**1.** Consider a relation R(A, B, C, D) with the following instance:

| A | B | C | D |
|---|---|---|---|
| 1 | 1 | 2 | 3 |
| 1 | 2 | 2 | 3 |
| 1 | 3 | 2 | 3 |
| 2 | 4 | 5 | 6 |
| 5 | 6 | 7 | 8 |

Which of the following functional dependencies are satisfied by the relation?

a. A → B
b. A → CD
c. AB → CD
d. C → D
e. B → A
f. BD → AC
g. AD → BC
h. D → B
i. D → C
j. C → A

**2.** The following relation is unnormalised (not in First Normal Form)
   a. Why?
   b. Explain the steps involved in transforming the relation into First Normal Form (1NF).
   c. Transform the relation into a set of First Normal Form (1NF) relations.

ProjectManagement (projectCode, projectTitle, projectManager, {Employees(employeeNo, employeeName, departmentNo, departmentName, hourlyRate)})
Primary key projectCode

**Project Management**

Project Code: PC010
Project Title: Pensions System

Project Manager: M Phillips

| Employee No. | Employee Name | Department No. | Department Name | Hourly Rate |
|---|---|---|---|---|
| S10001 | A Smith | L004 | IT | £22.00 |
| S10030 | L Jones | L023 | Pensions | £18.50 |
| S21010 | P Lewis | L004 | IT | £21.00 |
| S00232 | R Smith | L003 | Programming | £26.00 |

3.  The following relation is not in Second Normal Form (2NF).
    a.  Why?
    b.  Explain the steps involved in transforming the relation into Second Normal Form (2NF).
    c.  Transform the relation into a set of Second Normal Form (2NF) relations.

Taxi(cabNo, dateDriven, Driver, Make, Model)
Primary key cabNo, dateDriven

**Taxi**

| cabNo | dateDriven | Driver | Make | Model |
|-------|------------|--------|------|-------|
| 101 | 2-11-2016 | Joe Dunne | Ford | Mondeo |
| 102 | 2-11-2016 | Michael Kelly | Opel | Vectra |
| 103 | 4-11-2016 | John Doyle | Nissan | Qashqai |
| 102 | 4-11-2016 | Stephan Roche | Opel | Vectra |
| 103 | 6-11-2016 | Joe Dunne | Nissan | Qashqai |

4.  The following relation is not in Third Normal Form (3NF).
    a.  Why?
    b.  Explain the steps involved in transforming the relation into Third Normal Form (3NF).
    c.  Transform the relation into a set of Third Normal Form (3NF) relations.

**EmployeeWork**

| PPS | Name | hoursPerWeek | hotelNo | hotelName | hotelLocation |
|-----|------|--------------|---------|-----------|---------------|
| 113345S | John Brown | 20 | H25 | Glenview | Arklow |
| 213468S | Phil Finn | 25 | H25 | Glenview | Arklow |
| 233122S | Joe Dunne | 25 | H28 | Ashdown Park | Gorey |
| 289128S | Joe Roche | 39 | H28 | Ashdown Park | Gorey |