Chapter 2: Data Models

TRUE/FALSE

1. A data model is usually graphical.

   ANS: T PTS: 1 REF: 30

2. The terms data model and database model are often used interchangeably.

   ANS: T PTS: 1 REF: 30

3. An implementation-ready data model should contain a description of the data structure that will store the end-user data.

   ANS: T PTS: 1 REF: 30

4. Within the database environment, a data model represents data structures with the purpose of supporting a specific problem domain.

   ANS: T PTS: 1 REF: 30

5. Data modeling starts with a very complex representation, and as knowledge of the problem is gained, the model is simplified.

   ANS: F PTS: 1 REF: 30

6. A manager and a programmer usually have the same view of the same data.

   ANS: F PTS: 1 REF: 31

7. Database designers determine the data and information that yield the required understanding of the entire business.

   ANS: F PTS: 1 REF: 32

8. Business rules apply to businesses and government groups, but not to other types of organizations such as religious groups or research laboratories.

   ANS: F PTS: 1 REF: 32

9. Business rules must be rendered in writing.

   ANS: T PTS: 1 REF: 32

10. In an SQL-based relational database, each table is dependent on another.

    ANS: F PTS: 1 REF: 38

11. In an SQL-based relational database, rows in different tables are related based on common values in common attributes.

ANS: T PTS: 1 REF: 38

12. End-user interfaces require the end user to manually generate SQL code.

ANS: F PTS: 1 REF: 38

13. Each row in the relational table is known as an entity instance or entity occurrence in the ER model.

ANS: T PTS: 1 REF: 39

14. In Chen notation, entities and relationships must be oriented horizontally.

ANS: F PTS: 1 REF: 39

15. M:N relationships are not appropriate in a relational model.

ANS: T PTS: 1 REF: 40

16. Use of the relational model has declined because of the difficulty in incorporating features from the object-oriented (OO) data model.

ANS: F PTS: 1 REF: 44

17. The network model has structural level dependence.

ANS: T PTS: 1 REF: 44

18. The entity relationship model is limited to conceptual modeling, with no implementation component.

ANS: T PTS: 1 REF: 44

19. The hierarchical model is software-independent.

ANS: F PTS: 1 REF: 47

20. The relational model is hardware-dependent and software-independent.

ANS: F PTS: 1 REF: 47

MULTIPLE CHOICE

1. Which of the following is a basic building block of all data models?
   a. category
   b. class
   c. constraint
   d. customer

   ANS: C PTS: 1 REF: 31

2. A(n) ____ represents a particular type of object in the real world.
   a. attribute
   b. entity
   c. relationship
   d. constraint

   ANS: B PTS: 1 REF: 31

3. A(n) ____ is anything about which data are to be collected and stored.

a. attribute
b. entity
c. relationship
d. constraint

ANS: B PTS: 1 REF: 31

4. A(n) ____ is the equivalent of a field in a file system.
a. attribute
b. entity
c. relationship
d. constraint

ANS: A PTS: 1 REF: 31

5. A(n) ____ is bidirectional.
a. attribute
b. entity
c. relationship
d. constraint

ANS: C PTS: 1 REF: 32

6. A(n) ____ is a restriction placed on the data.
a. attribute
b. entity
c. relationship
d. constraint

ANS: D PTS: 1 REF: 32

7. ____ are important because they help to ensure data integrity.
a. Attributes
b. Entities
c. Relationships
d. Constraints

ANS: D PTS: 1 REF: 32

8. ____ are normally expressed in the form of rules.
a. Attributes
b. Entities
c. Relationships
d. Constraints

ANS: D PTS: 1 REF: 32

9. Students and classes have a ____ relationship.
a. one-to-one
b. one-to-many
c. many-to-one
d. many-to-many

ANS: D PTS: 1 REF: 32

10. Business rules are derived from ____.
a. a detailed description of an organization's operations
b. standards and practices developed over the years
c. managers' recommendations
d. governmental oversight organization standards

ANS: A PTS: 1 REF: 32

11. Which of the following is true of business rules?
a. They allow the designer to set company policies with regard to data.
b. They allow the designer to develop business processes.
c. They can serve as a communication tool between the users and designers.
d. They provide a framework for the company's self actualization.

