

ISAD156 Databases: Analysis, Design and Development
Coursework
Academic Year: 2018-19

Module Code:	ISAD156
Module Title:	Databases: Analysis, Design and Development
Module Leader:	Dr Marco Palomino
School:	Computing, Electronics and Mathematics

SUBMISSION DEADLINE: Tuesday, 7 May 2019, 10am

SOFT156

Group Coursework Assignment

This is a **group assignment**. Each group must consist of 4 students. You should notify the Module Leader (Marco Palomino—marco.palomino@plymouth.ac.uk) via email of the membership of your group by 18 February 2019. If you do not do this, you will be assigned to a group arbitrarily. A list of groups will be posted on the DLE in due course, and it is your responsibility to check and confirm that you are in the correct group. You cannot change groups without the agreement of the Module Leader.

This assignment is a significant piece of work carrying 50% of the marks for the module. You are required to spend about 60 hours on this assignment.

Assessed Learning Outcomes

- LO1. Demonstrate an understanding of the core principles that underpin data modelling and normalisation.
- LO2. Design and implement a relational database solution.
- LO3. Use a declarative query language to elicit information from a database.
- LO4. Demonstrate an understanding of the interdisciplinary nature of data-science and data modelling.

1 The Scenario

A group of taxi owners has decided to set up a database system to help their business in Plymouth. Several *control centres* are to be spread around Plymouth to receive calls made by *customers* requesting the services of a taxi. Each control centre is formed by a number of taxi owners, while each owner may have one or more taxis.

Taxi drivers are hired by individual control centres. After a driver has been hired, the driver will be assigned to drive a particular taxi. There are two working shifts for taxi drivers: *morning* and *evening* shift. A taxi driver works only either in the morning or in the evening. However, when a driver is unable to attend work, another taxi driver who usually works in the other shift replaces him. The replacement driver is determined by the control centre.

1.1 Booking a Taxi

Each control centre will have several *control desks* to receive calls from *customers*. Every call is bound to the control desk that responded to it. Each call is associated to only one customer: the customer who made the call. Each call is identified with a sequential number, which becomes the ID of the taxi journey that is being booked by the customer.

The first time a customer books a taxi, the contact details for such a customer are recorded in the database. The contact details include:

- Customer First Name
- Customer Last Name
- Home Telephone Number
- Mobile Telephone Number
- Address
- Postcode
- Comment
-

The *comment* is a brief note to keep track of important observations about the customers, which are made by the drivers and the staff at the control centres. For example, if a customer repeatedly cancels bookings, or is not present at the requested pick-up location, a comment stating this is added to the customer record. Then, it will be at the discretion of the staff at the control desk to accept or not future bookings by this customer.

Once the control desk finds a suitable driver to serve the call, it sends that driver—and that driver only—to the requested pick-up location.

1.2 Journey Plans

A Journey Plan details a taxi journey to be carried out, or a taxi journey which has already taken place. A Journey Plan comprises the following information:

- A customer ID—this is the ID of the customer who made the booking.
- A driver ID—this is the ID of the driver chosen by the control desk to carry out this journey.
- A pick-up location (address).
- A postcode for the pick-up location.
- A pick-up date and time.
- A drop-off location (address).
- A postcode for the drop-off location.
- A note to indicate whether the customer needs to transport a wheelchair, or requires a car of a specific size for a certain number of passengers and luggage.
- A valid credit/debit card number. To simplify accounting purposes, taxi drivers will only report to and receive commands from one control desk.

It should be observed that the only payment method allowed is credit/debit card; thus, a valid card number is indispensable for customers to make a booking.

1.3 Cancellations

Customers are able to cancel their bookings without incurring a penalty charge, provided they do it before a taxi has been dispatched to the requested pick-up location.

If a customer cancels a booking after a taxi has been dispatched, then a charge will be incurred. The amount for this charge will be based on the distance/time that the allocated driver has already travelled/spent prior to the point of cancellation. As a general rule, journeys within the surrounding area of Plymouth are normally dispatched up to twenty minutes before their due time.

1.4 Termination

Drivers may refuse to terminate a taxi journey with immediate effect if the driver or vehicle are placed at risk. Customers can be asked to vacate the vehicle as a consequence of violent or abusive behaviour. When this happens, no refunds will be given if the journey is terminated part way through the hire and a comment stating this will be added to the customer record.

1.5 Historical Details

Customer details and journey plans will be stored permanently in the database, so that taxi owners can regularly extract information such as:

- The list of customers served during the previous week.
- The list of customers who have been picked up, or dropped off, at the Railway Station.
- The number of taxis hired per shift during a particular day, week or a range of dates.
- The list of most frequent customers.
- The customers who have not hired a taxi recently—these are known as non-returning customers.

1.6 Payment

As stated above, payment can only be taken by credit/debit card. Payment is handled by a separate and existing payment processing system, which has to be integrated with the proposed database system. However, actual bank transactions should not be recorded, and there is no need to implement any interaction with the bank as part of this assignment.

