

CS5097/5098 - Database Systems and Big Data

CA2 – Database Design and SQL

Deadline: 12 noon Friday 19th November 2021

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- *This exercise counts as 40% of the overall course assessment. In this assignment, you design a database for the following user requirements and run queries on your designed database. This exercise is part of the formal assessment of the course, and the work must be your own.*
 - *You are reminded to read the section on Cheating and Plagiarism in your student handbook.*
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User Requirement Specification

A local art museum approaches you to develop a database for managing data about their collections. The museum owns a large permanent collection of art objects. In addition, the museum also borrows art objects from other museums on temporary loan. In return these other museums can also borrow art objects from this museum. The group of museums that shares art objects in this way is called 'Arts Friends Circle'. Every member of this circle has information (such as name which is unique, description, address, phone and name of the current contact) about the other members. Each art object is given a unique identification number such as AOXXXX. For each art object the museum records information about the artist, the year of its creation, a title and a description. Also for each art object information on the country or culture of its origin (Italian, Greek, Indian, etc) and epoch (renaissance, modern, ancient etc) is recorded. This information is displayed along with the art object in all the exhibitions. Art objects are mainly categorized into three types - painting, sculpture and statue. Any other art objects that do not fall into the above three types are categorized as 'others'. A painting can be of different types (such as watercolor, oil, etc) and is usually created on a material (such as paper, canvas, wood, etc) in any style such as (classic, modern, abstract, etc). A sculpture or a statue is created using a material (wood, stone, etc) and has specific height, weight and style. An art object in the 'others' category has a type (print, photo, etc) and style. For each art object in the permanent collection the museum keeps records of the date it was acquired, status (on display, on loan, under restoration, in store, etc) and cost. For each borrowed art object the museum records the museum from which it was borrowed, date borrowed and date to be returned. But this information is not displayed in exhibitions. If known, the museum records information about the artists: name, date born, date died, country of origin, epoch, main style, and any other details as description. The name, date born and date died uniquely identify an artist. The museum organizes exhibitions that are regular (involving all the available art objects on regular galleries) and featured (involving art objects sharing a feature such as artist, type, style etc). Featured exhibitions occur only for specific periods. During these featured exhibitions, the museum sells mimics of the original art objects to visitors, which is an important source of income for organizing such featured exhibitions. For promoting the featured exhibitions, the museum sends out invitations to loyal visitors. Each loyal visitor is issued a loyalty card with a unique loyalty number such as LMYYYY. Loyal visitors have individual preferences for featured exhibitions. The museum employs several types of staff such as curators, gallery supervisors etc. Each curator is responsible for maintaining certain number (say 20) and type of art objects which he/she maintains. Several curators are responsible for maintaining certain large art objects. Each supervisor can be allocated to any of the galleries in a regular exhibition or to a featured exhibition.

Transaction Requirements (to be implemented as views):

1. Add a new art object to the museum's permanent collection.
2. Change the end date of a featured exhibition.
3. List all the borrowed art objects.
4. Count the number of art objects created by a given artist.
5. Count the number of art objects per type displayed in the regular exhibition and sort the list.
6. List all the art objects borrowed from a given museum in the 'Arts Friends Circle'.
7. List the staff supervising a given featured exhibition.
8. List all the curators responsible for maintaining a given art object.
9. List all the featured exhibitions along with their start and end dates and their loyal visitors.
10. List all the art objects used in a given featured exhibition that are created by a given artist.

Design a database for the above requirements first by creating a conceptual (E)ER model and then deriving a relational ER model from the (E)ER model. Make sure that all the tables in your design are in 3NF.

Implement the database on the University's MySQL server by creating a new database using the procedure described in practical 3. (Since you have already created a MySQL account, you only need to create a new database).

Insert at least 3 rows of data in all the tables. If you are not happy with your design, go back and fix the problems. It is a good idea you learn this iterative approach to database design.

Write standard SQL queries as SQL views to fulfill all the transaction requirements stated above assuming any data you may need. SQL queries should be created without the use of the JOIN keyword. The transactional requirements are not precisely specified and you may have to make assumptions which you should state clearly in your submission. If any specific requirement cannot be fulfilled, check if this is because of your specific design.

For Submission:

- a) An (E)ER diagram showing your final conceptual design for the above requirements and a final relational ER diagram showing the logical design derived from the E(ER) diagram. Please assume that your (E)ER diagram will be used by someone other than you for carrying out the relational physical design. To help the new designer, your relational (E)ER diagram should contain all the required information. This means, your diagram should contain:
 - Meaningful labels for all the entities, attributes and relationships.
 - All required relationships and their attributes.
 - (Note: both entities and relationships can have attributes. In UML, notation used for attributes of a relationship are shown in a rectangle linked to the relationship using a dotted line.)
 - Multiplicity constraints for all the relationships.
 - Textual annotations to explain your design decisions which you feel might be useful at the relational design stage.
 - Generalization and specialization entities

Paste your final conceptual (E)ER diagram and ER relation model. Please state clearly any assumptions you make.

- b) For each of the transaction requirements cut and paste your SQL statement along with the results table produced. (10)
- c) Your newly created database and all the select queries (in the form of views) can be exported into an SQL script file (e.g. *script.sql*). The system displays the SQL script for your database. Paste all this information and save the script as *script.sql*. (5)
- d) The owners of the museum inform you that all museums in the UK also wish to use the database system. Produce a two-page (maximum 1000 words) report discussing the issue of developing a cloud-based database that can handle big data sets containing geographical information about each item in comparison with the database you have developed. You will have to research cloud-based databases, and their potential to handle aspects of big data. In your discussion, you should argue whether the organizers should in future be considering such an approach. Justify your argument with evidence related to theory and practice. (7)

Submit all files into the MyAberdeen system. Ensure you **select the Database Systems and Big Data Assignment link** within the Assessment section. In the subject field type only 'CS5097_CS5098_*[firstname_lastname]*'. Please follow all the submission instructions to help us mark your coursework efficiently.