

Database Concepts

- 1.(a) Explain what is meant by data normalisation. (4 marks)
(b) With reference to Relational Database Management Systems, explain the following terms:
(i) data consistency; (2 marks)
(ii) data integrity; (2 marks)
(iii) data independence. (2 marks)

a)

Any four:

- naming First Normal Form, Second Normal Form and Third Normal Form (1)
- (1NF) Removal of repeating fields/ attributes/ ensure that values are atomic (1)
- (2NF) Removal of composite keys/partial key dependencies/ ensure that nonkey fields are functionally dependent on the whole primary key (1)
- (3NF) Removal of non-key/transitive dependencies (1)
- process for making the structure of a relational database more efficient (1)
- by defining tables, fields, and relationships/ appropriate terminology (1)
- to enable complex queries (1)

Max 4 x 1 4 marks

b)

appropriate generic statement (1) example / expansion (1)

(i) **data consistency:**

Data is stored as one value, and not stored again as another (1) comes with reduced redundancy (1) **(2,1,0) marks**

(ii) **data integrity:**

Correctness/ how trustworthy the data is. (1) free from corruption / validated (1)

(2,1,0) marks

(iii) **data independence:**

Data is separate from programs that use it (1) same table may enable delivery function to see customer as name and address only, credit control function to see customer as income, credit history, etc (1) **(2,1,0) marks**

2. *The secretary of a local charity is constructing a database on behalf of the committee. It will be used to store data on events, and ticket sales for those events, including who has purchased them. He has been told that a relational database management system can assist him. Having found an article on relational database construction, he does not understand some of the terms it contains. He asks you for advice.*

(a) *Explain the following terms:*

(i) *normalisation;* 2

(ii) *data independence;* 2

(iii) *data consistency;* 2

(iv) *data integrity.* 2

(b) *The secretary constructs his database and then asks you to examine his work before he enters any data. You notice that he has not included any validation. With the aid of an example, explain why data validation is important.* 3

(c) *Give **three** reasons why he should consult with other members of the*

charity.s committee before finalising the design of his database system. 3 marks

2(a)

(i) Process of breaking down complex data structures into simpler forms. (1) + expansion/ example (1) **2 marks**

(ii) Changes in the structure of the data only affects those programs/ functions that are reliant on that part of the structure(1)+ expansion/ example (1)

OR

Data structure is separate from the programs that access it (1) + expansion/ example (1) **2 marks**

(iii) Data is only stored once, and this is the sole source of that data. (1) + expansion/ example (1) **2 marks**

(iv) How trustworthy/how reliable the data is/ correctness of data. (1) + expansion/ example (1) **2 marks**

(b)

What is validation (1)

What can you validate (an example of a field, e.g. National Insurance Number) (1)

How do you validate (an example of a validation method e.g. format check)

Max 3 marks

(c)

NB answers must be in the context of before the system is created.

to ensure that the data they require is recorded on the system (1)

to find out what training/ documentation may be needed by other members in order to make use of the system (1)

to ensure that the system can create the relevant outputs that different members require (1)

or any other sensible reasons (1 per reason up to a maximum of three)

3 x 1 mark

3.(a) Explain why entity-relationship diagrams are used when designing a relational database. **3**

(b) Describe the process of normalisation. **4**

(c) Explain, using an example, why normalisation is used when designing a relational database. **4**

a) 1 mark each for up to 3 points. The following are examples:

• provides a diagrammatic representation of the structure of the data(1)

• shows the types of relationships within the database (1)

• one to one, one to many, many to many relationships shown (1)

• shows the logical structure of the database (1)

3 x 1 marks

b)

• naming First Normal Form, Second Normal Form, Third Normal Form (1)

• (1NF) Removal of repeating fields/ attributes/ ensure that values are atomic (1)

• (2NF) Removal of partial key dependencies/ ensure that non-key fields are functionally dependent on the primary key (1)

• (3NF) Removal of non-key dependencies (1)

- process for making the structure of a relational database more efficient (1)
- by defining tables, fields, and relationships/ appropriate terminology (1)
- breaking the structure into simpler forms (1)

4 x 1 marks

c) The following answers are examples only. Credit any reasonable explanation of why normalisation is used for a maximum of 3 marks. Credit any reasonably example for 1 mark.

- in order to reduce/eliminate redundancy (1)
- in order to avoid data duplication (1)
- in order to increase consistency (1)
- to ensure that data in tables is independent (1)
- relevant example illustrating one of the points given (1)

4 x 1 marks

4. *Figure 1 is an entity-relationship diagram.*

Name and describe the relationship between Film and Actor as shown in the diagram.

