Kai-Uwe Sattler, Marius Schlegel, Ngozichukwuka Onah
Databases and Information Systems Group
Winter Semester 2025/26

Advanced Database Systems – Exercise Sheet 1

ERD and Normalization

Task 1

Consider a scenario where banks are given, each with its name and the name of its director. A bank has branches, each having a unique number and a manager. Customers of a bank have an ID, a name, and a registration date. Customers may be related to each other (e.g., family). A branch services at least 100 customers and administers accounts. Customers may have multiple accounts. Accounts have a balance and an account number. There are special savings accounts which have a cancellation period and an interest.

(a) Create an ERD for the given scenario and add appropriate attributes. Annotate the ERD with cardinality information.

(b) Transform the ERD into the relational model and simplify as much as possible.

Task 2

(a) What is a functional dependency? Discuss the normal forms of a relational database schema.

(b) Given the relational schema R(A, B, C, D, E) and the following functional dependencies:

- AC → BDE
- B → D
- A → E

convert the schema into its 3rd normal form.

Task 3

Given is a booking relation in a flight booking system:

- Booking(FlightNr, CNr, Airline, Country, Destination, DestinationCountry, Departure, FlightDate, BookingDate, Price, CName, BonusMiles).

The following functional dependencies hold for the relational schema, leading to data redundancies:

- FlightNr → Destination
- FlightNr → Airline

- FlightNr → DestinationCountry
- FlightNr → Country
- FlightNr → Departure
- Destination → DestinationCountry
- Airline → Country
- CNr → CName
- CNr → BonusMiles

Design, step-by-step, a database schema in 3rd normal form using decomposition. Note the primary keys and assume attribute values are atomic.