Question 1 (3 marks)
What is the purpose of a business use-case diagram? How does this differ from a system use-case diagram?

Question 2 (3 marks)
Describe the main objectives of logical database design. Identify the main steps associated with the logical database design process.

Question 3 (6 marks)
(a) Identify the set of functional dependencies for the data shown in the figure above.
(b) Draw a schema based on the data above that is in first normal form (but not fully normalised).
(c) Identify a potential insert anomaly for this schema.
(d) Describe and illustrate the process of normalising this schema to second (2NF) and third (3NF). For each stage, identify the primary keys.

Question 4 (9 marks)
This question assumes a schema Students(id, name, address, age), and is based on the following PL/SQL procedure Proc1.

```
CREATE OR REPLACE PROCEDURE Proc1 (x VARCHAR2, y VARCHAR2) AS
    reco1 Students%ROWTYPE;
    reco2 Students%ROWTYPE;
    reco3 Students%ROWTYPE;
BEGIN
```
SELECT * INTO reco1
FROM Students
WHERE Name = x;

SELECT * INTO reco2
FROM Students
WHERE Name = y;

IF reco1.Age < reco2.Age THEN
    reco3 := reco1;
    reco1 := reco2;
    reco2 := reco3;
END IF;

DBMS_OUTPUT.PUT_LINE ( reco1.Name || ', ' || reco2.Name);
END Proc1;
/

(a) Explain what the procedure Proc1 is meant to do.

(b) It has been brought to your attention that name is not the primary key of the
student table. What are some potential errors with the above code. Introduce an
error handling mechanism that will output an appropriate messages.

(c) Write some SQL that displays the address, id and name of students where there
are two or more students at the same address. Sort this by address.

(d) Use this SQL as the basis of a PL/SQL procedure called SameAddress. This will
output a report for each address with more than 2 students as follows

address: address
num students: num-students-at-address
student ids: student-ids at address

(3 marks)

Question 5 – SQL (7 marks)

The relational schema shown below is part of a real estate database.

Branch (branchno, street, city, postcode)
Staff (staffNo, fname, lname, position, sex, dob, annualsalary, branchno)
PropertyForRent (propertyno, street, city, postcode, type, rooms, rent, ownerno, staffno, branchno)
Client (clientno, fname, lname, telno, preftype, maxrent)
Viewing (clientno, propertyno, viewdate, comments)

Formulate the following as SQL statements:

(a) Produce a list of monthly salaries for all staff showing staff number, the first
and lastnames and the monthly salary.
(b) List the addresses of all branch offices in London or Glasgow.
(c) Find the total number of managers and the sum of their salaries.
(d) Find the number of staff working in each branch and the sum of their salaries.
(e) List the staff number and last name staff who work in the branch at “13 Main Road”. Use a nested subquery.
(f) List the branch offices and properties that are not in the same city as the branch office. It will be sufficient to list the branch number, the branch city, the property number and the city of the property.
(g) Construct a list of all cities where there is both a branch office and a property using nested subqueries.

Question 6 – Database analysis and design case study (total 20 marks)

Questions 6a to 6e refer to the following specification.

For these tasks you will be considering a case study of a video store (VIDSTORE), which is a typical small business application. The video store keeps in stock a wide-ranging video library of current and popular movies. All video tapes are bar-coded as are customer membership cards. The video system supports rentals and returns of videos, as well as a customer reservation and enquiry system.

One aspect of the overall VIDSTORE system is a subsystem that supports the returning of videos (VideoReturn). The following requirements have been extracted from a larger case-study requirements document:

- When a video is returned, there is a check to see if the video has been reserved.
- Videos returned late induce a payment equal to an extra rental period.
- The payment is either taken from the customer’s account or directly from the customer.
- If a video is overdue more than a couple of days, an Overdue notice is sent to the customer.
- When a customer has more than 2 overdue notices, the customer is noted to be delinquent.

Question 6a- Business-Use Case (4 marks)

Draw a business use-case diagram for the overall Video store application (VIDSTORE). Include one line descriptions of the main actors and use-cases.

Question 6b - Conceptual Design (5 marks)

Draw a conceptual model that will support the subsystem VideoReturn. Make sure that the conceptual design encompasses the requirements as listed in the requirements
However, be careful to limit the scope of your conceptual design to the essential elements of the VideoReturn subsystem (focus only on what is required to support the returning of videos as described above). Use common sense if you need to include additional information not necessarily mentioned in the above specification. It will be sufficient that the conceptual model identifies the main entities, the relationships and the cardinalities of those relationships.

**Question 6c - Logical Design (5 marks)**

Pick at least five of the entities that form a natural grouping in your conceptual design (it is advisable to include the entities associated with customer, video, video rental and reservation). Draw a logical database design based on those five entities. Make sure your answer shows the attributes, primary keys and foreign keys.

**Question 6d - SQL (3 marks)**

Write SQL statements to create 3 tables associated with customer, video and video rentals. The most important aspect of this answer is to demonstrate that you can describe primary and foreign key constraints in SQL.

**Question 6e - PL/SQL (3 marks)**

Write the skeleton of a trigger that will check for updates on the video rental table. If a video is returned (eg the return-date is changed from null to today’s date), check if there are any reservations. If so write a message to output “Video xxx returned – notify customer yyy that they may collect their reservation”

**Question 7 – Data Mining (5 marks)**

Write an executive summary that describes data mining. How is this different from OLAP. In your answer make reference to a case study that you have read about where data mining has been used to provide some benefit.