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Chapter 02: Data Models

True / False

1. A data model is usually graphical.
   a. True
   b. False

ANSWER: True
DIFFICULTY: Difficulty: Easy
REFERENCES: 2-1 Data Modeling and Data Models
LEARNING OBJECTIVES: 02.01 - Discuss data modeling and why data models are important

2. An implementation-ready data model needn't necessarily contain enforceable rules to guarantee the integrity of the data.
   a. True
   b. False

ANSWER: False
DIFFICULTY: Difficulty: Moderate
REFERENCES: 2-1 Data Modeling and Data Models
LEARNING OBJECTIVES: 02.01 - Discuss data modeling and why data models are important

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

ANSWER: True
DIFFICULTY: Difficulty: Easy
REFERENCES: 2-1 Data Modeling and Data Models
LEARNING OBJECTIVES: 02.01 - Discuss data modeling and why data models are important

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

ANSWER: True
DIFFICULTY: Difficulty: Easy
REFERENCES: 2-1 Data Modeling and Data Models
LEARNING OBJECTIVES: 02.01 - Discuss data modeling and why data models are important

5. Even when a good database blueprint is available, an applications programmer’s view of the data should match that of the manager and the end user.
   a. True
   b. False

ANSWER: False
DIFFICULTY: Difficulty: Moderate
REFERENCES: 2-2 The Importance of Data Models
LEARNING OBJECTIVES: 02.01 - Discuss data modeling and why data models are important

6. In the context of data models, an entity is a person, place, thing, or event about which data will be collected and stored.
   a. True

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b. False

ANSWER: True
DIFFICULTY: Difficulty: Easy
REFERENCES: 2-3 Data Model Basic Building Blocks
LEARNING OBJECTIVES: 02.02 - Describe the basic data-modeling building blocks

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

ANSWER: False
DIFFICULTY: Difficulty: Easy
REFERENCES: 2-4 Business Rules
LEARNING OBJECTIVES: 02.03 - Define what business rules are and how they influence database design

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

ANSWER: False
DIFFICULTY: Difficulty: Moderate
REFERENCES: 2-4 Business Rules
LEARNING OBJECTIVES: 02.03 - Define what business rules are and how they influence database design

9. Business rules must be rendered in writing.
a. True
b. False

ANSWER: True
DIFFICULTY: Difficulty: Easy
REFERENCES: 2-4 Business Rules
LEARNING OBJECTIVES: 02.03 - Define what business rules are and how they influence database design

10. A disadvantage of the relational database management system (RDBMS) is its inability to hide the complexities of the relational model from the user.
a. True
b. False

ANSWER: False
DIFFICULTY: Difficulty: Moderate
REFERENCES: 2-5b The Relational Model
LEARNING OBJECTIVES: 02.04 - Understand how the major data models evolved

11. In an SQL-based relational database, each table is dependent on every other table.
a. True
b. False

ANSWER: False
DIFFICULTY: Difficulty: Easy

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REFERENCES: 2-5b The Relational Model
LEARNING OBJECTIVES: 02.04 - Understand how the major data models evolved

12. In an SQL-based relational database, rows in different tables are related based on common values in common attributes.
    a. True
    b. False
ANSWER: True
DIFFICULTY: Difficulty: Easy
REFERENCES: 2-5b The Relational Model
LEARNING OBJECTIVES: 02.04 - Understand how the major data models evolved

13. Each row in the relational table is known as an entity instance or entity occurrence in the ER model.
    a. True
    b. False
ANSWER: True
DIFFICULTY: Difficulty: Easy
REFERENCES: 2-5c The Entity Relationship Model
LEARNING OBJECTIVES: 02.04 - Understand how the major data models evolved

14. M:N relationships are not appropriate in a relational model.
    a. True
    b. False
ANSWER: True
DIFFICULTY: Difficulty: Easy
REFERENCES: 2-5c The Entity Relationship Model
LEARNING OBJECTIVES: 02.04 - Understand how the major data models evolved

