

COS 221 Practical Assignment 3



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- Date Issued: **22nd March 2023**
 - Date Due: **5th April 2023** before **11:00 (in the morning)**
 - Submission Procedure: **Upload to ClickUP**
 - This assignment consists of **7 tasks** for a total of **90 marks**.
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1 Introduction

You have graduated from Computer Science at the University of Pretoria and you are hired by the First National Bank in South Africa. The bank would like to launch a new product designed for students and attract them to use it because it is cheap and provides a better service between the students, the bank staff, and the parents. Your new employer has requested that you design the conceptual data model for the system. The system must allow users to capture the client's information. All the clients are identified by a unique number only allocated to them. When registering new clients, they are required to provide names, age, sex, address, and contact details. For security reasons and monitoring, the new bank system asks the clients to update their ID numbers and provide proof of address every year. For proximity reasons, FNB provides several branches in South Africa. This will allow a parent who would like to deposit money into his child's account to easily do so. The account can be a cheque account, a savings account, or the money can be transferred directly to an ATM by making an electronic transfer. A student can also receive money from outside South Africa via forex. To open a bank account, a client must go to one of the FNB branches which are identified by a unique branch code. The FNB system will use more information related to branches such as an address, open and closing days and times, and contact details. Each branch will be responsible for administering various ATMs across South Africa. The bank would like to always know how much cash is available at each ATM as well as the date and time of the last filling of the ATM. FNB has contracts with multiple Cash-In-Transit (CIT) companies responsible for filling up the ATM. For each of these contracts, it is required to store the start and end date of the contract. To ensure cash is always available, an ATM is allowed to be filled up by various CIT contracts.

After successful completion of this assignment you should be able to:

- Create tables in MariaDB
- convert E(E)R-diagrams to relational models;
- draw relational models;
- implement derived relational models in an RDBMS and RDBMs mapping;
- Use Structured Query Language (SQL); and
- construct and execute relational algebra expressions against a relational model.

2 Constraints

1. You must complete this assignment individually or in pairs.
2. The database dump will be marked. The SQL scripts from the database dump:
 - (a) which run and perform what they are supposed to do get full marks
 - (b) which run but do not perform as required, will receive partial marks
 - (c) which do not run will be allocated partial marks based on the functionality they would have exhibited.
3. You need to use your MariaDB, MySQL Workbench and Duke University radb (Relational Algebra Interpreter) installations to complete the practical assignment.

3 Submission Instructions

You are required to upload a single archive (i.e: zip, tar) that includes the following files:

- A pdf containing the answers to the tasks.
- A file or files containing the SQL statements from your database dump to:
 - create your database,
 - create the tables in your database, and
 - populate the tables with the data you populated the tables with.
- A file or files containing the relational algebra expressions to:
 - query the relational extension
- a **readme.txt** file informing the marker what they should do to restore the database onto another machine.

Upload your archive to ClickUP. No late submissions will be accepted, so make sure you upload in good time.

4 Online resources

The following resources will help with creating a E(E)R model using Chen's Notation.

- Visual Paradigm Online: <http://online.visual-paradigm.com>
- draw.io: <http://diagrams.net>

You can access free SQL Tutorial at: https://www.w3schools.com/sql/sql_create_table.asp

Getting Started with MariaDB at: <https://mariadb.com/get-started-with-mariadb/>

To download MariaDB and access the documentation on your computer. Use the official MariaDB site – <https://www.mariadb.com/>

There are many other resources online for example Stack overflow – <https://stackoverflow.com/> a platform for developers to learn, share knowledge and build career.

Refer to the Practical Tutorial 4 for more information on obtaining, installing, setting up and using the radb tool from Duke University.

5 Rubric for marking

Creating a database	2
E(E)R Diagram	
Entities	1
Relationships	1
Cardinality	1
Specialisations/Generalisations/Unions	1
E(E)R-diagram to Relational Mapping	
Mapping of regular entities	4
Mapping of binary 1:1 relationships	2
Mapping of binary 1:N relationships	2
Mapping of binary M:N relationships	2
Mapping of multivalued attributes	1
Mapping of N-ary relationships	2
Mapping of specialisation and generalisation	2
Mapping unions	2
Creating tables and entities	
Table names	2
Column names	2
Use of datatypes	2
Inclusion of primary keys	4
Inclusion of referential integrity constraints	4
Inclusion of other constraints	3
Extensions	3
Sensible data entry	3
Innovative use of SQL	3
Structured Query Language	
Query	15
Results of query	5
Relational Algebra	
Query	10
Results of query	6
Database dump	5
Total	90

6 Assignment Instructions

Task 1: Creating a database (2 marks)

Create the database and name it `uXXXXXXXX_upbank` where `XXXXXXXX` is your student number.

Task 2: E(E)R-diagram (4 marks)

After all the additional knowledge you have obtained during the past few weeks, revise your submitted ER-diagram in Practical Assignment 2 and provide an updated E(E)R-diagram for the system as part of your uploaded PDF.

Task 3: E(E)R-diagram to Relational Mapping (17 marks)

Using the steps for conversion from ER-diagram to the Relational model as was discussed in detail in Lecture 14, provide a relational mapping of your E(E)R-diagram in your uploaded PDF.

Task 4: Creating tables and entities (26 marks)

Using your derived relational model to create all the appropriate relational intentions. Ensure to create your own relational extensions with **at least 7** entities for each relation. (Note: Make sure you have branches in **Randurg**, **Hatfield** and **Groenkloof** in your extension data.)

Task 5: Structured Query Language (20 marks)

For all of the below questions, ensure to provide the statements and a screenshot of the results in your uploaded PDF.

- 5.1 Provide a SQL statement to select sufficient attributes to identify a client (**Note:** For this question the primary key may not be selected.) (4)
- 5.2 Given that the **Randburg** branch has been closed, provide an appropriate SQL statement to update the relational extension. (4)
- 5.3 Provide a SQL statement to return all clients that have not validated their ID. (4)
- 5.4 Given that all ATM's belonging to the **Randburg** branch, needs to be moved to the **Hatfield** branch for administration, provide the appropriate SQL clauses. (4)
- 5.5 Provide a summary of all accounts in the system for the amount of transactions in which an account was involved. (4)

Task 6: Relational Algebra (16 marks)

For this question, you are required to use the radb tool from Duke University to query your relational database.

- 6.1 Select all attributes of ATMs whose serial number start with 'ABC123'. (4)
- 6.2 Provide the radb relational expression to return the contact information of all the Cash-In-Transit companies that fill ATM's operated by the **Groenkloof** branch. (6)
- 6.3 Select the naming and contact information of clients who has done more than 24 transactions in the past 9 months. (6)

Task 7: Database dump (5 marks)

Export your database from MariaDB to a text file that you will upload to ClickUP before the deadline. Ensure that your database intension and extension can be recreated on another machine.

IMPORTANT NOTE: Please refer to the rubric for the detailed allocation of marks.