14.16 An agency called *Instant Cover* supplies part-time/temporary staff to hotels within Scotland. The table shown in Figure 14.20 displays sample data, which 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.

(b) Identify the functional dependencies represented by the attributes shown in the table of Figure 14.20. State any assumptions that you make about the data and the attributes shown in this table.

(c) Describe and illustrate the process of normalizing the table shown in Figure 14.20 to 3NF. Identify primary, alternate, and foreign keys in your relations.

NIN	contractNo	hours	eName	hNo	hLoc
1135	C1024	16	Smith J	H25	East Kilbride
1057	C1024	24	Hocine D	H25	East Kilbride
1068	C1025	28	White T	H4	Glasgow
1135	C1025	15	Smith J	H4	Glasgow

Figure 14.20 Table displaying sample data for the *Instant Cover* agency.

1. Anomalies

a) Insert anomaly

- Add a new hotel like H1 location in Fairfield but doesn't have any employee to the table. But table requirement employee information and contract Number.

b) Update anomaly

- Update H4 location require update both rows contain NIN = 1068 and NIN = 1135. In case 1 row miss update, table data become inconsistent.

c) Delete anomaly

- Delete contract C1025 also remove working history of employee Smith J at H4 Glasgow

2. Attributes in the table:

NIN: National Insurance Number (unique for each staff member)

contractNo: Contract number for the staff member

hours: Hours worked by the staff member

eNAME: Employee name

hNo: Hotel number

hLoc: Hotel location

Function Dependencies:

- NIN → eNAME
  Since NIN is unique for each staff member, it determines the staff member's name (eNAME)

- hNo → hLoc
  Each hotel (hNo) has a single location (hLoc). H25 is always in East Kilbride.

- NIN, contractNo → hours
  From NIN and contract Number can determine Hours. 1135 and C1024 get 16

Assumptions:

NIN is unique for each staff member.

eNAME is the name of the staff member, which is determined by their NIN.

hNo uniquely identifies a hotel, and each hotel has a single location (hLoc).

contractNo and hours are specific to the staff member's work at a particular hotel.

3. Normalize to 3NF
   a. 1NF: In this table: each column contains atomic values, and each column has unique values and
      This table in 1NF

   b. 2NF: No partial dependency exists.
      Primary Key: (NIN, contractNo)
      Covert to 2NF

      Employee Table: Primary key: NIN

NIN	eName
1057	Hocine D
1068	White T
1135	Smith J

Employee and Contract

NIN	contractNo	hours	hNo	hLOC
1135	C1024	16	H25	East Kilbride
1057	C1024	24	H25	East Kilbride
1068	C1025	28	H4	Glasgow
1135	C1025	15	H4	Glasgow

c. 3NF: No transitive dependency exists

Hotel table: Primary key: hNo

hNo	hLOC
H25	East Kilbride
H4	Glasgow

Employee table: Primary key: NIN

NIN	eName
1057	Hocine D
1068	White T
1135	Smith J

Employee Contract table: Primary key: (NIN, contractNo)

Foreign key: hNo

NIN	contractNo	hours	hNo
1135	C1024	16	H25
1057	C1024	24	H25
1068	C1025	28	H4
1135	C1025	15	H4