15. In Chen notation, entities and relationships have to be oriented horizontally; not vertically.
    a. True
    b. False
ANSWER: False
DIFFICULTY: Difficulty: Easy
REFERENCES: 2-5c The Entity Relationship Model
LEARNING OBJECTIVES: 02.04 - Understand how the major data models evolved

16. Today, most relational database products can be classified as object/relational.
    a. True
    b. False
ANSWER: True
DIFFICULTY: Difficulty: Easy
REFERENCES: 2-5e Object/Relational and XML
LEARNING OBJECTIVES: 02.04 - Understand how the major data models evolved

17. The network model has structural level dependence.

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a. True
b. False

ANSWER: True
DIFFICULTY: Difficulty: Easy
REFERENCES: 2-5g Data Models: A Summary
LEARNING OBJECTIVES: 02.04 - Understand how the major data models evolved

18. The external model is the representation of the database as "seen" by the DBMS.
a. True
b. False

ANSWER: False
DIFFICULTY: Difficulty: Easy
REFERENCES: 2-6a The External Model
LEARNING OBJECTIVES: 02.06 - Explain how data models can be classified by their level of abstraction

19. The hierarchical model is software-independent.
a. True
b. False

ANSWER: False
DIFFICULTY: Difficulty: Easy
REFERENCES: 2-6 Degrees of Data Abstraction
LEARNING OBJECTIVES: 02.06 - Explain how data models can be classified by their level of abstraction

20. The relational model is hardware-dependent and software-independent.
a. True
b. False

ANSWER: False
DIFFICULTY: Difficulty: Easy
REFERENCES: 2-6 Degrees of Data Abstraction
LEARNING OBJECTIVES: 02.06 - Explain how data models can be classified by their level of abstraction

Multiple Choice

21. A(n) _____'s main function is to help one understand the complexities of the real-world environment.
a. node b. entity
c. model d. database

ANSWER: c
DIFFICULTY: Difficulty: Easy
REFERENCES: 2-1 Data Modeling and Data Models
LEARNING OBJECTIVES: 02.01 - Discuss data modeling and why data models are important

22. A(n) _____ is anything about which data are to be collected and stored.
a. attribute b. entity
c. relationship d. constraint

ANSWER: b

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DIFFICULTY: Difficulty: Easy
REFERENCES: 2-3 Data Model Basic Building Blocks
LEARNING OBJECTIVES: 02.02 - Describe the basic data-modeling building blocks

23. A(n) _____ represents a particular type of object in the real world.
a. attribute b. entity
c. relationship d. node
ANSWER: b
DIFFICULTY: Difficulty: Easy
REFERENCES: 2-3 Data Model Basic Building Blocks
LEARNING OBJECTIVES: 02.02 - Describe the basic data-modeling building blocks

24. A(n) _____ is the equivalent of a field in a file system.
a. attribute b. entity
c. relationship d. constraint
ANSWER: a
DIFFICULTY: Difficulty: Easy
REFERENCES: 2-3 Data Model Basic Building Blocks
LEARNING OBJECTIVES: 02.02 - Describe the basic data-modeling building blocks

25. A(n) _____ is bidirectional.
a. attribute b. entity
c. relationship d. constraint
ANSWER: c
DIFFICULTY: Difficulty: Easy
REFERENCES: 2-3 Data Model Basic Building Blocks
LEARNING OBJECTIVES: 02.02 - Describe the basic data-modeling building blocks

26. A(n) _____ is a restriction placed on the data.
a. attribute b. entity
c. relationship d. constraint
ANSWER: d
DIFFICULTY: Difficulty: Easy
REFERENCES: 2-3 Data Model Basic Building Blocks
LEARNING OBJECTIVES: 02.02 - Describe the basic data-modeling building blocks

27. _____ are important because they help to ensure data integrity.
a. Attributes b. Entities
c. Relationships d. Constraints
ANSWER: d
DIFFICULTY: Difficulty: Easy
REFERENCES: 2-3 Data Model Basic Building Blocks
LEARNING OBJECTIVES: 02.02 - Describe the basic data-modeling building blocks

28. _____ are normally expressed in the form of rules.

