SOLUTIONS TO REVIEW QUESTIONS

AND EXERCISES

FOR PART 3 - DATABASE ANALYSIS AND DESIGN
(CHAPTERS 10 – 15)
Chapter 10 Database System Development Lifecycle

Review Questions

10.1 Describe the major components of an information system.

Database, database software, application software, computer hardware including storage media, and people using and developing the system.

10.2 Discuss the relationship between the information systems lifecycle and the database system development lifecycle.

See Sections 10.1 and 10.2.

10.3 Describe the main purpose(s) and activities associated with each stage of the database system development lifecycle.

See Table 10.1 in Section 10.2.

10.4 Discuss what a user view represents in the context of a database system.

User view: defines what is required of a database system from the perspective of a particular job role (such as Manager or Supervisor) or enterprise application area (such as marketing, personnel, or stock control) (See Section 10.4.1).

10.5 Discuss the main approaches for managing the design of a database system that has multiple user views.

Three main approaches: centralized, view integration, and combination of both approaches (see Section 10.5).

10.6 Compare and contrast the three phases of database design.

Three phases are conceptual database design, logical database design, and physical database design.

Conceptual database design constructs a model of the information used in an enterprise, independent of all physical considerations. Logical database design is based on a specific data model, but independent of all other physical considerations. Physical database design constructs a description of the implementation of the database on secondary storage (see Section 10.6.3).

10.7 What are the main purposes of data modeling and identify the criteria for an optimal data model.
The two main purposes of data modeling are to assist in the understanding of the meaning (semantics) of the data and to facilitate communication about the information requirements (see Section 10.6.2).

10.8 Identify the stage(s) where it is appropriate to select a DBMS and describe an approach to selecting the ‘best’ DBMS.

Physical database design is tailored to a specific DBMS; therefore it is essential the DBMS is determined before the physical design phase can begin. Physical database design is described in Section 10.6.3.

10.9 Application design involves transaction design and user interface design. Describe the purpose and main activities associated with each.

See Section 10.8.

10.10 Discuss why testing cannot show the absence of faults, only that software faults are present.

See Section 10.12.

10.11 Describe the main advantages of using the prototyping approach when building a database system.

Should be relatively inexpensive to develop and quick to build (see Section 10.9).

Exercises

10.12 Assume that you are responsible for selecting a new DBMS product for a group of users in your organization. To undertake this exercise, you must first establish a set of requirements for the group and then identify a set of features that a DBMS product must provide to fulfil the requirements. Describe the process of evaluating and selecting the best DBMS product.

The student should follow the approach to DBMS selection described in Section 10.7 and produce a report that identifies a suitable DBMS product that meets the requirements of the organization. The selection should be fully justified and any assumptions made should be highlighted.

10.13 Describe the process of evaluating and selecting a DBMS product for each of the case studies described in Appendix B.

The student should follow the approach to DBMS selection described in Section 10.7 and produce a report that identifies a suitable DBMS product that meets the requirements of each organization described in Appendix B. The selection should be fully justified and any assumptions made about the case study should be highlighted.
10.14 Assume that you are an employee of a consultancy company that specializes in the analysis, design, and implementation of database systems. A client has recently approached your company with a view to implementing a database system but they are not familiar with the development process. You have been assigned the task to present an overview of the Database System Development Lifecycle (DSDL) to them, identifying the main stages of this lifecycle. With this task in mind, create a slide presentation and/or short report for the client. (The client for this exercise can be any one of the fictitious case studies given in Appendix or some real company identified by you or your professor).

The student should use the information presented in overview form in Section 10.2 and in more detail in sections 10.3 through 10.13 to create the presentation.

10.15 This exercise requires you to first gain permission to interview one or more people responsible for the development and/or administration of a real database system. During the interview(s), find out the following information:
(a) The approach taken to develop the database system.
(b) How the approach taken differs or is similar to the DSDL approach described in this chapter.
(c) How the requirements for different users (user views) of the database systems were managed.
(d) Whether a CASE tool was used to support the development of the database system.
(e) How the DBMS product was evaluated and then selected.
(f) How the database system is monitored and maintained.

The results of this student project will depend on the people being interviewed. Students should develop a list of questions that should lead to answers to items a-f above before beginning the interview.
Chapter 11 Database Analysis and the DreamHome Case Study

Review Questions

11.1 Briefly describe what the process of fact-finding attempts to achieve for a database developer.

Attempts to uncover facts about the business and the users of the database system including the vocabulary, problems, opportunities, constraints, requirements, and priorities.

11.2 Describe how fact-finding is used throughout the stages of the database system development lifecycle.

See Table 11.1 in Section 11.2.

11.3 For each stage of the database system development lifecycle identify examples of the facts captured and the documentation produced.

See Table 11.1 in Section 11.2.

11.4 A database developer normally uses several fact-finding techniques during a single database project. The five most commonly used techniques are examining documentation, interviewing, observing the business in operation, conducting research, and using questionnaires. Describe each fact-finding technique and identify the advantages and disadvantages of each.

See Section 11.3.

11.5 Describe the purpose of defining a mission statement and mission objectives for a database system.

Mission statement defines the major aims of the database system; the mission objectives identify the particular tasks that the database must support (see Section 11.4.2).

11.6 What is the purpose of identifying the systems boundary for a database system?

Ensures that all appropriate areas of the organization are supported by the database system (see Section 11.4.3).

11.7 How does the contents of a users’ requirements specification differ from a systems specification?

Systems specification describes the any features to be included in the new database system such as networking and shared access requirements, performance requirements, and the levels of security required. On the other hand, the users’ requirements specification describes in detail the data to be held in the database and how the data is to be used (see Section 10.4.4).
11.8 Describe one method to deciding whether to use either the centralized or view integration approach, or a combination of both when developing a database system for multiple user views.