ANS: C PTS: 1 REF: 33

12. A noun in a business rule translates to a(n) ____ in the data model.
    a. entity
    b. attribute
    c. relationship
    d. constraint

    ANS: A PTS: 1 REF: 33

13. A verb associating two nouns in a business rule translates to a(n) ____ in the data model.
    a. entity
    b. attribute
    c. relationship
    d. constraint

    ANS: C PTS: 1 REF: 33

14. The hierarchical data model was developed in the ____.
    a. 1960s
    b. 1970s
    c. 1980s
    d. 1990s

    ANS: A PTS: 1 REF: 35

15. The object-oriented data model was developed in the ____.
    a. 1960s
    b. 1970s
    c. 1980s
    d. 1990s

    ANS: C PTS: 1 REF: 35

16. VMS/VSAM is an example of a(n) ____.
    a. hierarchical model
    b. file system data model
    c. relational data model
    d. XML data model

    ANS: B PTS: 1 REF: 35

17. Oracle 11g is an example of a(n) ____.
    a. hierarchical model
    b. file system data model
    c. relational data model
    d. XML/Hybrid data model

    ANS: D PTS: 1 REF: 35

18. MySQL is an example of a(n) ____.
    a. hierarchical model
    b. file system data model
    c. relational data model
    d. XML data model

    ANS: C PTS: 1 REF: 35

19. In the ____ model, the basic logical structure is represented as an upside-down tree.
    a. hierarchical
    b. network
    c. relational
    d. entity relationship

    ANS: A PTS: 1 REF: 35

20. In the ____ model, each parent can have many children, but each child has only one parent.
    a. hierarchical
    b. network
    c. relational
    d. entity relationship

    ANS: A PTS: 1 REF: 35

21. The relational data model was developed in the ____.
    a. 1960s
    b. 1970s
    c. 1980s
    d. 1990s

ANS: B PTS: 1 REF: 35

22. In the ____ model, the user perceives the database as a collection of records in 1:M relationships, where each record can have more than one parent.
    a. hierarchical
    b. network
    c. object-oriented
    d. entity relationship

    ANS: B PTS: 1 REF: 35

23. A(n) ____ enables a database administrator to define schema components.
    a. extensible markup language (XML)
    b. data definition language (DDL)
    c. unified modeling language (UML)
    d. query language

    ANS: B PTS: 1 REF: 36

24. The ____ model was developed to allow designers to use a graphical tool to examine structures rather than describing them with text.
    a. hierarchical
    b. network
    c. object-oriented
    d. entity relationship

    ANS: D PTS: 1 REF: 38

25. The ____ model uses the term connectivity to label the relationship types.
    a. relational
    b. network
    c. object-oriented
    d. entity relationship

    ANS: D PTS: 1 REF: 39

26. The ____ model is said to be a semantic data model.
    a. relational
    b. network
    c. object-oriented
    d. entity relationship

    ANS: C PTS: 1 REF: 41

27. The ____ model uses the concept of inheritance.
    a. relational
    b. network
    c. object-oriented
    d. entity relationship

    ANS: C PTS: 1 REF: 41

28. One of the limitations of the ____ model is that there is a lack of standards.
    a. hierarchical
    b. network
    c. relational
    d. entity relationship

    ANS: A PTS: 1 REF: 45

29. Which data model has the highest level of abstraction?
    a. Object-oriented
    b. Entity relationship
    c. Relational
    d. Hierarchical

    ANS: B PTS: 1 REF: 47

30. A(n) ____ model represents a global view of the database as viewed by the entire organization.
    a. external
    b. conceptual
    c. internal
    d. physical

ANS: B PTS: 1 REF: 48

COMPLETION

1. A(n) _____ is a relatively simple representation of more complex real-world data structures.

   ANS: data model

   PTS: 1 REF: 30

2. A(n) _____ is a brief, precise, and unambiguous description of a policy, procedure, or principle within a specific organization.

   ANS: business rule

   PTS: 1 REF: 32

3. A(n) _____ in a hierarchical model is the equivalent of a record in a file system.

   ANS: segment

   PTS: 1 REF: 35

4. The _____ is the conceptual organization of the entire database as viewed by the database administrator.

   ANS: schema

   PTS: 1 REF: 35

5. The _____ defines the portion of the database "seen" by the application programs that produce information from the data.

   ANS: subschema

   PTS: 1 REF: 36

6. Each row in a relation is called a(n) _____.

   ANS: tuple

   PTS: 1 REF: 36

7. Each column in a relation represents a(n) _____.

   ANS: attribute

   PTS: 1 REF: 36

8. A(n) _____ is a representation of the relational database's entities, the attributes within those entities and the relationships between those entities.

ANS: relational diagram

PTS: 1 REF: 37

9. In _____, relationships are represented by a diamond connected to the related entities through a relationship line.

ANS: Chen notation

PTS: 1 REF: 39

10. In _____, a three-pronged symbol represents the "many" side of the relationship.

ANS: Crow's Foot notation

PTS: 1 REF: 39

11. A(n) _____ is a collection of similar objects with a shared structure and behavior.

ANS: class

PTS: 1 REF: 41

12. In object-oriented terms, a(n) _____ defines an object's behavior.

ANS: method

PTS: 1 REF: 41

13. _____ is a language based on OO concepts that describes a set of diagrams and symbols used to graphically model a system.