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a. Attributes b. Entities
c. Relationships d. Constraints

ANSWER: d
DIFFICULTY: Difficulty: Easy
REFERENCES: 2-3 Data Model Basic Building Blocks
LEARNING OBJECTIVES: 02.02 - Describe the basic data-modeling building blocks

29. Students and classes have a _____ relationship.
a. one-to-one b. one-to-many
c. many-to-one d. many-to-many

ANSWER: d
DIFFICULTY: Difficulty: Easy
REFERENCES: 2-3 Data Model Basic Building Blocks
LEARNING OBJECTIVES: 02.02 - Describe the basic data-modeling building blocks

30. 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.

ANSWER: c
DIFFICULTY: Difficulty: Moderate
REFERENCES: 2-4a Discovering Business Rules
LEARNING OBJECTIVES: 02.03 - Define what business rules are and how they influence database design

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

ANSWER: a
DIFFICULTY: Difficulty: Easy
REFERENCES: 2-4b Translating Business Rules into Data Model Components
LEARNING OBJECTIVES: 02.03 - Define what business rules are and how they influence database design

32. 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

ANSWER: c
DIFFICULTY: Difficulty: Easy
REFERENCES: 2-4b Translating Business Rules into Data Model Components
LEARNING OBJECTIVES: 02.03 - Define what business rules are and how they influence database design

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

ANSWER: a

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DIFFICULTY: Difficulty: Easy
REFERENCES: 2-5a Hierarchical and Network Models
LEARNING OBJECTIVES: 02.04 - Understand how the major data models evolved

34. 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
ANSWER: a
DIFFICULTY: Difficulty: Easy
REFERENCES: 2-5a Hierarchical and Network Models
LEARNING OBJECTIVES: 02.04 - Understand how the major data models evolved

35. The hierarchical data model was developed in the _____.
a. 1960s b. 1970s
c. 1980s d. 1990s
ANSWER: a
DIFFICULTY: Difficulty: Easy
REFERENCES: 2-5a Hierarchical and Network Models
LEARNING OBJECTIVES: 02.04 - Understand how the major data models evolved

36. 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
ANSWER: b
DIFFICULTY: Difficulty: Easy
REFERENCES: 2-5a Hierarchical and Network Models
LEARNING OBJECTIVES: 02.04 - Understand how the major data models evolved

37. The object-oriented data model was developed in the _____.
a. 1960s b. 1970s
c. 1980s d. 1990s
ANSWER: c
DIFFICULTY: Difficulty: Easy
REFERENCES: 2-5a Hierarchical and Network Models
LEARNING OBJECTIVES: 02.04 - Understand how the major data models evolved

38. VMS/VSAM is an example of the _____.
a. hierarchical model b. file system data model
c. relational data model d. XML data model
ANSWER: b
DIFFICULTY: Difficulty: Easy
REFERENCES: 2-5a Hierarchical and Network Models
LEARNING OBJECTIVES: 02.04 - Understand how the major data models evolved

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39. Oracle 12c, MS SQL Server, and Tamino are examples of _____ data models.
a. hierarchical b. file system
c. relational d. XML Hybrid
ANSWER: d
DIFFICULTY: Difficulty: Easy
REFERENCES: 2-5a Hierarchical and Network Models
LEARNING OBJECTIVES: 02.04 - Understand how the major data models evolved

40. MySQL is an example of the _____.
a. hierarchical model b. file system data model
c. relational data model d. XML data model
ANSWER: c
DIFFICULTY: Difficulty: Easy
REFERENCES: 2-5b The Relational Model
LEARNING OBJECTIVES: 02.04 - Understand how the major data models evolved

41. A(n) _____ enables a database administrator to describe schema components.
a. extensible markup language (XML) b. data definition language (DDL)
c. unified modeling language (UML) d. query language
ANSWER: b
DIFFICULTY: Difficulty: Easy
REFERENCES: 2-5a Hierarchical and Network Models
LEARNING OBJECTIVES: 02.04 - Understand how the major data models evolved

