14.14 Examine the Patient Medication Form for the *Wellmeadows Hospital* case study (see Appendix B) shown in Figure 14.18.

(a) Identify the functional dependencies represented by the attributes shown in the form in Figure 14.18. State any assumptions that you make about the data and the attributes shown in this form.

(b) Describe and illustrate the process of normalizing the attributes shown in Figure 14.18 to produce a set of well-designed 3NF relations.

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

Wellmeadows Hospital
Patient Medication Form

Patient Number: P10034

Full Name: Robert MacDonald **Ward Number:** Ward 11

Bed Number: 84 **Ward Name:** Orthopaedic

Drug Number	Name	Description	Dosage	Method of Admin	Units per Day	Start Date	Finish Date
10223	Morphine	Pain Killer	10mg/ml	Oral	50	24/03/13	24/04/14
10334	Tetracyclene	Antibiotic	0.5mg/ml	IV	10	24/03/13	17/04/13
10223	Morphine	Pain Killer	10mg/ml	Oral	10	25/04/14	02/05/15

Figure 14.18 The *Wellmeadows Hospital* Patient Medication Form.

Solution

(a) Functional Dependencies & Assumptions

Assumptions

- A drug is uniquely identified by **Drug Number**.
- Each entry represents a **prescription** of a drug to a patient.
- **Dosage**, **Description**, **Method of Administration**, and **Name** depend on the **Drug Number**.
- Each prescription instance has its own **Start Date**, **Finish Date**, and **Units per Day**.
- A drug can be prescribed **multiple times** with different start dates.

Functional Dependencies

From the table, we can infer the following:

1. Drug Number → Name, Description, Dosage
2. Drug Number, Start Date → Method of Admin, Units per Day, Finish Date

(b) Normalization to 3NF

1NF

- The relation is in **First Normal Form (1NF)** as all fields contain **atomic values** (no repeating groups or arrays).

2NF *(Eliminating Partial Dependencies)*

- **Composite primary key**: *(Drug Number, Start Date)* — uniquely identifies each prescription.

Split into Two Tables:

a. Drug Table

Drug Number	Start Date	Method of Admin	Units per Day	Finish Date
10223	24/03/13	Oral	50	24/04/14
10334	24/03/13	IV	10	17/04/13
10223	25/04/14	Oral	10	02/05/15

b. Prescription Table

Drug Number	Start Date	Method of Admin	Units per Day	Finish Date
10223	24/03/13	Oral	50	24/04/14
10334	24/03/13	IV	10	17/04/13
10223	25/04/14	Oral	10	02/05/15

3NF *(Eliminating Transitive Dependencies)*

- In the above 2NF structure:
    - All **non-key attributes** in both tables depend only on the **primary key**.
    - There are **no transitive dependencies** (i.e., no non-key attribute depends on another non-key attribute).

Thus, both tables are in **Third Normal Form (3NF)**.

(c) Keys

Drug Table

- **Primary Key**: Drug Number
- **Alternate Keys**: None
- **Foreign Keys**: None

Prescription Table

- **Primary Key**: Composite (Drug Number, Start Date)
    - (Assumption: The same drug is not prescribed more than once on the same start date. If this is not true, a surrogate key such as Prescription ID should be used.)
- **Foreign Key**: Drug Number → Drug Table