9-1 Database [1]

Point!

1 Database Management System

(1) ([1]**Database**) : An organized collection of data, organized and stored in a format that makes it easy to access for specific purposes. In addition to collecting data, it also makes it easy to search, process, and share.
<Examples> Smartphone contact lists, company customer information, etc.

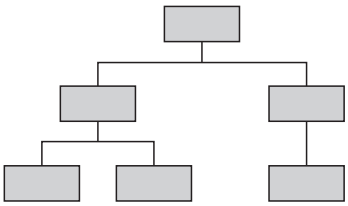
(2) ([2]**Database management system (DBMS)**) : A system that creates, operates, and manages databases.

(3) Database Management System Functions
[1] Data ([3]**consistency**) : Ensuring that concurrent operations for shared data do not cause inconsistencies.
[2] Data ([4]**integrity**) : Preventing duplication, tampering, and unauthorized registration or updating of data.
[3] Data ([5]**independence**) : Managing databases separately from the programs that use them.
[4] Data ([6]**confidentiality**) : Setting access permissions and performing authentication.
[5] Data ([7]**availability**) : Performing backups, restoration, and recovery to prepare for possible failures so that data can be recovered.

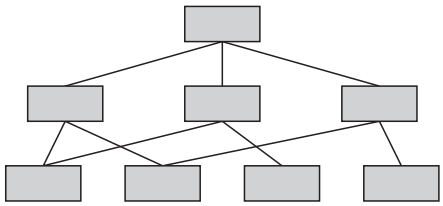
2 Types of Databases

(1) ([8]**Hierarchical database**) : Database where data is represented in a tree-like hierarchical structure.
(2) ([9]**Network database**) : Database where data is represented in a structure similar to a web or mesh.
(3) ([10]**Relational database**) : Database where collected data is organized and managed across multiple tables.

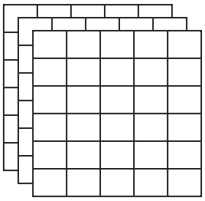
Hierarchical database



Network database



Relational database



(4) ([11]**NoSQL**) : Database management systems other than relational database management systems.

Warm Up

Answer the following questions.

(1) What is the term for information that is organized and stored in a format that makes it easy to access for a specific purpose?

(2) Choose one correct statement regarding data integrity from the options **A** to **D** below, and answer using the letter.

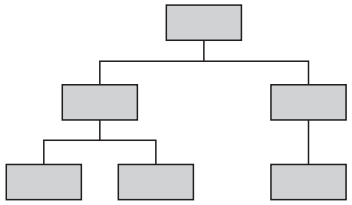
A Function where a database is managed separately from the programs that use it.

B Function that grants access rights to the data being used and limits users.

C Function that prevents duplication, tampering, and unauthorized registration or updating of data.

D Function for backing up and restoring to prepare for data failures.

(3) What is the term for a database with a structure like the one shown on the right?



Explanation

(1) Database

(2) **C**

(3) Data is represented in a tree-like hierarchical structure, therefore hierarchical database

Try

1 Answer the following questions.

(1) Complete the following sentences by filling in the blanks [1] to [4] with the appropriate terms.

> Data that is managed and stored in a certain format to make it easier to use large amounts of data is referred to as a ([1]). A system that creates, operates, and manages a ([1]) is called a ([2]), and it has functions such as data consistency, integrity, independence, ([3]), and ([4]).

(2) Choose the correct explanation for each of the terms [1] to [5] related to database management systems from the options **A** to **E**, and answer using the letters.

[1] Data independence [2] Data integrity [3] Data consistency
[4] Data availability [5] Data confidentiality

A Setting access permissions and performing authentication for data.
B Providing a mechanism to ensure there are no inconsistencies in the relationships between data.
C Method where stored data is managed separately according to its use.
D Backing up and taking other measures so that it is easier to recover data after a failure.
E Providing a mechanism to prevent accidental revisions to or unauthorized tampering of data.

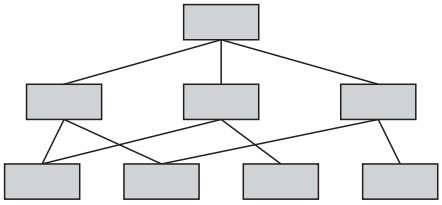
2 Answer the following questions.

(1) Choose the term that best fits into the blanks [1] to [3] in the following sentences from the options **A** to **D** below, and answer using the letters.

