# Homework 2 Normalisation Answers

# 1. A boat hire company stores details of its customers, boats and rentals in a database. The relations in the database hold the following data:

#  Boat (BoatName, type, length, berths)

#  Customer (CustomerID, Surname, Firstname, AddressLine1, AddressLine2, Town, Postcode, DateOfBirth, email)

#  BoatHire (CustomerID, BoatName, HireDate, HireEndDate)

#  (a) The key in the BoatHire relation consists of three attributes.

#  What is the name given to a key made up of more than one attribute? [1]

 Composite key

#  (b) The relations in this database are in Third Normal Form.

#  State the properties of a relation in Third Normal Form. [3]

 A relation in 3NF depends on the key, the whole key and nothing but the key

In other words no non-key attributes depend on any other non-key attributes

 (c) State, with reasons, why it is important that relations in a database are in
Third Normal Form. [6]

 There is no unnecessary duplication of data – so for example an attribute lke a person’s name will only be in one place, i.e. on row of one table, and not anywhere else.

Minimise data errors, for example if a person’s address changes you only need to change it one place. If there were multiple tables and rows where that person’s address was stored then there would the potential for there to be multiple addresses for that person and that would lead to confusion.

 Data integrity is maintained – i.e. it is not possible to delete a record whose primary key is a foreign key in another table. For example if a student is enrolled in courses at a college then you will be unable to delete the student’s record from the Student table as it will be included in the StudentCourse table. Therefore this stops accidental deletion of data that should not be deleted.

 Normalising means you have minimum attributes/fields in tables and minimum number of rows in those tables thereby saving disk space.

 Because there is less data in the database searches, sorting and updates are faster (6)

 (d) Complete the Entity-Relationship diagram below to show the degree of the relationships between the entities. [3]

Boat

Customer

BoatHire

2. A database is to be created to hold data about students at a Sixth Form College and the subjects they study.

 Students study a number of subjects, and each subject has one subject leader.

 The table below is a first attempt at the design of the database.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| StudentID | Name | TutorGroup | Tutor | Subject | Level | SubjectLeader |
| S1000 | Bella | 2 | CKE | HistoryGeographyEconomics | AAAS | AJHBJGCKE |
| S2000 | Jane | 3 | KPR | EnglishFrenchRussian | ASAA | DREFJFKPR |
| S3000 | Greg | 1 | DRE | EnglishGeography | AA | DREBJG |

 (a) Explain, with reference to the data, why the table is not in First Normal Form (1NF). [2]

 Subject and SubjectLeader attributes are repeated.

 (b) The design is changed to:

 Student (StudentID, Name, TutorGroup, Tutor)

 StudentSubject (StudentID, Subject, Level, SubjectLeader)

 Show how the data given in the table above would be held in these two tables. [3]

 Table: **Student**

|  |  |  |  |
| --- | --- | --- | --- |
| StudentID | Name | TutorGroup | Tutor |
| S1000 | Bella | 2 | CKE |
| S2000 | Jane | 3 | KPR |
| S3000 | Greg | 1 | DRE |

 Table: **StudentSubject**

|  |  |  |  |
| --- | --- | --- | --- |
| StudentID | Subject | Level | SubjectLeader |
| S1000 | History | A | AJH |
| S1000 | Geography | A | BJG |
| S1000 | Economics | AS | CKE |
| S2000 | English | AS | DRE |
| S2000 | French | A | FJF |
| S2000 | Russian | A | KPR |
| S3000 | English | A | DRE |
| S3000 | Geography | A | BJG |

 (c) A student is not allowed to study the same subject at A and AS Level. [1]

 What is the primary key of the table StudentSubject?

 StudentID, Subject (composite key)

 (d) The two tables Student and StudentSubject are related. Explain how this is achieved using a primary and a foreign key. [2]

 Student ID is a primary key in the Student table and a foreign key in the StudentSubject table

 (e) Explain why the table StudentSubject is not in Second Normal Form (2NF). [2]

2NF says that all non-key attributes must depend on the whole key (so only applies to tables with composite keys), however, Subject leader is dependent on only one part of the composite primary key, i.e. the Subject and not the StudentID

 (f) Explain why the table Student is not in Third Normal Form (3NF) [2]

 For 3NF non-key attributes should only depend on the primary key and not on another non-key attribute. However, here the non-key attribute Tutor is dependent on the non-key attribute TutorGroup rather than the primary key.

 [Total 25 Marks]