data Queries
- tested and verified via Docker



Key Queries

- **Coordinators and their assigned classes**
- **Courses linked to each program** (excluding independent courses)
- **Programs and their active classes with main courses**
- **Students enrolled in each class**
- **Sensitive personal information** per student/employee (personnummer, emergency contacts)



```
(3 rows)

     program_name      | class_name |   course_name    | start_date
-----------------------+------------+------------------+------------
 Cloud Engineering     | CE24-1     | Database Systems | 2024-08-15
 Fullstack Development | FS24-1     | Web Development  | 2024-08-15
 Fullstack Development | FS24-2     | Database Systems | 2024-09-01
(3 rows)

     program_name      |   course_name    | course_code | independent_course
-----------------------+------------------+-------------+--------------------
 Cloud Engineering     | Database Systems | DB201       | f
 Fullstack Development | Web Development  | WD101       | f
 Fullstack Development | Database Systems | DB201       | f
(3 rows)

Select Postgres Server
```

Normalization (3NF)

Title: Normalization (3NF)

- Each table has a primary key
- Non-key columns depend only on the key
- No transitive dependencies
- Many-to-many handled with linking tables
- Sensitive data separated for compliance and modularity

Summary

Designed a fully normalized relational database tailored to Vocational University real-world operations and needs
Successfully implemented all core functionalities, including students, courses, programs, coordinators, consultants, and enrollments
Incorporated advanced features such as independent courses, consultant tracking, and future location scalability (bonus requirements)
Strengthened technical skills in SQL, data modeling, normalization (3NF), and relationship mapping
Built a **scalable, maintainable, and secure database foundation** to support Vocational University continued growth and data management needs


THANK YOU