42. The relational data model was developed in the _____.
a. 1960s b. 1970s
c. 1980s d. 1990s
ANSWER: b
DIFFICULTY: Difficulty: Easy
REFERENCES: 2-5b The Relational Model
LEARNING OBJECTIVES: 02.04 - Understand how the major data models evolved

43. 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
ANSWER: d
DIFFICULTY: Difficulty: Easy
REFERENCES: 2-5c The Entity Relationship Model
LEARNING OBJECTIVES: 02.04 - Understand how the major data models evolved

44. A(n) _____ enables a database administrator to describe schema components.
a. extensible markup language (XML) b. data definition language (DDL)
c. unified modeling language (UML) d. query language
ANSWER: b

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DIFFICULTY: Difficulty: Easy
REFERENCES: 2-5a Hierarchical and Network Models
LEARNING OBJECTIVES: 02.04 - Understand how the major data models evolved

45. The _____ model uses the term connectivity to label the relationship types.
a. relational b. network
c. object-oriented d. entity relationship
ANSWER: d
DIFFICULTY: Difficulty: Easy
REFERENCES: 2-5c The Entity Relationship Model
LEARNING OBJECTIVES: 02.04 - Understand how the major data models evolved

46. The _____ data model is said to be a semantic data model.
a. relational b. network
c. object-oriented d. entity relationship
ANSWER: c
DIFFICULTY: Difficulty: Easy
REFERENCES: 2-5d The Object-Oriented Model
LEARNING OBJECTIVES: 02.04 - Understand how the major data models evolved

47. The _____ data model uses the concept of inheritance.
a. relational b. network
c. object-oriented d. entity relationship
ANSWER: c
DIFFICULTY: Difficulty: Easy
REFERENCES: 2-5d The Object-Oriented Model
LEARNING OBJECTIVES: 02.04 - Understand how the major data models evolved

48. Which of the following types of HDFS nodes stores all the metadata about a file system?
a. Data node b. Client node
c. Name node d. Map node
ANSWER: c
DIFFICULTY: Difficulty: Moderate
REFERENCES: 2-5f Emerging Data Models: Big Data and NoSQL
LEARNING OBJECTIVES: 02.05 - List emerging alternative data models and the needs they fulfill

49. Which of the following is true of NoSQL databases?
a. They do not support distributed database architectures.
b. They are not based on the relational model.
c. They are geared toward transaction consistency rather than performance.
d. They do not support very large amounts of sparse data.
ANSWER: b
DIFFICULTY: Difficulty: Moderate
REFERENCES: 2-5f Emerging Data Models: Big Data and NoSQL
LEARNING OBJECTIVES: 02.05 - List emerging alternative data models and the needs they fulfill

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50. Which of the following types of HDFS nodes acts as the interface between the user application and the HDFS?

a. Data node b. Client node

c. Name node d. Map node

ANSWER: b
DIFFICULTY: Difficulty: Easy
REFERENCES: 2-5f Emerging Data Models: Big Data and NoSQL
LEARNING OBJECTIVES: 02.05 - List emerging alternative data models and the needs they fulfill

Completion

51. A(n) _____ is a relatively simple representation of more complex real-world data structures.
ANSWER: data model
DIFFICULTY: Difficulty: Easy
REFERENCES: 2-1 Data Modeling and Data Models
LEARNING OBJECTIVES: 02.01 - Discuss data modeling and why data models are important

52. A(n) _____ is a brief, precise, and unambiguous description of a policy, procedure, or principle within a specific organization.
ANSWER: business rule
DIFFICULTY: Difficulty: Easy
REFERENCES: 2-4 Business Rules
LEARNING OBJECTIVES: 02.03 - Define what business rules are and how they influence database design

53. A(n) _____ in a hierarchical model is the equivalent of a record in a file system.
ANSWER: segment
DIFFICULTY: Difficulty: Easy
REFERENCES: 2-5 The Evolution of Data Models
LEARNING OBJECTIVES: 02.04 - Understand how the major data models evolved

