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COS 221 Practical Assignment 2

- Date Issued: **7th April 2021**
- Date Due: **21st April 2021** before **11:00am**
- Submission Procedure: **Upload to ClickUp**
- This assignment consists of **6 tasks** for a total of **65 marks**.

1 Introduction

In this assignment, you are required to create a database for a car rental garage. This system includes a *Customer* table (which contains each customer's personal information), a table for *Cars* and another for *Motorbikes*. Customers can borrow multiple Vehicles. Two other tables keep record of the Cars and Motorbikes that each user has borrowed. Once a user returns a Vehicle their record is inserted into the Returned tables, depending on the type of vehicle returned. An ER diagram for the system is given in Figure 1. You are required to use the given schema and database state (Figure 2) to specify and execute queries in SQL and Relational Algebra (RA). For RA, a RA[1] interpreter will be used.

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

- implement various referential integrity constraints on any database schema,
- create and accurately populate referenced tables in a given relation schema,
- specify and execute basic retrieval requests as relational algebra expressions,
- apply the basic SQL constructs for specifying retrieval queries.

2 Constraints

1. You must complete this assignment individually.
2. The SQL scripts will be marked
   (a) Scripts which run and perform what they are supposed to do get full marks
   (b) Scripts which run but do not perform as required, will receive partial marks
   (c) Scripts which do not run will be allocated partial marks based on the functionality they would have exhibited.
3. You may ask the Teaching Assistants for help but they will not be able to give you the solutions.
4. You may utilise any text editor or IDE, upon an OS of your choice.
5. Install RA interpreter to access and retrieve the information from the database.

[1] RA is a simple relational algebra interpreter written in Java. It is built on top of an SQL-based relational database system. It implements relational algebra queries by translating them into SQL queries and executing them on the underlying database system through JDBC. RA is packaged with SQLiteJDBC, so you can use RA as a standalone relational-algebra database system. Alternatively, you can use RA as a relational-algebra frontend to other database systems.

3 Submission Instructions

You are required to upload all .txt files, screenshots and a database dump (in an archive) to ClickUP. No late submissions will be accepted, so make sure you upload in good time.

4 Online resources

Access a free SQL Tutorial at: `https://www.w3schools.com/sql/sql_create_table.asp`

Download the RA interpreter on your computer, by using the official site: `https://users.cs.duke.edu/~junyang/ra2/`

Get started with the RA interpreter documentation available at: `https://users.cs.duke.edu/~junyang/radb/`

Follow the RA Github project at: `https://github.com/junyang/RA`

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

5 Rubric for marking

Screenshots connecting to MySQL locally	2
Creating a database	1
Creating tables	
Use of datatypes	6
implementation of constraints	6
Population of tables	
Use of correct clauses	6
correct data entry	6
Installing RA interpreter	5
Queries	
SQL Queries	14
RA Queries	14
Database dump	5
Total	**65**

6 Assignment Instructions

Task 1: Creating a database ..... (2 marks)

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

Task 2: Creating tables ..... (12 marks)

Create the corresponding eight Tables as shown in Figure 1 with the appropriate constraints and attributes.

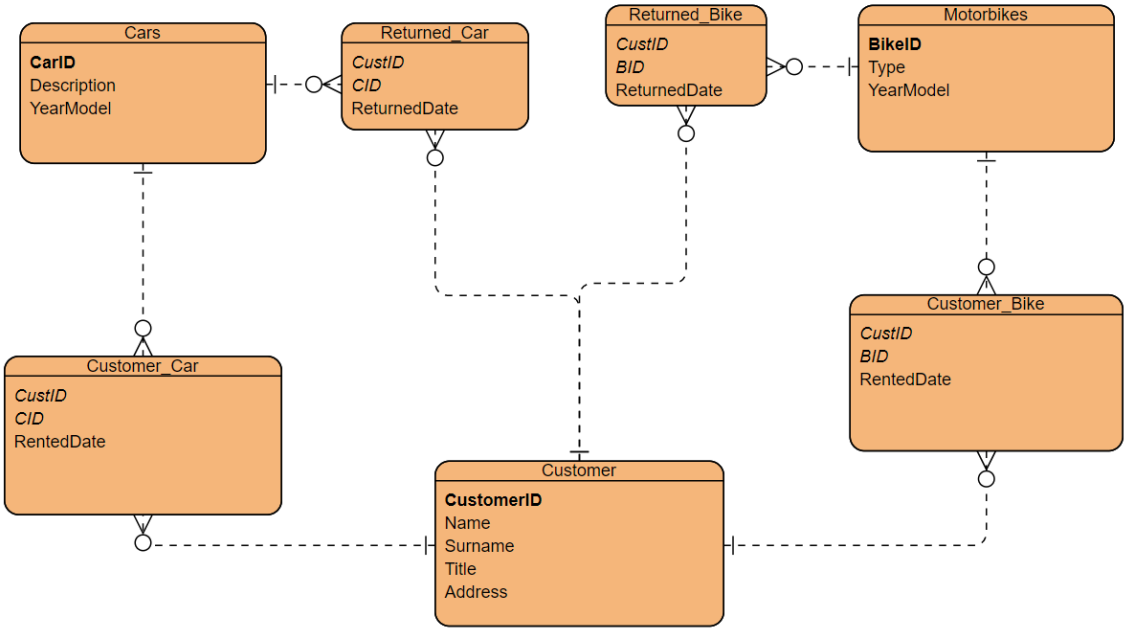

Figure 1: ER diagram

Task 3: Populating tables ..... (18 marks)

Populate the tables with the values given in Figure 2 to ensure that the database is in a valid state

Task 4: Installing and configuring RA interpreter ..... (5 marks)

Download the RA interpreter zip file by using the link: `https://users.cs.duke.edu/~junyang/ra2/ra-2.2b.zip` or `https://users.cs.duke.edu/~junyang/ra2/ra-2.2b.tgz`.

