

**3.3****Database****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.

**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.

## Q3-15 □□□

A company with offices spread across multiple buildings decides to create a database for managing the locations where PCs are installed. The three tables of “Asset”, “Room”, and “Building” are created, and the relations for each table are defined. When new data is entered, the data must already exist in the referenced table. Which of the following is the appropriate sequence of entering data in each table? Here, the underlined items in the respective tables indicate a primary key or a foreign key.

Asset

<u>PC_number</u>	<u>Building_number</u>	<u>Room_number</u>	Model_name
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Room

<u>Building_number</u>	<u>Room_number</u>	Room_name
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Building

<u>Building_number</u>	Building_name
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- a) Asset → Building → Room                      b) Building → Room → Asset  
 c) Room → Asset → Building                    d) Room → Building → Asset

## 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.  
 d) The primary key cannot be composed of multiple columns.

## Calculation of Disk Access Time 2

$$\text{Search time of hard disk (average rotational latency time)} = \frac{1}{2 \times \text{Rotation speed}}$$

Check!

## Q3-17 □□□

Which of the following is the third normal form of the “Employee” table? Here, the underlined items indicate a primary key.

Employee (Employee\_number, Employee\_name,  
           {Skill\_code, Skill\_name, Skill\_years\_of\_experience})  
           ({ } indicates repetition)

- a) 

<u>Employee_number</u>	<u>Employee_name</u>
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<u>Skill_code</u>	Skill_name	Skill_years_of_experience
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- b) 

<u>Employee_number</u>	Employee_name	<u>Skill_code</u>	Skill_years_of_experience
------------------------	---------------	-------------------	---------------------------

  

<u>Skill_code</u>	Skill_name
-------------------	------------
- c) 

<u>Employee_number</u>	<u>Skill_code</u>	Skill_years_of_experience
------------------------	-------------------	---------------------------

  

<u>Employee_number</u>	Employee_name
------------------------	---------------

  

<u>Skill_code</u>	Skill_name
-------------------	------------
- d) 

<u>Employee_number</u>	<u>Skill_code</u>
------------------------	-------------------

  

<u>Employee_number</u>	Employee_name	Skill_years_of_experience
------------------------	---------------	---------------------------

  

<u>Skill_code</u>	Skill_name
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**Q3-18** □□□

When the attributes of the relation “Order” shown below has the functional dependencies from (1) through (7), which of the following is the correct primary key? Here,  $(A, B)$  indicates the tuple of attributes  $A$  and  $B$ , and  $A \rightarrow C$  indicates that  $C$  is functionally dependent on  $A$ .

Relation “Order”:

(Order\_number, Order\_date, Customer\_number, Customer\_name, Product\_number, Product\_name, Quantity, Sales\_amount)

Functional dependencies

- (1) Order\_number  $\rightarrow$  Order\_date
- (2) Order\_number  $\rightarrow$  Customer\_number
- (3) Order\_number  $\rightarrow$  Customer\_name
- (4) Customer\_number  $\rightarrow$  Customer\_name
- (5) (Order\_number, Product\_number)  $\rightarrow$  Quantity
- (6) (Order\_number, Product\_number)  $\rightarrow$  Sales\_amount
- (7) Product\_number  $\rightarrow$  Product\_name

- a) (Order\_number)
- b) (Order\_number, Customer\_number)
- c) (Order\_number, Customer\_number, Product\_number)
- d) (Order\_number, Product\_number)

**Q3-19** □□□**Mandatory question**

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.

**Calculation of Disk Access Time 3**

$$\text{Data transfer time of hard disk} = \frac{\text{Data volume}}{\text{Data transfer rate}} = \frac{\text{Data volume}}{\text{Transfer rate} \times \text{Capacity of one track}}$$

Check!

**Q3-20** ☐☐☐ **Mandatory question**

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 a dotted underline 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

**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
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Daily sales data of sales agents

Sales_agent	Date	Product	Sales_quantity
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Product data bought by customers

Customer	Sales_agent	Product	Sales_quantity
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- 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

**Q3-22** □□□

Which of the following is the SQL statement in the “Shipping\_record” table that returns the maximum value?

Shipping\_record

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'`

**Q3-23** ☐☐☐ **Mandatory question**

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`

**Calculation of MTBF**

MTBF (Mean Time Between Failure) =  $T_1 + T_2 + \dots + T_n$   $T_1, \dots, T_n$ : Each continuous operating time of a system

**Check!**

## Q3-24 □□□

Which of the following is an appropriate SQL statement that can be used to search for Department\_code of departments that have less than five employees with the job duty of Programmer in the “Employee” table? Here, the structure of the “Employee” table is given below, and none of the columns has a null value.

Employee (Employee\_number, Employee\_name, Department\_code, Job\_duty)

- a) 

```
SELECT DISTINCT Department_code FROM Employee S1
WHERE 5 > (SELECT COUNT(S2.Employee_number) FROM Employee S2
WHERE S1.Department_code = S2.Department_code
AND S2.Job_duty = 'Programmer')
```
- b) 

```
SELECT DISTINCT Department_code FROM Employee S1
WHERE 5 < (SELECT COUNT(S2.Employee_number) FROM Employee S2
WHERE S1.Department_code = S2.Department_code
AND S2.Job_duty <> 'Programmer')
```
- c) 

```
SELECT DISTINCT Department_code FROM Employee S1
WHERE EXISTS (SELECT * FROM Employee S2
WHERE S1.Department_code = S2.Department_code
AND S2.Job_duty = 'Programmer')
GROUP BY S1.Department_code HAVING COUNT(*) < 5
```
- d) 

```
SELECT DISTINCT Department_code FROM Employee S1
WHERE S1.Department_code IN (SELECT S2.Department_code FROM Employee S2
WHERE S1.Department_code = S2.Department_code
AND S2.Job_duty = 'Programmer')
GROUP BY S2.Department_code HAVING COUNT(*) < 5)
```



## Q3-25 □□□

As shown in the table below, when tables  $T_1$  and  $T_2$  that are shared resources are updated by transactions  $A$  and  $B$ , which of the following is the point where deadlock occurs? Here, steps (1) through (8) in the table show the execution sequence of processes. Moreover, each table is locked just before the table is updated, and unlocked once the transaction is completed.

	Transaction $A$	Transaction $B$
Time ↓	(1) Start transaction	(2) Start transaction
	(3) Update Table $T_1$	(4) Update Table $T_2$
	(5) Update Table $T_2$	(6) Update Table $T_1$
	(7) Finish transaction	(8) Finish transaction

- a) (3)                      b) (4)                      c) (5)                      d) (6)

## Calculation of MTTR

$$\text{MTTR (Mean Time To Repair)} = \frac{t_1 + t_2 + \dots + t_n}{n} \quad \begin{array}{l} t_1, \dots, t_n: \text{Each repair time of a system} \\ n: \text{Number of repairs} \end{array}$$

Check!

**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.

**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    |

**Q3-28** □□□**Mandatory question**

Transaction  $T$  is completed after the checkpoint is processed, and then system failure occurs. Which of the following is the recovery technique that is used for restoring the database to the state just after the completion of Transaction  $T$ ? Here, in addition to the checkpoint, the transaction log is also available.

- |                      |                           |
|----------------------|---------------------------|
| a) Two-phase locking | b) Transaction scheduling |
| c) Roll back         | d) Roll forward           |

**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

**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.

**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

**Calculation of Availability 1**

$$\text{Availability} = \frac{\text{MTBF}}{\text{MTBF} + \text{MTTR}}$$

Check!