54. A(n) _____ is the conceptual organization of an entire database as viewed by a database administrator.
ANSWER: schema
DIFFICULTY: Difficulty: Easy
REFERENCES: 2-5a Hierarchical and Network Models
LEARNING OBJECTIVES: 02.04 - Understand how the major data models evolved

55. A(n) _____ defines the environment in which data can be managed and is used to work with the data in the database.
ANSWER: data manipulation language (DML)
DIFFICULTY: Difficulty: Easy
REFERENCES: 2-5a Hierarchical and Network Models
LEARNING OBJECTIVES: 02.04 - Understand how the major data models evolved

56. The relational model's foundation is a mathematical concept known as a(n) _____.
ANSWER: relation
DIFFICULTY: Difficulty: Easy
REFERENCES: 2-5b The Relational Model
LEARNING OBJECTIVES: 02.04 - Understand how the major data models evolved

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57. Each row in a relation is called a(n) _____.
ANSWER: tuple
DIFFICULTY: Difficulty: Easy
REFERENCES: 2-5b The Relational Model
LEARNING OBJECTIVES: 02.04 - Understand how the major data models evolved

58. Each column in a relation represents a(n) _____.
ANSWER: attribute
DIFFICULTY: Difficulty: Easy
REFERENCES: 2-5b The Relational Model
LEARNING OBJECTIVES: 02.04 - Understand how the major data models evolved

59. Each row in the relational table is known as a(n) _____.
ANSWER: entity instance
DIFFICULTY: Difficulty: Easy
REFERENCES: 2-5c The Entity Relationship Model
LEARNING OBJECTIVES: 02.04 - Understand how the major data models evolved

60. In _____, a three-pronged symbol represents the “many” side of the relationship.
ANSWER: Crow’s Foot notation
DIFFICULTY: Difficulty: Easy
REFERENCES: 2-5c The Entity Relationship Model
LEARNING OBJECTIVES: 02.04 - Understand how the major data models evolved

61. A(n) _____ is a collection of similar objects with a shared structure and behavior.
ANSWER: class
DIFFICULTY: Difficulty: Easy
REFERENCES: 2-5d The Object-Oriented Model
LEARNING OBJECTIVES: 02.04 - Understand how the major data models evolved

62. In object-oriented terms, a(n) _____ defines an object’s behavior.
ANSWER: method
DIFFICULTY: Difficulty: Easy
REFERENCES: 2-5d The Object-Oriented Model
LEARNING OBJECTIVES: 02.04 - Understand how the major data models evolved

63. _____ is a language based on OO concepts that describes a set of diagrams and symbols used to graphically model a system.
ANSWER: UML (Unified Modeling Language)
Unified Modeling Language (UML)
Unified Modeling Language
UML
DIFFICULTY: Difficulty: Easy
REFERENCES: 2-5d The Object-Oriented Model
LEARNING OBJECTIVES: 02.04 - Understand how the major data models evolved

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64. The term _____ is used to refer to the task of creating a conceptual data model that could be implemented in any DBMS.
ANSWER: logical design
DIFFICULTY: Difficulty: Easy
REFERENCES: 2-6b The Conceptual Model
LEARNING OBJECTIVES: 02.06 - Explain how data models can be classified by their level of abstraction

65. The _____ is the representation of a database as "seen" by the DBMS.
ANSWER: internal model
DIFFICULTY: Difficulty: Easy
REFERENCES: 2-6c The Internal Model
LEARNING OBJECTIVES: 02.06 - Explain how data models can be classified by their level of abstraction

66. One of the limitations of the _____ model is that there is a lack of standards.
ANSWER: hierarchical
DIFFICULTY: Easy
REFERENCES: 2-5g Data Models: A Summary
LEARNING OBJECTIVES: 02.04 - Understand how the major data models evolved

67. The _____ model is the end users' view of the data environment.
ANSWER: external
DIFFICULTY: Easy
REFERENCES: 2-6a The External Model
LEARNING OBJECTIVES: 02.06 - Explain how data models can be classified by their level of abstraction

