Assignment One: Database Design and Implementation

Weight 10%, marks out of 40   **Deadline: 3:30pm (GMT) WED 12th Feb 2020**

Overview:

The coursework takes the form of a group project. You must register your group on Vision using the group sign up form linked from the Assessment section.

The coursework involves the design of a relational database (using MySQL) for a specified task, that involves the design of an ERD, relational schema, the SQL to generate the relations in MySQL, and indexes.

Groupwork:

Form groups of 5 or 6, then register your group on Vision. Ensure you sign up to the correct campus, and only join a group once you have teammates (i.e. don't sign up to a random group before you've formed a team).

Share the work among the group members, ensuring that everyone has an equal share. All members should contribute to all areas of the coursework as experience gained in these topics will help in the examination.

Ensure that all members of the group have access to the files developed by the group. You can use the collaboration tools on Vision to support this, or other cloud-based system. However, you must ensure that it is secure against other groups gaining access.

Please provide a summary in your report stating the contributions of each group member. If necessary, marks will be adjusted if some students have not participated enough.

Collaboration and Plagiarism:

Coursework reports and code must be the group's own work. If some text or code in the coursework has been taken from other sources, these sources must be properly referenced. Failure to reference work that has been obtained from other sources or to copy the words and/or code of another student is plagiarism[1] and if detected, this will be reported to the School's Discipline Committee. If a group is found guilty of plagiarism, the penalty could involve voiding the course.

Students must never give hard or soft copies of their coursework reports or code to students in another group. Students must always refuse any request from another student not in their group for a copy of their report and/or code. It is expected that all group members will have read and write access to the report and code for their group. Sharing a coursework report and/or code with another group is collusion, and if detected, this will be reported to the School's Discipline Committee. If found guilty of collusion, the penalty could involve voiding the course.

---

[1] Heriot-Watt guidelines on plagiarism
https://www.hw.ac.uk/students/studies/examinations/plagiarism.htm

Scenario:

You have been hired by **HW Motors**, a start-up UK based car/van rental company, to design a mySQL database to manage the renting of their range of cars and vans to the public. They have a number of bases across the UK, and although they wish to grow as a company they are focussed on the UK market with no plans to expand overseas at this stage.

At each base they have a range of cars and vans, which have a fixed hire price per day. Booking of 7 days or more will receive a discount (e.g. 20%) from the total cost.

One of **HW Motors'** unique selling points, is that when you book a vehicle you are guaranteed to get that exact vehicle, rather than an alternative model.

They offer a range of cars from small town car, to family car, MPV (7 seaters), sports car, luxury, and minivans. With each booking they will need to hold details of the person renting the vehicle, including their driving licence details, date of birth, home address, mobile number, and email address.

Each booking will have a start and end date, and store if the hirer has opted to take out any insurance extras.

All bookings will be made via webpage/mobile app which requires the user to register. The person that makes the booking must be the main driver, and there may be additional drivers listed with each booking. The website will support searching for vehicles based on number of seats, engine size, automatic/manual, cost and location.

HW Motors will handle its own vehicle servicing, this includes MOTs, and during these times the vehicles will not be available for rental.

Further Details / Assumptions:

- Vehicles can be rented from a base and returned to another rental location (i.e 1 way rentals).
- Each vehicle has a home base where it will be serviced. All service schedules for the vehicles will be handled by this system so that they know when cars are not available, but car parts, mechanics time, detailed service reports will be handled by a separate system.
- They only rent to the public, not commercial rentals.
- The minimum rental period is 1 day and rentals are whole numbers of days.
- All cars can be driven on a standard UK driving licence.
- The company policy sets a minimum age to rent a car as 25 years, and 30 years to hire an MPV, van, sports or luxury vehicle.
- Rental prices will vary during the seasons (i.e. peak time prices).
- Any booking which is cancelled will be removed from this system, however this will not impact user registrations for the web/mobile app booking system.
- The website/app will show a picture of the actual car being hired with each booking.
- Assume that all cars can be moved to any UK location overnight based on a car-carrier service.

The Tasks:

Overview (full details below):

Task	Description	Marks
1.	Design and draw an ER-diagram that captures the requirements	15
2.	Translate your ER-diagram into a relational schema	10
3.	Implementation of the schema in MySQL	10
4.	Define 5 suitable indexes for your tables (other than PKs)	5

Submission

- Report through TurnItIn assignment on Vision as a single **PDF**
- This should include the 4 sections clearly labelled with headings.
- SQL code should be included as text, not screenshots.
- **Ensure the REPORT includes the <u>team member names</u> on the first page.**

T1 Conceptual model (15 marks)

Create an ER diagram for the stated database requirements in the scenario provided using UML notation.

The diagram should include one-to-many and many-to-many relationships, and several other advanced ER features such as:

- A recursive relationship;
- Derived attributes;
- Composite attributes;
- Composite keys;
- Repeating attributes;
- Use of generalization and specialisation.

The diagram **should contain a minimum of 10** (entities and relationships) for a group of 5/6 students, e.g. *Employee* Works for *Department*, and *Department* has *Employee* as manager => 2 entities and 2 relationships = 4 (entities and relationships).

- You might need to use a drawing tool like yEd[2], draw.io, or Microsoft Visio; rather than a relational database tool which will put in the foreign keys.
- Make a note in your report of any details of the requirements that could not be captured by the diagram.

Deliverable: Report to include the ER diagram for your database, and any supporting notes for you diagram.

---

[2] https://www.yworks.com/products/yed accessed Jan 2020

T2 Translation into Relational Schema (10 marks)

Define a relational schema from your conceptual ER diagram.

Use the steps given in the lectures to convert your conceptual design into a relational schema. The schema will include foreign keys, and extra tables where required, e.g. for many-to-many relationships. Primary and foreign keys should be clearly identified. Make a note explaining how it has been derived from the original conceptual ER diagram, for those cases where you have had to make a decision.

Deliverable: Report to include the relational schema and notes for any unusual steps that were followed.

T3 Implementation of the Schema in MySQL (10 marks)

Generate a script to create the tables in MySQL using the InnoDB storage engine. The data definition language statements must specify:

- Appropriate types for the attributes
- The primary key;
- Constraints such as NOT NULL and UNIQUE whenever appropriate;
- Default values if appropriate;
- FOREIGN KEY constraints, together with the policy for reacting to changes
- Write comments into the script explaining what is happening in each part.

Deliverable: Commented SQL script should be included in your report

T4 Indexes (5 marks)

Provide 5 index definitions that are designed to improve performance for queries that could be asked from your database. This must be for fields **other than the Primary Keys,** which will be indexed already.

Write an SQL script containing a set of `CREATE INDEX` commands.

Deliverables:

- Report to contain five INDEX definitions using MySQL syntax.
- Report to contain an explanation why each index is needed.