BCS THE CHARTERED INSTITUTE FOR IT

BCS HIGHER EDUCATION QUALIFICATIONS
BCS Level 5 Diploma in IT

DATABASE SYSTEMS

Thursday 19th September 2019 – Morning
Answer **any** FOUR questions out of SIX. All questions carry equal marks
Time: TWO hours

Answer any Section A questions you attempt in Answer Book A
Answer any Section B questions you attempt in Answer Book B

The marks given in brackets are **indicative** of the weight given to each part of the question.

Calculators are NOT allowed in this examination.

[Turn Over]

Section A
Answer Section A questions in Answer Book A

A1.

a) Explain how a database management system differs from the file storage used in an operating system such as Linux or Windows.

(5 Marks)

b) Describe using examples EACH of the following terms and explain why they are important in a database system: -

i) Transaction.
ii) ANSI Standards.
iii) Meta Data or Data Dictionary.
iv) Schema.

(20 Marks)

A2. Database Administration is an important job carried out by a DBA (Database Administrator) that involves managing and maintaining a database management system (DBMS). For the purpose of the questions below, the DBA is responsible for managing a multiuse DBMS for a medium sized company with up to 100 users at any one time.

a) Describe five tasks the DBA would need to carry out on a regular basis.

(10 Marks)

b) Describe EACH of the following related pairs of concepts highlighting the association that exists between them.

i) Availability and Integrity.
ii) Authorisation and Authentication.

(12 Marks)

c) Briefly discuss how the role of DBA has changed over recent years due to changes in the use of technology.

(3 Marks)

[Turn Over]

A3. This question uses the 'Professionals' relation below:

Professionals

ID	Name	Profession	Age	Salary
1	Billy Builder	Architect	45	75,000
2	Steve Surfer	Swimming Instructor	21	13,000
3	Frankie Fetch	Lorry Driver	33	24,000
4	Brian Brush	Dentist	45	75,000
5	Nicky Nurse	Midwife	38	32,000
6	Roger Road	Lorry Driver	27	25,000
7	Fiona Floss	Dentist	52	120,000
8	Colin Crawl	Swimming Instructor	24	13,000

a) Based *solely on the 'Professionals'* relation, write down the answer to the following calculation and show all steps in your working.

$$\frac{\text{(DEGREE x CARDINALITY) + (NUMBER OF DOMAINS)}}{\text{(NUMBER OF CANDIDATE KEYS)}}$$

(5 Marks)

b) Using the 'Professionals' relation and Venn diagrams (or any other suitable diagrams), explain how the following relational algebra operations are processed. Explain the key concepts, provide an actual example and a suitable diagram for each.

i) UNION;
ii) INTERSECT;
iii) MINUS (DIFFERENCE);
iv) SELECTION;
v) PROJECTION.

(15 Marks)

c) For each of the following relational concepts, explain the key ideas behind it, provide a suitable example and/or diagram and compare/contrast their application.

i) UNION COMPATIBILITY and its importance for set operations.
ii) JOIN CRITERIA and its importance for seeing if two or more tables are joinable.

(5 Marks)

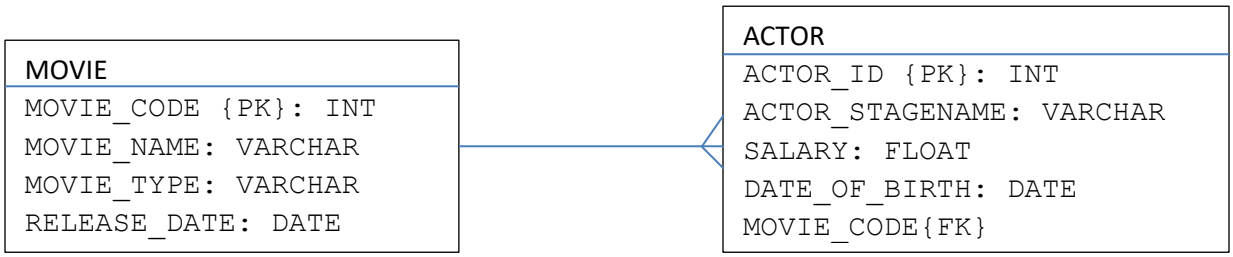
[Turn Over]

Section B
Answer Section B questions in Answer Book B

B4.

a) Write the SQL statements that would build tables and constraints from the following Entity Relationship Diagram (ERD). The answer can be given purely in terms of two CREATE statements.

(10 Marks)



b) The table shown below displays the details of customers and the movies that they stream from a movie streaming company. Identify any problem areas such as repeating groups, part-key dependencies and transitive dependencies and show how they may be resolved by normalizing this table into a set of 3rd Normal Form (3NF) tables.

(10 Marks)

Customer-details

Full Name	Title	**Addre**ss	Rented Movies	Category
Janet Jones	Ms.	1st street, plot no 4	Pirates of the Caribbean, Clash of the Titans	Action Action
Robert Phil	Mr.	3rd Street 34	Forgetting Sarah Marshal, Daddy's Little Girls	Romance Romance
Robert Phil	Mr.	5th Avenue	Clash of the Titans	Action

c) In certain cases, it may be advisable to de-normalise a set of fully normalised database tables.

Under what circumstance would de-normalisation of a fully normalised database be considered and what would be the benefits of doing so?

(5 Marks)

[Turn Over]

B5.

a) Draw data models for the following scenarios. Make certain that you show the attributes' feasible identifiers and correct relationships: (Note: avoid M-to-N relationships)

i) An aircraft can have many seats, but a seat can be on only one aircraft.

ii) An exam is based on one course, but one course can have many exams.

iii) A mechanic can repair many cars, and a car can be repaired by many mechanics.

(10 Marks)

b) With reference to a sample relation of your own choosing, explain and discuss the following relational model terminology, including its function in query processing and any related concepts. A diagram showing your sample relation should be included.

i) Cardinality ratio.
ii) Participation constraints.
iii) Recursive relationship.
iv) Composite Key.
v) Domain.

(15 Marks)

[Turn Over]

B6.

Consider the following scenario of an agency that rents out accommodation.

There are two types of accommodation: flats (apartments) and trailers (also known as caravans or mobile homes). These accommodations are associated with one manager who oversees them. A manager can oversee multiple accommodations.

Each accommodation can be rented out to a client.
A client could rent multiple accommodations. On each occasion, the rent date is recorded.
Trailers must be parked at a trailer park.

A trailer park has a unique ID and an address.
A trailer park may contain multiple trailers but could be empty at any point in time.

Each manager has a unique staff ID and a name. A client is also uniquely identified by an ID and has a name.

An accommodation has a unique ID and a rent charge (in £). Moreover, a flat has an address and a trailer has a trailer number.

a) Using a modelling notation of your choice, draw an Entity-Relationship model for the scenario above, showing:

   i) The entity types, with corresponding attributes and primary keys.
   ii) The relationships between those entities.
   iii) For each relationship show their degree (One:One; One:Many or Many:Many) and participation (Mandatory or Optional).

   State any assumptions you make to fill any gaps in the scenario.

(14 Marks)

b) Design a set of tables derived from your Entity-Relationship model in part (a) above. Clearly highlight all primary keys and foreign keys.

(11 Marks)

End of Exam