Answer ALL questions.

Clearly cross out surplus answers.

Time: 3 hours

The maximum mark for this paper is 100.

Any reference material brought into the examination room must be handed to the invigilator before the start of the examination.
Question 1

a) Identify FIVE (5) ways in which a large educational institution such as a university might use data.  

b) Explain what metadata means and provide THREE (3) examples of metadata from the systems you identified in part (a).

Total: 10 Marks

Question 2

An online restaurant booking system allows customers to make a reservation for a table. A table might be reserved by many customers over a period of time.

a) Draw an entity-relationship (ER) diagram for this scenario.  
b) Identify attributes, including primary and foreign keys, for this ER model.

Total: 10 Marks

Question continue on next page
Question 3

Consider the following relational model. In a property management company a branch has many staff members who manage properties, but not every property must be managed by someone.

![Diagram of database model]

a) This model is an example of a chasm trap. Explain what a chasm trap is.

b) How might this problem be resolved in the scenario shown?

c) Define the term tuple.

d) Explain what is meant by cardinality in the relational model and give THREE (3) examples.

Total: 10 Marks

Question 4

a) Explain the term relation.

b) What is meant by the term data independence in the context of relational databases?

Total: 10 Marks
Question 5

a) List FOUR (4) data manipulation commands in SQL.  4

b) In what ways can SQL be used to enforce domains?  2

c) What issue with the CHAR data type does the use of the VARCHAR data type overcome?  2

d) Explain how SQL does not support the full relational model.  2

Total: 10 Marks

Question 6

The table below is associated with customers and the products they have purchased.  10

<table>
<thead>
<tr>
<th>Customer ID</th>
<th>Customer Name</th>
<th>Products Purchased</th>
<th>Product Type Code</th>
<th>Product Type Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>Danny Whybrow</td>
<td>Lawnmower</td>
<td>G</td>
<td>Gardening</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rake</td>
<td>G</td>
<td>Gardening</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Microwave Oven</td>
<td>K</td>
<td>Kitchen</td>
</tr>
<tr>
<td>C2</td>
<td>Anderson Smith</td>
<td>Saucepan Set</td>
<td>K</td>
<td>Kitchen</td>
</tr>
<tr>
<td>C3</td>
<td>Tommy West</td>
<td>Chrome Book</td>
<td>T</td>
<td>Technology</td>
</tr>
<tr>
<td>C6</td>
<td>Charun Singh</td>
<td>Lawnmower</td>
<td>G</td>
<td>Gardening</td>
</tr>
</tbody>
</table>

Split the table into FOUR (4) third normal form (3NF) relations. You do not have to show data or the steps that you took to normalise the table.

Total: 10 Marks

Question 7

a) Explain the role that prototyping can play in systems development.  4

b) Identify SIX (6) activities that could be involved in physical database design.  6

Total: 10 Marks

Question continue on next page
Question 8

a) What activities need to be carried out during database design to understand how transactions will interact with the database?  

b) What is meant by the term *performance* with regard to data manipulation statements?  

c) Suggest TWO (2) ways in which a database developer might increase the performance of database transactions.

Total: 10 Marks

Question 9

Consider the following tables for a vehicle hire company that operates largely online and needs to keep a record of its customers and rentals.

<table>
<thead>
<tr>
<th>Customer ID</th>
<th>Customer Name</th>
<th>Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>232</td>
<td>Donald Smith</td>
<td>55 Treetop Avenue, London, N1</td>
</tr>
<tr>
<td>345</td>
<td>Mandy Jackson</td>
<td>101 Tops Road, London, SE15</td>
</tr>
<tr>
<td>123</td>
<td>Tamara O’Toole</td>
<td>99 Ustinov Road, London, N1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Vehicle ID</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ford Transit Van</td>
</tr>
<tr>
<td>2</td>
<td>VW Utility Van</td>
</tr>
<tr>
<td>3</td>
<td>VW Camper</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Customer ID</th>
<th>Vehicle ID</th>
<th>Rental Start Date</th>
<th>Rental End Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>232</td>
<td>1</td>
<td>01/01/2015</td>
<td>05/01/2015</td>
</tr>
<tr>
<td>232</td>
<td>1</td>
<td>09/06/2015</td>
<td>10/06/2015</td>
</tr>
<tr>
<td>123</td>
<td>3</td>
<td>01/01/2015</td>
<td>30/01/2015</td>
</tr>
</tbody>
</table>

a) Write the SQL statements to create the above tables.  

b) Write an SQL statement to change the name of the vehicle ‘VW Camper’ to ‘VW Luxury Camper’.  

c) Write an SQL statement to delete Donald Smith as a customer.

Total: 10 Marks

Question continue on next page
Question 10

Consider the entity-relationship (ER) diagram shown below for an events management company.

![Entity-Relationship Diagram]

**a)** Create a CRUD matrix to show the following transactions:

Transaction 1 – add a new event
Transaction 2 – delete a customer
Transaction 3 – record an event
Transaction 4 – show a list of events and the staff and customers they are for

**b)** Identify and explain the FOUR (4) basic properties of a transaction.

**c)** What are the concerns of the concept of *authorisation* with regard to transactions in a relational database?

Total: 10 Marks

End of Examination Paper