Database Systems (V1.0)

A.Y. 2021/2022

PROJECT ASSIGNMENT

Description of the mini-world:

It's holiday time and Christmas has just passed. The number of gifts has grown tremendously over the years and Santa Claus has realized that the elves need to be helped by new technologies.
For this reason, Santa Claus wants to create a database that can help him in this arduous task.

Santa Claus will have to manage on the one hand the requests for gifts and on the other hand their production and delivery.

Gift production is organized in the following manner:
Each type of gift is characterized by a name, its size, the colours from which it is composed, the type (high-tech, food, clothing, etc.), the localization version (e.g., Italian, Spanish, German, etc.), a number identifying the version since the gifts are updated from year to year, the list and quantity in grams of the raw materials necessary for its production (wood, iron, plastic, etc.), and an indicator (0,1] of the complexity of its production (where 1 represents maximum complexity).
For each type of gift, a certain quantity is produced based on 75% of the previous year's demand before the autumn time. Each gift produced will have its serial code and the lot in which it was produced.

Santa's elves take care of the production of the gifts and some of them also prepare the loads for shipping. The elves then organized themselves into departments and sub-departments. Each department is aligned with the types of gifts/tasks (high-tech, food, dress, shipping etc.) and manages the sub-departments. Each sub-department handles the production of a few specific versions of gifts. Each sub-department has a manager who is in charge of checking and distributing the load on the elves.

Each elf is characterized by his/her name and years of experience and daily makes a certain number of pieces of a certain version of gift.
To prevent the elves from getting too tired each elf cannot produce more than a number of gifts equal to 30 in total complexity (the sum of the complexities of the gifts produced) per day.
Each department has a manager who has to monitor the raw materials at his disposal in order to reorder them.

The shipment department does not have any sub-department but has some elves in each department that are in charge to organise their portion of the load. The other elves in the shipment department are in charge of finalising and scheduling the loads.

The loads must be organised to optimise Santa’s time thus all the gifts of each load must be dispatched in the same area/district.

The shipment department also receives and manage the childs’ letters. The elf knows, even if it is not directly reported in the letter, the name and surname of the child, their address, and their preferred localization.

The elves are aware that each gift must be ready before its shipping time. Thus they need to manage its production keeping track of this hard deadline. Since we live in a 4.0 world the parents of the children want to keep track of gifts production and shipment.

Project Requirements:

The project is individual, which means that each student must perform the tasks independently. The project is articulated by several tasks that all must be completed at your own best. As a rule of thumb if you complete all the points bad in an incomplete or wrong way the exam can be passed. On the other hand, if the project is completed perfectly but solely for just one or two points without developing in any way the remaining ones, it will not suffice to pass the exam. The project can be realised in a more simplistic way or by using all the statements and the functionalities illustrated during the lectures. Using all the kinds of statements and functionalities, as also views and constraints, will lead to a better grade.

Note that the project requirements do not describe explicitly all the statements and the functionalities that you might use.

Note that the solution must not involve any external programming language. Even it is not part of the program the transaction are allowed but they are not the recommended solution.

Tasks:

1. Draw an E-R diagram of a database that represents the mini-world described above. Remember to draw all the conceptual steps (intermediate diagrams) that lead to the final one.

2. Apply the translation algorithm to the E-R diagram in order to obtain a corresponding relational database schema.

3. Implement your database by using the SQL language:
    a. Provide the DDL of each table/view;
    b. Provide the DML to insert, delete, and update the data for each table;
    c. Provide the two statements to manipulate the schema of 2 tables of your choice:
        i. Change the data type definition of one of the attributes;
        ii. Change one of the referential constraints;

4. Populate your database as much as possible providing the relative CSV files and the commands to load them in the DB.

5. Using the SQL create the statements that solve the following problems:
    a. Having a list of all the gifts that must be produced before a certain date;
    b. Having a list of which are the gifts that must be included in a certain load;
    c. Check if it is necessary to reorder the raw materials for the entire Santa's factory;
    d. Checking which is the production state of the gifts for a certain family (parents);
    e. Having a list of all the departments where the elves have a personal production lower than a given threshold (e.g. 20);
    f. For each department that has an average production (among the elves) below a given threshold (e.g 20) report the number of elves that has a personal production lower than the threshold.

Required deliverables:

1. The E-R diagram with its intermediate diagrams (task 1);
2. The diagram of the relational database schema (task 2);
3. The requested SQL code (tasks 3 e 5);
4. The CSV files with the data;
5. A report that describes the provided files and the design process you have done, the problem that you have encountered and the solutions that you have chosen;

To be admitted to the exam the deliverables must be presented by email 3 days before the exam date.