> There are several types of databases, including a ([1]) where collected data is organized and managed across multiple tables. Data that is organized in a hierarchical structure resembling a tree is referred to as a ([2]), while data expressed in a network-like structure is referred to as a ([3]).

A Hierarchical database **B** Relational database
C Network database **D** Object-oriented database

(2) What is the term for a database with a structure like the one shown on the right?



(3) What is the term for database management systems other than relational database management systems?

Exercise

1 Cover the **Point!** section on page 110 with a red sheet and test yourself by writing the items in order in your notebook.

2 Answer the following questions.

(1) Complete the following sentences by filling in the blanks [1] and [2] with the appropriate terms.

> A ([1]) refers to data that is organized and stored in a certain format for large-scale use. A ([1]) not only makes data easy to store, but also to search, process, and share. A ([2]) is a system for creating, operating, and managing a ([1]).

(2) Choose one correct statement regarding data availability from the options **A** to **D** below, and answer using the letter.

A Function where a database is managed separately from the programs that use it.
B Function that grants access rights to the data being used and limits users.
C Function that prevents duplication, tampering, and unauthorized registration or updating of data.
D Function for backing up and restoring to prepare for data failures.

(3) For the following statements [1] to [5] regarding the functions of database management systems, mark "○" if the statement is correct, and "×" if it is incorrect.

[1] Data confidentiality involves setting data access rights and implementing authentication.
[2] Data integrity means ensuring that concurrent operations for shared data do not cause inconsistencies.
[3] Data consistency involves not only preventing data duplication but also protecting against data tampering and the registration of fraudulent data.
[4] Data availability involves performing backups, restoration, and recovery to prepare for data failures.
[5] Data independence refers to managing databases separately from the programs that use them.

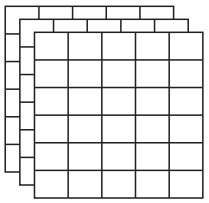
3 Answer the following questions.

(1) Choose the appropriate database for the following items [1] to [3] from the options **A** to **C** below, and answer using the letters.

[1] A database that represents data in a mesh-like structure.
[2] A database where collected data is organized and managed across multiple tables.
[3] A database where data is represented in a tree-like hierarchical structure.

A Hierarchical database **B** Network database
C Relational database

(2) What is the term for a database with a structure like the one shown on the right?



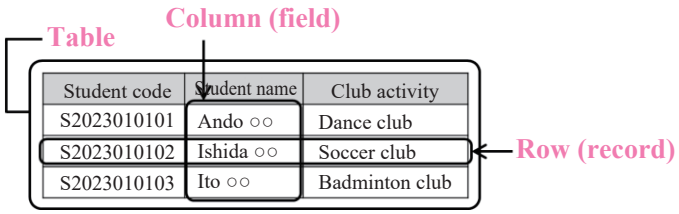
9-2 Database [2]

Point!

Relational Database

(1) ([1]**Relational database** (**RDB**)) : Database where collected data is organized and managed across multiple tables.

- A spreadsheet ([2]**table**) consists of ([3]**rows** (**records**)) and ([4]**columns** (**fields**)).



- Establishing ([5]**relationships**) between multiple tables makes it possible to eliminate duplicate data, which allows data to be handled with integrity.

(2) ([6]**SQL**) : A language used in relational databases to manipulate data.
Performs data registration, insertion, retrieval, and deletion.

(3) Relational Database Operations (Relational Algebra Operations)

[1] ([7]**Selection**) : Only rows that meet given conditions are extracted and displayed.

Student code	Student name	Club code
S2023010101	Ando ○○	C1
S2023010102	Ishida ○○	C2
S2023010103	Ito ○○	C1
S2023010104	Udagawa ○○	C1
S2023010105	Ezawa ○○	C2

Record for club code C2 → **Selection**

Student code	Student name	Club code
S2023010102	Ishida ○○	C2
S2023010105	Ezawa ○○	C2

[2] ([8]**Projection**) : Displaying only certain columns from a table.

Student code	Student name	Club code
S2023010101	Ando ○○	C1
S2023010102	Ishida ○○	C2
S2023010103	Ito ○○	C1
S2023010104	Udagawa ○○	C1
S2023010105	Ezawa ○○	C2

Student name → **Projection**

Student name
Ando ○○
Ishida ○○
Ito ○○
Udagawa ○○
Ezawa ○○

[3] ([9]**Join**) : Linking data from multiple tables according to specific conditions and displaying it as a single table.