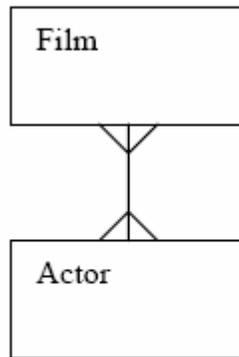


Figure 1

- A many-to-many relationship (1)
- One actor appears in many films (1)
- One film has many actors (1)

SPECIAL CASE: many actors in many films and many films have many actors (1)

3 x 1 mark

5. *When designing a relational database it is necessary to normalise the data.*

- (a) *Describe the process of normalisation.* 4
- (b) *Describe three facilities that are provided by a Relational Database Management System.* 6

a)

- naming First Normal Form, Second Normal Form, Third Normal Form (1)
- (1NF) Removal of repeating fields/ attributes/ ensure that values are atomic (1)
- (2NF) Removal of partial key dependencies/ ensure that non-key fields are functionally dependent on the primary key (1)
- (3NF) Removal of non-key dependencies (1)

- process for making the structure of a relational database more efficient (1)
- by defining tables, fields, and relationships/ appropriate terminology (1)

4 x 1 mark

b)

- mechanism for constructing/ maintaining the database (1) + expansion (1)
- provides the interface between user and data (1) + expansion (1)
- provides querying facilities (1) + expansion (1)
- provides reports/ output formatting (1) + expansion (1)
- provides security (1) + expansion (1)
- provides method of data definition (1) + expansion (1)
- provides facilities to aid data definition (1) + expansion (1)
- Open Database Connectivity/ ODBC (1) allowing program-data independence(1)

3 x (2,1,0) marks

6. *A charitable organisation needs to coordinate all the data that it holds at several locations across the world. They have discovered that there is often conflicting data held in different sites, and time is wasted in reconciling them. A consultant has recommended that they use a relational database management system. The organisation has accepted this advice and is now advertising for the post of database administrator. In the advertisement it states that each applicant should write a supporting letter. You have decided to apply for this post.*

Write a letter in support of your application, paying particular attention to:

- *the role of a database administrator;*
- *how a relational database management system can help with this problem;*
- *the advantages of a client/ server solution to this problem.*
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Quality of written communication will be assessed in your answer. 20 marks

The role of database administrator (R marks) Allow marks for up to three points only, with the second mark available for a good expansion.

Design of the database (1) setting up appropriate tables, relationships, fields, naming conventions etc. (1)

Maintain the data dictionary (1) i.e. the data structure, aliases etc. (1)

Monitoring performance of RDBMS (1) and making appropriate adjustments to deal with problems as they arise e.g. system taking too long to produce a report (1)

Notifying user of changes made (1) so that they can make changes to the way they use the database appropriately e.g. availability of new reports/ queries (1)

Allocation of access to users (1) including access rights, providing user names etc. (1)

Provide training to the users as appropriate (1) so new users learn how to use the system, and existing users get updates as necessary/ DBA will have to create remote learning materials in this context and be available to help with any queries that arise (1)

In charge of the backup procedure (1) ensuring that the database is available to users at the times that they need it (1)

Allow point to do with being an effective ICT professional (1) plus valid expansion (1) Max 3 x (2,1,0) marks

Application of a relational database management system (A marks) Allow marks for up to three points only, with the second mark available for a good expansion.

Provides a buffer between the user and the underlying structure of the database (1) so the user is not concerned with the structure of the database, just with making relevant use of the data (1)

Can be used to create a consistent database with a consistent interface (1) so if users move from one location to another they already know how to use the system (1) RDBMS will control access to data (1) so all places will see the most up to date data (1)

In event of disaster, RDBMS should help with disaster recovery (1) e.g. provide ability to consolidate data and roll back to a known correct state (1) RDBMS may provide improved security to the system (1) so that there is less chance of inexperienced users inadvertently changing data/ malicious attempts to corrupt data succeeding (1)

Max 3 x (2,1,0) marks

The advantages of a client/ server solution to the problem (C marks)

Centralised store of data (1) so there is control over the data itself; must be consistent across all users (1)

Control over access (1) this can be monitored and restrictions set up as necessary (1)

Lower level of equipment needed as clients (1) as processing and storage is dealt with centrally (1)

Network traffic issues (1) only requests and results are sent over the network, not entire tables of data (1)

Clients do not need all the software to run the database (1) they only need software to access the database, not the rest of the RDBMS (1)

Max 3 x (2,1,0) marks 16 Marks

max for content