2 The Database

Inserting data into a database provides you with an opportunity to filter available information, storing what you want to keep and separating out what you do not need.

To make sense of the scenario and help you with this assignment, let us begin by analysing Table 1. Note that Table 1 provides a list of journeys that have been booked for a particular taxi on a given day in December 2018. The particular taxi which was hired is an 8-seater, Peugeot E7. Such a car is regularly driven by 4 different drivers over the week. The list of drivers and the shifts covered by each of them is also included in Table 1.

Using the scenario and explanation given above, you are expected to produce a logical data model for your database following the next four steps.

2.1 Initial ERD

Draw an initial *Entity Relationship Diagram* (ERD) for your proposed database, using Table 1 as your starting point. This initial ERD should only include entities and relationships that can be justified from reasonable assumptions. Make sure that all one-to-one and many-to-many relationships are resolved prior to the submission—state all your assumptions.

You may want to draw the ERD using *Draw.io*, *PowerPoint* or *Microsoft Visio*. You may also draw it “manually” and scan it, provided it is clear and readable. **If it is not readable, it will not be marked.**

2.2 Normalisation

Your next step is to produce the *Third Normal Form* (3NF) for the list of attributes in the scenario. Then, normalise all the attributes to 3NF showing all the intermediate stages, namely: *Un-normalised Form* (UNF), *First Normal Form* (1NF) and *Second Normal Form* (2NF). Be careful to highlight the attributes used for keys.

2.3 Final ERD

Name the 3NF relations and draw the ERD using the taught notation of soft boxes and crow’s feet. **You are not required to show optionality on relationships.**

You must use MySQL Workbench to draw the final ERD. You must make sure that the ERD offers an accurate representation of the database that you are submitting. **Inconsistencies between the ERD and the actual database will be penalised.**

Plymouth Taxi Services Ltd									
Control Centre: CC-PL4-01 Control Desk: CD-03									
Vehicle Registration Plate: BD51 SMR Car make: Peugeot E7 Licensed to carry: 8 persons									
Drivers									
	Driver ID	Driver First Name	Driver Last Name	Days	Shift				
	AA123456A	Jordan	Dougherty	Mon-Fri	Morning				
	TN311258F	Chandler	Werner	Sat-Sun	Morning				
	QQ123456C	Josh	Woodard	Mon-Wed	Evening				
	DQ613524C	Bentley	Dickerson	Sat-Sun	Evening				
Taxi Journeys									
Call ID	Customer ID	Date-Time	Pick-up Address	Pick-up Postcode	Destination Address	Destination Postcode	Note	Driver ID	Credit Card
0000000925	0000000191	10-12-2018 07:30	31 Orchard Road	PL2 3QW	Boniface Lane	PL5 3AG	3 passengers	AA123456A	4867
0000000927	0000000090	10-12-2018 08:30	Railway Station	PL4 6AB	28 Sutton Road	PL4 0HT		AA123456A	3818
0000000926	0000000191	10-12-2018 15:00	Boniface Lane	PL5 3AG	31 Orchard Road	PL2 3QW	3 passengers	AA123456A	4867
0000001031	0000000232	10-12-2018 16:00	Plymbridge Road	PL6 7LH	2 Drake Circus	PL4 8AQ	6 passengers	AA123456A	0515
0000001048	0000000243	10-12-2018 19:00	Railway Station	PL4 6AB	300 Plymouth Rd	PL3 6RW		QQ123456C	0830
0000001053	0000000025	10-12-2018 20:00	Sutton Harbour	PL4 0DW	59 Regent St	PL4 8AR	Wheelchair	QQ123456C	0531

Table 1. Taxi Journeys booked for BD51 SMR on 10 December 2018

2.4 Populate the Database

Sample records of journeys, drivers and customers will be provided for you to populate the database.

The sample records can be downloaded from the module DLE website under the *Coursework Section*—look for a number of files stored on a folder named **Plymouth Taxi Services – Data**. Although the records will be spread across different files, you are expected to import all the data into the database that you will submit—marks will be deducted for failing to include all the data provided.

3 Deliverables

You need to make an initial assessment of the main requirements, before starting the work on your database. Then, you are required to derive a suitable *Logical Data Model*, implement the database and, finally, produce a document specifying your data model and the details of your database. This entails the following tasks.

Task 1: Produce the Logical Data Model

Submit your initial ERD—as stated in Section 2.1. Also, submit the details of the normalisation of the attributes included in Table 1 to 3NF, showing all intermediate stages and highlighting the attributes used for the keys—as indicated in Section 2.2. Finally, name the 3NF relations appropriately and produce the final ERD—as explained in Section 2.3.

What should you submit? A group report written in WORD containing the initial ERD, the details of the normalisation process and the final ERD. Recall that the final ERD must be created using MySQL Workbench.

Task 2: Implement the Database and make it available on Xserve

Your database must be available on Xserve and it cannot be amended after the deadline—databases stored in individual laptops will not be accepted.