To run the RA do the following:

- check whether java is installed on your computer → Open the command prompt and type `java -version`. If you get the version info, Java is installed correctly and PATH is also set correctly.
- locate the downloaded zip file, extract it,
- create a copy of the `sample.properties file`
- rename the copy file `uXXXXXXXX_CARRENTALS.properties` (This is your configuration file) where `XXXXXXXX` is your student number. Ensure that it is part of the `ra-2.2b folder`.
- open your configuration file, under MySQL-specific, set your path details as shown below;
  - `url=jdbc:mysql://MySQL Data Directory/uXXXXXXXX_CARRENTALS`
  - `user = your username`
  - `password = your password`

Note: The user configuration file is useful for telling RA how to connect to your own database server. Please make sure other required properties are not active (commented). We are only interested in MySQL settings

Customer

CustomerID	Name	Surname	Title	Address
1	Mohammed	Abraham	Mr	2 Jean Drive
2	Abby	Smith	Ms	514 Mackenzie St
3	Refiloe	Molete	Mrs	6 Joker St
4	Corlize	van Heerden	Ms	12 Lotus Ave
5	Simone	Fourie	Dr	2 Duncan St
6	Samantha	Hanna	Mrs	34 Lynwood St
7	Rebecca	Duncan	Ms	111 Bondev Drive
8	Gary	Lou	Mr	5555 Rands St
9	Ronald	Wang	Prof	65 Quinton Ave
10	Fatima	Vallee	Ms	987 Sabie Road
11	Thando	Moloi	Dr	9 Lira St
12	Sphesihle	Mangena	Ms	3333 Warden St
13	Daniel	Alberts	Mrs	3 Peso St
14	Jason	Mackenzie	Mr	98 Theo St
15	Michael	Nouwens	Mr	18 De Villiers St

Returned_Bike

CustID	BID	ReturnedDate
4	2	2020/12/14
9	4	2020/08/06
15	6	2021/02/14
14	7	2021/01/11

Returned_Car

CustID	CID	ReturnedDate
4	2	2020/12/14
8	3	2020/02/16
9	4	2020/08/06
4	7	2020/12/14

Cars

CarID	Description	YearModel
1	Red Mercedez AMG	2020
2	White BMW X5	2017
3	Grey Mini Cooper JCW	2020
4	Silver Toyota Corolla	2015
5	Yellow Honda Jazz Sport	2021
6	Blue Nissan Amra	2018
7	Orange Toyota Hilux	2020

Customer_Car

CustID	CID	RentedDate
1	1	2021/11/11
4	2	2020/11/09
8	3	2020/02/14
9	4	2020/06/06
14	5	2021/11/11
1	6	2021/01/01
4	7	2020/11/09

Motorbikes

BikeID	Type	YearModel
1	Ducati V4S	2021
2	BMW S1000RR	2020
3	Honda Fireblade SP	2018
4	Yamaha YZF-R1M	2015
5	Kawasaki Ninja H2	2017
6	Kawasaki ZX-10R SE	2019
7	Yamaha YZF-R1	2020

Customer_Bike

CustID	BID	RentedDate
1	1	2021/11/11
4	2	2020/12/10
8	3	2020/08/14
9	4	2020/07/06
14	5	2021/11/11
15	6	2020/11/11
14	7	2020/11/11

Figure 2: Database state

- open cmd and navigate to the extracted `ra-2.2b folder` and type
  `java -jar ra.jar uXXXXXXXX_CARRENTALS.properties`
  You should be able to get RA running after successfully executing this command.
- type the command `\list;` in the prompt to see the tables you created.

Task 5: Specifying and executing Queries ..... (28 marks)

You are required to specify and execute the following queries in SQL using the CARRENTALS database schema.

1. List the names of all the customers who have rented more than one Car and display the number of Cars that they have rented.
2. Display the Type and Year Model of the Bike with the oldest Year Model.
3. List the names of all the customers who have rented at least one Bike but no Cars.
4. List the names of all the customers who have not rented any Cars.

   You are also required to specify and execute the following queries both in SQL and in relational algebra using the RA interpreter on the CARRENTALS database schema.

5. List all the Cars released in 2020.
6. List the type of all the bikes released in 2020 that have been rented by the Mackenzie family.
7. List the names of all the customers who are renting a Bike on the same day that "Kawasaki ZX-10R SE" was rented and not yet returned.

   Note: Please refer to the RA documentation at `https://users.cs.duke.edu/~junyang/radb/basic.html` and the notes to familiarise yourself with the relevant commands for interacting with your database most appropriately

Task 6: Database dump ..... (5 marks)

Dump your database structure and data into a text file or .sql file. Your queries should also be extracted and placed in a separate text file, one for your SQL queries and one for the RA queries. If you use the ra_file

[2], make sure it is part of the text files that you will submit for marking. Create a single archive (zip file) containing the database dump, a text file containing the SQL queries and a text file containing the RA queries. Upload this archive to ClickUP. No extra files will be marked apart from the submitted files.

[2]RA also supports the command `source 'ra_file';`. This command makes RA read statements from the specified file and execute them. Note that ra_file must be enclosed in single quotes. The file should be just a simple text file containing RA statements and comments. This file can be prepared manually with a text editor, or it can be the result of a save command.