Databases

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The Course Outline

Course Outline

- **Course Title:** Preparation course for FE examination
- **Intended Participants:** University Students who are going to take ITPEC examinations
- **Course Duration:** 60 hours

The Lecture Plan

Lecture Plan: Morning Exam, Sec 3-Technology Elements, Chapter 3-Databases

Time	Learning Points/Keywords	Explanation Points	Method	Level	Note
10 minutes	Database Architecture	Difference Between Database and File	Verbal Explanation	Medium	
		Database Design-Data Model			
		Database Design-Relational Model			
		Conceptual, logical and physical Design of Databases			
10 minutes	Database Design	Elimination of data duplication	Verbal Explanation	High	
		Data normalization			
		Functional dependency			
20 minutes	SQL and Data Manipulation	Data Definition	Text Book Page 276	High	
		Definition of Access Right			
		Data Storage and manuipulation			
		Grouping and sorting of Data			
		Joining the Tables			
		Sub Reference (Subquery)			
10 minutes	Transaction Processing	Failure recovery	Verbal Explanation	High	
		Exclusive control			
		Transaction management			
10 minutes	Database Application	Distributed Database	Verbal Explanation	Medium	
		Data Warehouse			

Objectives

3.1 Database architecture

- Understand the types of database, their characteristics, database models, and basic concept of a three-layer schema, and apply them to associated matters.

- Understand the purpose and typical functions of a database management system, and apply them to associated matters.

Keywords

3.1 Database architecture

- Relational database, Structured database, HDB (Hierarchical DataBase), NDB (Network DataBase), OODB (Object Oriented DataBase), Hypertext database, Multimedia database, XML database, Conceptual data model, Logical data model (External model), Relational model, Hierarchical model, Network model, Physical data model (Internal model), Conceptual schema, External schema (Subschema), Internal schema (Storage schema), Relation, Tuple (Row), Attribute (Column, Field), Occurrence, Domain, Database definition function, Database manipulation function, Database control function, Maintenance function, Data security protection, Exclusive control, Failure recovery, Security

Objectives

3.2 Database design***

- Understand the concept of data analysis and database design, and apply them to associated matters.
- Understand the purpose and procedure of data normalization, and apply them to associated matters.
- Understand the points to be considered in the physical design of databases, and apply them to associated matters.

Keywords

3.2 Database design***

- Elimination of data duplication, Metadata, Data dictionary, Entity, Attribute , Relationship, Primary key, Foreign key, Field (Item), Record, File, NULL, Unique constraint, Normalization, Full functional dependency, Partial functional dependency, Transitive functional dependency

3.3 Data manipulation***

- Understand the typical data manipulations for a relational database, and apply them to associated matters.
- Understand the basics of key database languages and SQL statements, and apply them to associated matters.

3.3 Data manipulation***

- Relational algebra, Interactive SQL, Embedded SQL, View, Query, Referential constraint, Check constraint, Non-NULL constraint, Access right, Set function, Cursor

3.4 Transaction processing***

- Understand the basic mechanisms of failure recovery and exclusive control of a database, and apply them to associated matters.
- Understand the concept for transaction management and improving access efficiency, and apply them to associated matters.
- Understand the necessity of access control for data, and key types of access rights.

3.4 Transaction processing***

- Exclusive lock, Shared lock, Lock granularity, Deadlock, One-phase commitment, Two-phase commitment, Journal file (Log file), Checkpoint, Roll forward, Roll back, Warm start, Cold start

3.5 Database application

- Understand how databases are applied to data analysis, business systems, software development and maintenance, etc.
- Understand the characteristics and advantages of distributed databases, their points to be kept in mind, and mechanism of data synchronization.
- Understand the outline of data resource management.

3.5 Database application

- OLTP (Online Transaction Processing), Document management system, SFA (Sales Force Automation), Transparency, Commitment control, Replication, IRDS (Information Resource Directory System), Repository

Analyzation

Analyzation

- Analyzed 2 questions
- Covered most recent years
  - 2021 Q1 Exam
  - 2021 Q2 Exam

Questions

Question 1

Q1.(q3-13) Which of the following is an appropriate description of relational databases?

- **a.** Relation of data is shown with hierarchical structure.
- **b.** Related data is linked with pointer.
- **c.** Data structures that contain the combination of data and its operation procedure are handled.
- **d.** A collection of data is shown with several two-dimensional tables.

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Question 2

Q2. (q3-14) Which of the following is an appropriate description concerning the three-schema architecture of a database?

a. The three-schema architecture is composed of the three layers: a database server layer, an application sever layer, and a client layer.

b. Logical data independence is achieved by preparing a schema that shows the logical relationship of data, and a schema that shows the view of data as desired by users.

c. An internal schema describes data itself separately from the viewpoint of individual applications and the viewpoint of computers.

d. An external schema describes how to memorize data on the storage device so that the user need not be concerned about the physical database structure.

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Question 3

Q3. (q3-16) Which of the following is an appropriate characteristic of the primary key of a relational database?

a. Unless search conditions are specified on the column identified as a primary key, rows cannot be searched.

b. If a numerical type column is specified as a primary key, that column cannot be used in arithmetic operations.

c. In one table, there cannot be multiple rows that have the same primary key value.