68. An internal _____ refers to a specific representation of an internal model, using the database constructs supported by the chosen database.
ANSWER: schema
DIFFICULTY: Easy
REFERENCES: 2-6c The Internal Model
LEARNING OBJECTIVES: 02.06 - Explain how data models can be classified by their level of abstraction

69. From a database point of view, the collection of data becomes meaningful only when it reflects properly defined _____.
ANSWER: business rules
DIFFICULTY: Moderate
REFERENCES: 2-4 Business Rules
LEARNING OBJECTIVES: 02.03 - Define what business rules are and how they influence database design

70. The movement to find new and better ways to manage large amounts of web- and sensor-generated data and derive business insight from it, while simultaneously providing high performance and scalability at a reasonable cost is referred to as "_____."
ANSWER: Big Data
DIFFICULTY: Easy
REFERENCES: 2-5f Emerging Data Models: Big Data and NoSQL
LEARNING OBJECTIVES: 02.05 - List emerging alternative data models and the needs they fulfill

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Essay

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

ANSWER: 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.

DIFFICULTY: Difficulty: Moderate

REFERENCES: 2-1 Data Modeling and Data Models

LEARNING OBJECTIVES: 02.01 - Discuss data modeling and why data models are important

72. What do business rules require to be effective?

ANSWER: 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.

DIFFICULTY: Difficulty: Moderate

REFERENCES: 2-4 Business Rules

LEARNING OBJECTIVES: 02.03 - Define what business rules are and how they influence database design

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

ANSWER: The main sources of business rules are company managers, policy makers, department managers, and written documentation such as a company's procedures, standards, and operations manuals. A faster and more direct source of business rules is direct interviews with end users. Unfortunately, because perceptions differ, end users are sometimes 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.

DIFFICULTY: Difficulty: Moderate

REFERENCES: 2-4a Discovering Business Rules

LEARNING OBJECTIVES: 02.03 - Define what business rules are and how they influence database design

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

ANSWER: 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.

1. The end-user interface. Basically, the interface allows the end user to interact with the data (by automatically 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.
2. A collection of tables stored in the database. In a relational database, all data are

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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. Rows in different tables are related by common values in common attributes.

3. 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, SQL is said to be a declarative language that tells what must be done but not how.

DIFFICULTY: Difficulty: Moderate
REFERENCES: 2-5b The Relational Model
LEARNING OBJECTIVES: 02.04 - Understand how the major data models evolved

75. Describe the three basic characteristics of Big Data databases.

ANSWER: Douglas Laney, a data analyst from the Gartner Group, first described the basic characteristics of Big Data databases4: volume, velocity, and variety, or the 3 Vs.

• *Volume* refers to the amounts of data being stored. With the adoption and growth of the Internet and social media, companies have multiplied the ways to reach customers. Over the years, and with the benefit of technological advances, data for millions of e-transactions were being stored daily on company databases. Furthermore, organizations are using multiple technologies to interact with end users
and those technologies are generating mountains of data. This ever-growing volume of data quickly reached petabytes in size, and it's still growing.
• *Velocity* refers not only to the speed with which data grows but also to the need to process this data quickly in order to generate information and insight. With the advent of the Internet and social media, business response times have shrunk considerably. Organizations need not only to store large volumes of quickly accumulating data but also need to process such data quickly. The velocity of data growth is also due to the increase in the number of different data streams from which data is being piped to the organization (via the web, e-commerce, Tweets, Facebook posts, emails, sensors, GPS, and so on).
• *Variety* refers to the fact that the data being collected comes in multiple different data formats. A great portion of these data comes in formats not suitable to be handled by the typical operational databases based on the relational model.

The 3 Vs framework illustrates what companies now know, that the amount of data being collected in their databases has been growing exponentially in size and complexity.

DIFFICULTY: Moderate
REFERENCES: 2-5f Emerging Data Models: Big Data and NoSQL
LEARNING OBJECTIVES: 02.05 - List emerging alternative data models and the needs they fulfill

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