One way is to examine the overlap in the data used between the various user views (see, for example, Table 11.7).

Exercises

11.9 Assume that you are an employee of a consultancy company that specializes in the analysis, design, and implementation of database systems. A client has recently approached your company with a view to implementing a database system, but they are not familiar with the development process.

Task: You are required to present an overview of the fact-finding techniques that your company intends to use to support the development of the client’s database system. With this task in mind, create a slide presentation and/or report that describes each fact-finding technique and how the fact-finding techniques will be used throughout the development of the database system. The client for this exercise and those that follow can be any one of the fictitious case studies given in Appendix B or some real company identified by you or your professor.

In preparing a slide presentation or report about fact-finding techniques, students should cover the five commonly used fact-finding techniques:
- Examining documentation (Section 11.3.1, Table 11.2);
- Interviewing (Section 11.3.2);
- Observing the enterprise in operation (Section 11.3.3);
- Research (Section 11.3.4);
- Questionnaires (Section 11.3.5).

11.10 Assume that you are an employee of a consultancy company that specializes in the analysis, design, and implementation of database systems. A client has recently approached your company with a view to implementing a database system.

Task: You are required to establish the database project through the early stages of the project. With this task in mind, create a mission statement and mission objectives and high-level systems diagram for the client’s database system.

Students will find it helpful to review the definition of a mission statement, mission objectives, and high-level systems diagram in Sections 11.4.2 and 11.4.3.

11.11 Assume that you are an employee of a consultancy company that specializes in the analysis, design, and implementation of database systems. A client has recently approached your company with a view to implementing a database system. It has already been established that the client’s database system will support many different groups of users (user views).

Task: You are required to identify how to best manage the requirements for these user views. With this task in mind, create a report that identifies high-level requirements for each user view and shows the relationship between the user views. Conclude the report by identifying and justifying the best approach to managing the multi-user view requirements.

Students should create documentation on the required views including a table documenting view relationships such as the one shown in Figure 11.7.
Chapter 12 Entity-Relationship Modeling

Review Questions

12.1 Describe what entity types represent in an ER model and provide examples of entities with a physical or conceptual existence.

An entity type represents a group of ‘objects’ in the real world with the same properties (see Section 12.1). Examples of entities with physical and conceptual existence are shown in Figure 12.2.

12.2 Describe what relationship types represent in an ER model and provide examples of unary, binary, ternary, and quaternary relationships.

A relationship type is a set of associations between one or more participating entity types (see Section 12.2). Examples:

Unary: Staff Supervise Staff (also called recursive relationship)
Binary: Branch Has Staff
Ternary: Staff Registers Client at Branch
Quaternary: Solicitor Arranges Bid with a Buyer supported by a Financial Institution.

12.3 Describe what attributes represent in an ER model and provide examples of simple, composite, single-value, multi-value, and derived attributes.

An attribute represents a property of an entity or a relationship type (see Section 12.3). Examples:

Simple: position or salary attribute of Staff
Composite: address attribute composed of street, city, and postcode attributes
Single-valued: branchNo attribute of Branch
Multi-valued: telNo attribute of Branch
Derived: duration attribute of Lease, calculated from rentStart and rentFinish attributes.

12.4 Describe what the multiplicity constraint represents for a relationship type.

Multiplicity represents the number (or range) of possible occurrences of an entity type that may relate to a single occurrence of an associated entity type through a particular relationship (see Section 12.6).

12.5 What are enterprise constraints and how does multiplicity model these constraints?

Enterprise constraints are rules that the data in the database must conform to as specified by users or database administrators of a database (see Section 4.3.4). Multiplicity constrains the way that entities are related – it is a representation of the policies (or business rules) established by the user or enterprise.
12.6 **How does multiplicity represent both the cardinality and the participation constraints on a relationship type?**

Multiplicity actually consists of two separate constraints (see Section 12.6.5):

- **Cardinality** – which describes the maximum number of possible relationship occurrences for an entity participating in a given relationship type.
- **Participation** – which determines whether all or only some entity occurrences participate in a relationship.

12.7 **Provide an example of a relationship type with attributes.**

The relationship **Newspaper Advertises PropertyForRent** consists of two attributes: `dateAdvert` (representing the date the advert took place) and `cost` (representing the cost of the advert).

12.8 **Describe how strong and weak entity types differ and provide an example of each.**

A strong entity type is an entity type that is not existence-dependent on some other entity type (see Section 12.4). Examples of strong entity types are **Branch**, **Staff**, and **PropertyForRent**.

A weak entity type is an entity type that is existence-dependent on some other entity type. An example of a weak entity type is **Preference**.

12.9 **Describe how fan and chasm traps can occur in an ER model and how they can be resolved.**

A fan trap occurs where a model represents a relationship between two entity types, but the pathway between certain entity occurrences is ambiguous. Resolve the fan trap by restructuring the original ER diagram to represent the correct association between these entities (see Section 12.7.1).

A chasm trap occurs where a model suggests the existence of a relationship between entity types, but the pathway does not exist between certain entity occurrences. A chasm trap may occur where there are one or more relationships with optional participation. Resolve the chasm trap by identifying the missing relationship (see Section 12.7.2).
Exercises

12.10  Create an ER diagram for each of the following descriptions:

(a)  *Each company operates four departments, and each department belongs to one company.* (Note when the exact cardinality is known (in this example, 4) a value can replace the multiplicity range.

(b)  *Each department in part (a) employs one or more employees, and each employee works for one department.*

(c)  *Each of the employees in part (b) may or may not have one or more dependants, and each dependant belongs to one employee.*

(d)  *Each employee in part (c) may or may not have an employment history.*