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Question 4

Q4. (q3-19) Which of the following is an appropriate description concerning the operation of a relational database?

a. "Join" combines two or more tables in order to create a single table.

b. "Project" retrieves rows that satisfy certain conditions from a table.

c. "Select" retrieves specific columns from a table.

d. "Insert" puts specific columns in a table.

Q4. (q3-19) Which of the following is an appropriate description concerning the operation of a relational database?

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Question 5

Q5. (q3-26) Which of the following is an appropriate description concerning exclusive control of the database?

- a. For a resource on which a shared lock is placed by one transaction, a shared lock can be placed by another transaction.
- b. For a resource on which a shared lock is placed by one transaction, an exclusive lock can be placed by another transaction.
- c. For a resource on which an exclusive lock is placed by one transaction, a shared lock can be placed by another transaction.
- d. For a resource on which an exclusive lock is placed by one transaction, an exclusive lock can be placed by another transaction.

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Question 6

Q6. (q3-27) There are two main files that are used for recovering a database at the occurrence of a media failure. One of these files is a backup file. Which of the following is the other file?

- a. Transaction file
- b. Master file
- c. Rollback file
- d. Log file

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- a. Two-phase locking
- b. Transaction scheduling
- c. Roll back
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Question 8

Q8. (q3-29) Which of the following is an appropriate description of data mining?

a. A parallel access method for searching through a large amount of data at high speed

b. A technique for analyzing a large amount of data statistically and mathematically to discover rules and cause-effect relationships

c. A method for storing a database for the accumulation of a large amount of time-series data such as sales performance and actual production results

d. A technique for creating individual databases for each department according to the purpose of usage by users

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Question 9

Q9. (q3-30) Which of the following is an appropriate explanation of transparency of a distributed database?

a. A client application program accesses databases on multiple servers. The application program can access the databases as if they are operating on one server.

b. A client application program accesses the databases on multiple servers. The application program needs to know which server's database should be accessed.

c. Application programs of multiple clients share and access a database on one server.

d. Application programs of multiple clients access a database on one server through the application program operating on the server

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Question 10

Q10. (q3-31) In a client/server system that uses a database server, the generation of a large number of SQL statements becomes a problem that is caused by communication load between the client and the server. Which of the following is the appropriate solution to this problem?

a. Redefinition the index

b. Use of the stored procedure function

c. Reorganization of the database

d. Use of dynamic SQL

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Question 11

Q11. (2021 S FE AS-q25) Which of the following is an appropriate explanation of a relational database?

- **a.** Data is represented as a table, and the tables are linked to one another using the column values of these tables.
- **b.** Each attribute is represented as a pair of the attribute value and the storage location of the record having that value and used as an index.
- **c.** The relationship among records is represented by a data structure using links that can represent both tree and network structures.
- **d.** The relationship among records is represented by a data structure using pointers that are limited to representing a tree structure.

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Question 12

Q12. (q3-20) Among data manipulations concerning the three tables "Product", "Orders" and "Customers", shown below, which of the following can be executed without being subject to referential constraints? Here, a solid underline represents a primary key, and blue color represents a foreign key.

Product (Product_code, Product_name, Unit, Amount)
Order (Order_code, Product_code, Order_quantity, Customer_code)
Customer (Customer_code, Customer_name, Customer_address)

- **a.** Adding a new record to the "Customer" table
- **b.** Deleting a record from the "Product" table
- **c.** Changing the Product_code in the "Product" table
- **d.** Adding a new record to the "Order" table

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Question 13

Q13. (q3-21) Company A produces cosmetics and sells its products through sales agents. For the purpose of developing the future sales strategy, the company plans to create a database consisting of three tables shown below. Which of the following information cannot be obtained simply by using this data?

Customer data:
Customer, Name, Gender, Date_of_birth
Daily sales data of sales agents:
Sales_agent, Date, Product, Sales_quantity
Product data bought by customers:
Customer, Sales_agent, Product, Sales_quantity

a. Daily variation in sales quantity for each product

b. Hot-selling products by gender

c. Daily variation in the number of buyers for each sales agent

d. Age distribution of the buyers for each sales agent

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- c. Daily variation in the number of buyers for each sales agent
- d. Age distribution of the buyers for each sales agent

Question 14

Q14. (q3-22) Which of the following is the SQL statement in the "Shipping_record" table that returns the maximum value?

Product_number	Date	Quantity
NP200	2006-10-10	3
FP233	2006-10-10	2
NP200	2006-10-11	1
FP233	2006-10-11	2

- **a.** SELECT AVG(Quantity) FROM Shipping_record WHERE Product_number = 'NP200'
- **b.** SELECT COUNT(*) FROM Shipping_record
- **c.** SELECT MAX(Quantity) FROM Shipping_record
- **d.** SELECT SUM(Quantity) FROM Shipping_record WHERE Date = '2006-10-11'

Q14. (q3-22) Which of the following is the SQL statement in the "Shipping_record" table that returns the maximum value?

