Assignment 1 -
Database Design and Implementation

Overview

Assignment 1 consist of three parts, A: Analysis and Design, B: Implementation, and C: Implementation of Business rules. The case we will use in this assignment is the Database Books Borrowing system (DBB-system). There is a need for a database that supports the library with lending out books and DVDs, and other administrative activities. You will find the case in the document "The Case Library" in Canvas.

Report

The report should be submitted in the folder *Assignments - Assignment 1 – Database Design and Implementation* before deadline (see course schedule in Canvas). The structure of the report should follow the structure of the assignment, i.e. divided into three parts A-C. The Assignment is done in groups of max. 5 students.

Part A: Database Analysis and Design

Introduction

Part A is divided in three parts; conceptual, logical, and physical database design.

Task

For the case The Database Book Borrowing System (DBB System)

- Identify user-views, transactions, and data requirements.
- Design a logical database model using the ER-model
- Develop the logical database model to a physical model. The target database management system is a RDBMS (Relational Database Management System).

You should motivate your decisions in the design process.

Method

You will find the method for the tasks in the course literature.

- System Definition, Requirements Collection and Analysis (Chapter 10.1-6, 10.8.1, 11, and Appendix A)
- Database design theory (Chapter 12, 14-15 and Appendix C)
- Database design methodology (Chapter 16, 17, 18 and Appendix D)

  Step 1. Build Conceptual Data Model
  - 1.1 Identify entity types
  - 1.2 Identify relationship types
  - 1.3 Identify and associate attributes with entity or relationship types
  - 1.4 Determine attribute domains
  - 1.5 Determine candidate, primary, and alternate key attributes
  - 1.7 Check model for redundancy

Step 2. Build Logical Data Model
- 2.1 Derive relations for logical data model
- 2.2 Validate relations using normalization
- 2.3 Validate relations against user transactions
- 2.4 Check integrity constraints

Step 3 Translate logical data model for target DBMS
- 3.1 Design base relations (see picture 18.1 p.518)
- 3.2 Design representation of derived data (Identify and list derived data and design a solution, implement in the database or calculate every time it's needed.) Motivate your design.
- 3.3 Design general constraints (Identify and describe in textual form, no code)

Step 4 Design file organizations and indexes
- 4.1 Analyse transactions that runs frequently and critical transactions.
- 4.3 Choose indexes (Guidelines for choosing a "wish-list" of indexes, p.528). Motivate your choices!

Step 7 Introduction of controlled redundancy (denormalization: step 7.1 to 7.5, pp. 539-546)

Examination (i.e. what to include in the report)

- Logical database model.
- Physical database model which shows all changes from the logical design.
- List of derived data and how to handle them.
- A textual description of general constraints
- Motivate choice of indexes.

References

Connolly & Begg: Database systems (6th edition)

Part B: Implementation

Introduction

In this assignment you should implement the physical model of the Database Books Borrowing system into the database management system (RDBMS). You should use MySQL or similar RDBMS (e.g. MS SQL Server, PostgreSQL, etc.).

Tasks and method

- Implement the physical design model.

Implementation

The main task in this assignment is to implement the physical design model (from part A) including integrity constraints. The database should be implemented on a relational database management system. There is no specific method for this work, but you should implement the database so that it adheres to your physical design.

Examination

- The implemented database should be submitted as scripts in an appendix to the report.

References

Support pages for selected RDBMS

Part C: Implementing Business Rules

Introduction

In this part you should implement business rules for the Database Books Borrowing System into the database management system. You have to use a database management system with support for database programmability using stored procedures, triggers, and functions, such as SQL Server or similar.

Tasks and method

- Implement general constraints using stored procedures, triggers, and functions.

Implementation

The general constraint that is mandatory to implement is the rule for maximum number of books allowed to be on loan at a specific point in time for each borrower/user depending on category of user.

Examination

- Implemented constraints using database programmability should be handed in as scripts as an appendix to the report.