ANS:
UML (Unified Modeling Language)
Unified Modeling Language (UML)
Unified Modeling Language
UML

PTS: 1 REF: 41

14. The term _____ is used to refer to the task of creating a conceptual data model that could be implemented in any DBMS.

ANS: logical design

PTS: 1 REF: 49

15. When you can change the internal model without affecting the conceptual model, you have _____ independence.

ANS: logical

PTS: 1 REF: 49

ESSAY

1. What components should an implementation-ready data model contain?

   ANS:
   An implementation-ready data model should contain at least the following components:
   A description of the data structure that will store the end-user data.
   A set of enforceable rules to guarantee the integrity of the data.
   A data manipulation methodology to support the real-world data transformations.

   PTS: 1 REF: 30

2. What do business rules require to be effective?

   ANS:
   To be effective, business rules must be easy to understand and widely disseminated to ensure that every person in the organization shares a common interpretation of the rules. Business rules describe, in simple language, the main and distinguishing characteristics of the data *as viewed by the company*.

   PTS: 1 REF: 33

3. What are the sources of business rules, and what is the database designer's role with regard to business rules?

   ANS:
   The main sources of business rules are company managers, policy makers, department managers, and written documentation such as a company's procedures, standards, or operations manuals. A faster and more direct source of business rules is direct interviews with end users. Unfortunately, because perceptions differ, end users sometimes are a less reliable source when it comes to specifying business rules. For example, a maintenance department mechanic might believe that any mechanic can initiate a maintenance procedure, when actually only mechanics with inspection authorization can perform such a task. Such a distinction might seem trivial, but it can have major legal consequences. Although end users are crucial contributors to the development of business rules, *it pays to verify end-user perceptions*. Too often, interviews with several people who perform the same job yield very different perceptions of what the job components are. While such a discovery may point to "management problems," that general diagnosis does not help the database designer. The database designer's job is to reconcile such differences and verify the results of the reconciliation to ensure that the business rules are appropriate and accurate.

   PTS: 1 REF: 33

4. Describe the three parts involved in any SQL-based relational database application.

   ANS:
   From an end-user perspective, any SQL-based relational database application involves three parts: a user interface, a set of tables stored in the database, and the SQL "engine." Each of these parts is explained below.
   • *The end-user interface.* Basically, the interface allows the end user to interact with the data (by auto-generating SQL code). Each interface is a product of the software vendor's idea of meaningful interaction with the data. You can also design your own customized interface with the help of application generators that are now standard fare in the database software arena.

- *A collection of tables stored in the database.* In a relational database, all data are perceived to be stored in tables. The tables simply "present" the data to the end user in a way that is easy to understand. Each table is independent from another. Rows in different tables are related based on common values in common attributes.
- *SQL engine.* Largely hidden from the end user, the SQL engine executes all queries, or data requests. Keep in mind that the SQL engine is part of the DBMS software. The end user uses SQL to create table structures and to perform data access and table maintenance. The SQL engine processes all user requests—largely behind the scenes and without the end user's knowledge. Hence, it's said that SQL is a declarative language that tells what must be done but not how it must be done.

PTS: 1 REF: 38

5. Describe a conceptual model and its advantages. What is the most widely used conceptual model?

ANS:
The **conceptual model** represents a global view of the entire database as viewed by the entire organization. That is, the conceptual model integrates all external views (entities, relationships, constraints, and processes) into a single global view of the entire data in the enterprise. Also known as a **conceptual schema**, it is the basis for the identification and high-level description of the main data objects (avoiding any database model-specific details).
The most widely used conceptual model is the ER model. Remember that the ER model is illustrated with the help of the ERD, which is, in effect, the basic database blueprint. The ERD is used to graphically *represent* the conceptual schema.
The conceptual model yields some very important advantages. First, it provides a relatively easily understood bird's-eye (macro level) view of the data environment.
Second, the conceptual model is independent of both software and hardware. **Software independence** means that the model does not depend on the DBMS software used to implement the model. **Hardware independence** means that the model does not depend on the hardware used in the implementation of the model. Therefore, changes in either the hardware or the DBMS software will have no effect on the database design at the conceptual level. Generally, the term **logical design** is used to refer to the task of creating a conceptual data model that could be implemented in any DBMS.

PTS: 1 REF: 48-49