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FP233	2006-10-10	2
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a. SELECT AVG(Quantity) FROM Shipping_record WHERE Product_number = 'NP200'

b. SELECT COUNT(*) FROM Shipping_record

c. SELECT MAX(Quantity) FROM Shipping_record

d. SELECT SUM(Quantity) FROM Shipping_record WHERE Date = '2006-10-11'

Question 15

Q15. (q3-23) Which of the following is the correct syntax of SQL statement?

a. SELECT Order_date, AVG(Quantity)
   FROM Order_details

b. SELECT Order_date, AVG(Quantity)
   FROM Order_details
   GROUP BY Order_date

c. SELECT Order_date, AVG(SUM(Quantity))
   FROM Order_details
   GROUP BY Order_date

d. SELECT Order_date
   FROM Order_details
   WHERE SUM(Quantity) > 1000
   GROUP BY Order_date

Q15. (q3-23) Which of the following is the correct syntax of SQL statement?

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Question 16

Q16. (2021 S FE AM-q26) Which of the following is performed periodically to prevent a decline in the access efficiency of a database?

a. Backup

b. Database dump

c. Reorganization

d. Rollback

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Question 17

Q17. (2021 S FE AM-q27) A student's ID, name, and class ID are recorded in the Student table. Which of the following SQL returns records of all students whose names start with A?

- a. SELECT * FROM Student WHERE name LIKE '%A';
- b. SELECT * FROM Student WHERE name LIKE '%A_';
- c. SELECT * FROM Student WHERE name LIKE 'A_';
- d. SELECT * FROM Student WHERE name LIKE 'A%';

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c. SELECT * FROM Student WHERE name LIKE 'A_';

d. SELECT * FROM Student WHERE name LIKE 'A%';

Question 18

Q18. (2021 S FE AM-q28) Among the search processes for the "Sales" table, which of the following is appropriate to set a hash index rather than a B+ tree index? Here, the column in which the index is set is shown inside $\langle \rangle$.

Sales (form number, sales date, product name, user ID, store number, sales amount)

- a) Searching for sales with a sales amount of 100 dollars or more. $\langle$ sales amount$\rangle$
- b) Searching for sales with the product name beginning with 'DB'. $\langle$product name$\rangle$
- c) Searching for sales with the sales date as the current month. $\langle$sales date$\rangle$
- d) Searching for sales with the user ID as '1001'. $\langle$user ID$\rangle$

Q18. (2021 S FE AM-q28) Among the search processes for the "Sales" table, which of the following is appropriate to set a hash index rather than a B+ tree index? Here, the column in which the index is set is shown inside ⟨⟩.?

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- d. Searching for sales with the user ID as '1001'. ⟨user ID⟩

Question 19

Q19. (2021 S FE AM-q29) Which of the following is the appropriate explanation of the key value store that is used in the processing of big data?

a. It is represented by a two-dimensional table with rows and columns based on the set theory.

b. It represents the relationship among nodes with the three (3) elements, i.e., "node", "relationship", and "property".

c. It saves the desired data together with a value that enables this data to be uniquely identified as a pair.

d. The data for one (1) case is called a "document", and the data structure of each document is unrestricted and can be changed whenever data is added.

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Question 20

Q20. (2021 A FE AM-q27) Which of the following is an appropriate explanation of an E-R diagram?

a. A relationship is expressed by describing the related entity name in the entity type.

b. The relationship between entity types is expressed by an arrow from the referencing side in the direction of the referenced side.

c. There are no attributes in the entity type, but the relationship type has attributes.

d. There are several kinds of relationships between entity types such as one-to-many or many-to-many.

Q20. (2021 A FE AM-q27) Which of the following is an appropriate explanation of an E-R diagram?

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Question 21

Q21. (2021 A FE AM-q28) Which of the following is the main purpose of transaction support in a database management system?

a. To ensure that either all the updates corresponding to a given transaction are made or none of them are made

b. To ensure that only authorized users can access the database

c. To help users update data by providing a graphical user interface

d. To provide an accessible catalog in which descriptions of data items are stored

Q21. (2021 A FE AM-q28) Which of the following is the main purpose of transaction support in a database management system?

Theme: Databases, Category: FE

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- c. To help users update data by providing a graphical user interface
- d. To provide an accessible catalog in which descriptions of data items are stored

Question 22

Q22. (2021 A FE AM-q29) Which of the following is an appropriate description of distributed databases?

- **a.** Access to a database server is shared among a globally distributed userbase so that everyone can access the database.
- **b.** It is a database that is distributed to all interested researchers and other users worldwide so that everyone can benefit.
- **c.** It is a NoSQL database instead of a Relational Database Management System (RDBMS).
- **d.** It stores different parts of a database in different locations, and its processing is distributed across those parts.

Q22. (2021 A FE AM-q29) Which of the following is an appropriate description of distributed databases?

Theme: Databases, Category: FE

a. Access to a database server is shared among a globally distributed userbase so that everyone can access the database.

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Any Questions?

References

📄 IT Fundamentals (New FE Textbook Vol. 1)