All the data provided in plain text files must be imported into your database prior to the submission. You may edit the data provided to perform your own tests. However, it is your responsibility to make sure that the version of the database that you submit accurately stores all the data provided. Recall that the data in plain text files will be available on the DLE under the *Coursework Section*—look for a number of files stored on a folder named **Plymouth Taxi Services – Data**.

The underlying structure of your database will be examined. You must make sure that a sensible choice of datatypes is made for every single attribute in the database.

It is not advisable to carry out this task without first drawing your entity relationship diagrams and normalising the attributes in Table 1 (Task 1). The Module Leader can review your diagrams and normalisation work and give you feedback prior to the submission deadline—formative sessions will be scheduled.

What should you submit? Your database must be implemented on xServe. While each student will have a different xServe account, the group report must indicate which account contains the group submission. Failure to include this information in the group report will be penalised.

You are not allowed to modify your database after the submission deadline. If any member of the group does so, the group mark for Task 2 will be zero (0%).

The group report has to include a section listing all the necessary queries to produce the tables, keys and relationships included in your database. Marks will be deducted for submitting queries which do not accurately produce the database provided on xServe for the group submission.

Task 3: Query the database

It should be possible to add records to your database, delete records from it, and edit existing records. Similarly, the necessary queries to retrieve the information listed in Section 1.5 must be submitted as part of the group report.

Task 4: Group Report

A suitable structure for the report is given below for guidance. The report should not exceed 2,000 words, and it has to include an accurate word count on the front cover—penalties will be applied for exceeding 2,000 words or omitting the word count. Diagrams, pictures, appendices and listings of queries do not affect the word count.

Your report should be written clearly, avoiding acronyms in the text.

Front cover

- List of students included in the group
- Word count

Data Modelling

- Initial entity relationship diagram
- Results of normalisation
- Final entity relationship diagram

Database Development

- Queries employed to produce your database
- Queries employed to retrieve the information listed in Section 1.5.

Evaluation / Critical Review

- Problems encountered and any deviations from the design with reasons
- Suitability and completeness of the solution
- Further work—what else you would like to do and what you would do differently?

Group Involvement

- Project Plan Template: Have all members of the group contributed equivalently to the final submission? Use the provided Project Plan template to indicate the amount of work each member of the group has produced. The Project Plan Template can be downloaded from the DLE—find it under the *Coursework Section*.

You must submit your report online via the DLE. Your database must be available on Xserve and it cannot be amended after the deadline.

4 Demonstration

A 20-minute demonstration involving all group members will take place during the week beginning 7 May 2019 in the Portland Square Building (Room B311). The demonstration will be assessed by the Module Leader, but a second member of staff will be present. All members of the group must attend the demonstration. **The mark for students who fail to attend the demonstration will be zero (0%).**

Any member of the group may be questioned during the demonstration regarding the analysis, design and development of the database. Marks will be deducted for incorrectly answering the questions.

4.1 Demonstration date and time

Demonstration times will be posted on the DLE on 25 March 2019. Demonstrations will take place during the week beginning Monday, 7 May 2019.

EC and Plagiarism

Please note that the University enforces a penalty of zero percent for work submitted after the published deadline without valid extenuating circumstances.

Also, note that this is a group assignment and must reflect the work of the whole group. Thus, while you may discuss, in general terms, the assignment with your fellow students, the assignment must be carried out, exclusively, by the members of the group. Do not share designs or SQL code with anyone, or submit a program design or code that is, wholly or partially, someone else's work.

4 Assessment and grade criteria

Marks will be awarded according to the following criteria

Mark	Grade Criteria
Poor (0-39%)	The quality of the work has not met the learning outcomes. Understanding and application of fundamental concepts and techniques is questionable. Work of this quality would not be acceptable in professional employment.
Satisfactory (40-49%)	The quality of work has only met the threshold level but still requires further rework to get it to a better standard. The work you have submitted contains logical and analytical errors related to analysis and design techniques. Also, it only demonstrates a basic understanding of the subject competence. Further improvement is required to demonstrate personal thoroughness, effort and independent learning.
Fair (50-59%)	The quality of work submitted suggests that you have demonstrated a fair understanding of the analysis and design techniques. The work you have submitted contains some errors and incomplete analysis and design. Also, it demonstrates you are able to apply your knowledge but need to improve understanding of the subject competence and personal thoroughness, effort and independent learning.
Good (60-69%)	The quality of work submitted suggests that you are able to apply the analysis and design techniques well. The work you have submitted is substantially correct and complete. Also, it demonstrates a good understanding of subject competence and personal thoroughness, effort and independent learning.
Excellent (70-100%)	The quality of work is outstanding with no significant flaws. It demonstrates a high level of subject knowledge and competence; personal thoroughness, effort and independent learning; and possibly significant additional analytical/critical thought. Well done!

Feedback: Students will receive feedback within 20 working days of submission.