14.4 Describe the concept of functional dependency.

Functional dependency describes the relationship between attributes in a relation. For example, if A and B are attributes of relation R, B is functionally dependent on A (denoted $A \rightarrow B$), if each value of A in R is associated with exactly one value of B in R.

Functional dependency is a property of the meaning or semantics of the attributes in a relation. The semantics indicate how the attributes relate to one another and specify the functional dependencies between attributes. When a functional dependency is present, the dependency is specified as a constraint between the attributes.

14.10 Describe the concept of full functional dependency and describe how this concept relates to 2NF. Provide an example to illustrate your answer.

Full functional dependency Indicates that if A and B are attributes of a relation, B is fully functionally dependent on A if B is functionally dependent on A, but not on any proper subset of A.

Second Normal Form (2NF) is a relation that is in first normal form and every non-primary-key attribute is fully functionally dependent on the primary key.

14.11 Describe the concept of transitive dependency and describe how this concept relates to 3NF. Provide an example to illustrate your answer.

Transitive dependency A condition where A, B, and C are attributes of a relation such that if A ->B and B ->C, then C is transitively dependent on A via B (provided that A is not functionally dependent on B or C)

Third Normal Form (3NF) is a relation that is in first and second normal form in which no non-primary-key attribute is transitively dependent on the primary key.

14.14 Examine the Patient Medication Form for the Wellmeadows Hospital case study shown in Figure 14.18

(a) Identify the functional dependencies represented by the data shown in the form in Figure 14.18.

patientNo -> fullName

wardNo ->wardName

wardName -> wardNo

drugNo ->name, description, dosage, methodOfAdmin

patientNo, drugNo, startDate ->unitsPerDay, finishDate

The functional dependencies for bedNo are unclear. If bedNo was a unique number for the entire hospital, then could say that bedNo ® wardNo. However, from further examination of the requirements specification, we can observe that bedNo is to do with the allocation of patients on the waiting list to beds.

(b) Describe and illustrate the process of normalizing the data shown in Figure 14.18 to First (1NF), Second (2NF), and Third (3NF).

First Normal Form

patientNo, drugNo, startDate, fullName, wardNo, wardName, bedNo, name, description, dosage, methodOfAdmin, unitsPerDay, finishDate

Second Normal Form

patientNo, drugNo, startDate, wardNo, wardName, bedNo, unitsPerDay, finish Date

drugNo, name, description, dosage, methodOfAdmin

patientNo, fullName

Third Normal Form

patientNo, drugNo, startDate, wardNo, bedNo, unitsPerDay, finish Date

drugNo, name, description, dosage, methodOfAdmin

patientNo, fullName

wardNo, wardName

(c) Identify the primary, alternate, and foreign keys in your 3NF relations.

patientNo (FK), drugNo(FK), startDate, wardNo(FK), bedNo, unitsPerDay, finish Date

drugNo, name, description, dosage, methodOfAdmin

patientNo, fullName

wardNo, wardName (AK)

14.15 The table shown in Figure 14.19 lists dentist/patient appointment data. A patient is given an appointment at a specific time and date with a dentist located at a particular surgery. On each day of patient appointments, a dentist is allocated to a specific surgery for that day.

(a) The table shown in Figure 14.19 is susceptible to update anomalies. Provide examples of insertion, deletion, and update anomalies.

The student should provide examples of insertion, deletion and update anomalies using the data shown in the table. An example of a deletion anomaly is if we delete the details of the dentist called 'Helen Pearson', we also loose the appointment details of the patient called 'Ian MacKay'.

(b) Describe and illustrate the process of normalizing the table shown in Figure 14.19 to 3NF. State any assumptions you make about the data shown in this table.

The student should state any assumptions made about the data shown in the table. For example, we may assume that a patient is registered at only one surgery. Also, a patient may have more than one appointment on a given day.

14.16 An agency called Instant Cover supplies part-time/temporary staff to hotels within Scotland. The table shown in Figure 14.20 lists the time spent by agency staff working at various hotels. The National Insurance Number (NIN) is unique for every member of staff.

(a) The table shown in Figure 14.20 is susceptible to update anomalies. Provide examples of insertion, deletion, and update anomalies.

The student should provide examples of insertion, deletion and update anomalies using the data shown in the table. An example of an update anomaly is if we wish to change the name of the employee called 'Smith J', we may only change the entry in the first row and not the last with the result that the database becomes inconsistent.

(b) Describe and illustrate the process of normalizing the table shown in Figure 14.20 to 3NF. State any assumptions you make about the data shown in this table.

The student should state any assumptions made about the data shown in the table. For example, we may assume that a hotel may be associated with one or more contracts.