Club table

Club code	Club activity
C1	Dance club
C2	Tennis club

Student table

Student code	Student name	Club code
S2023010101	Ando ○○	C1
S2023010102	Ishida ○○	C2
S2023010103	Ito ○○	C1
S2023010104	Udagawa ○○	C1
S2023010105	Ezawa ○○	C2

Join

Student code	Student name	Club code	Club activity
S2023010101	Ando ○○	C1	Dance club
S2023010102	Ishida ○○	C2	Tennis club
S2023010103	Ito ○○	C1	Dance club
S2023010104	Udagawa ○○	C1	Dance club
S2023010105	Ezawa ○○	C2	Tennis club

Warm Up

Answer the following questions.

(1) Complete the following sentences by filling in the blanks [1] to [4] with the appropriate terms.

> Summarizing data into a table often makes it easier to understand. A database where data is managed in a table is referred to as a ([1]). In a ([1]), rows are referred to as ([2]), and columns are referred to as ([3]). Also, establishing ([4]) between multiple tables makes it possible to eliminate duplicate data, which allows data to be handled with integrity.

(2) Consider the operations of relational databases. Table 3 below was created by performing certain operations with Table 1 and Table 2. List all the operations performed among selection, projection, and join.

Table 1

Student code	Student name	Club code
S2023010101	Ando ○○	C1
S2023010102	Ishida ○○	C2
S2023010103	Ito ○○	C1
S2023010104	Udagawa ○○	C1
S2023010105	Ezawa ○○	C2

Table 2

Club code	Club activity
C1	Dance club
C2	Tennis club

Table 3

Student code	Student name	Club activity
S2023010101	Ando ○○	Dance club
S2023010102	Ishida ○○	Tennis club
S2023010103	Ito ○○	Dance club
S2023010104	Udagawa ○○	Dance club
S2023010105	Ezawa ○○	Tennis club

Explanation

(1) [1] Relational database (RDB) [2] Record [3] Field [4] Relationships

(2) Table 3 combines “Student code” and “Student name” from Table 1, and “Club activity” from Table 2, indicating that a join operation has been performed. Also, since the “Club code” in Table 1 is not included in Table 3, it can be concluded that it also involves a projection.
Therefore, join and projection

Try

Answer the following questions.

(1) Choose the appropriate name of the database where data is managed as a table from the options **A** to **C** below, and answer using the letter.

A Hierarchical database **B** Network database

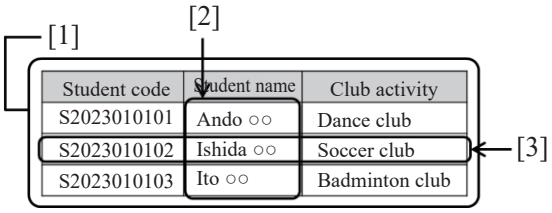
C Relational database

(2) Choose two appropriate names for each of the sections [1] to [3] in the table on the right from the options **A** to **F** below, and answer using the letters.

A Spreadsheet **B** Row

C Column **D** Field

E Table **F** Record



(3) Choose the term that best fits into the blanks [1] to [3] in the following sentences from the options **A** to **D** below, and answer using the letters.

Searches in a relational database are conducted using relational algebra operations.

- The process of extracting multiple columns from a table to create a new table is referred to as ([1]).
- The process of extracting only the rows that meet given conditions to create a new table is referred to as ([2]).
- The process of linking multiple tables based on the relationship between certain items to create a new table is referred to as ([3]).

A Projection **B** Join **C** Selection **D** Normalization

(4) For tables [1] to [3] which were created using the following two tables (Student table and Club table), choose the name of the operation that was performed from the options **A** to **D** below, and answer using the letters.

Student table

Student code	Student name	Club code
S2023010101	Ando ○○	C1
S2023010102	Ishida ○○	C2
S2023010103	Ito ○○	C1
S2023010104	Udagawa ○○	C1
S2023010105	Ezawa ○○	C2

Club table

Club code	Club activity
C1	Dance club
C2	Tennis club

[1]

Student name
Ando ○○
Ishida ○○
Ito ○○
Udagawa ○○
Ezawa ○○

[2]

Student code	Student name	Club code
S2023010102	Ishida ○○	C2
S2023010105	Ezawa ○○	C2

[3]

Student code	Student name	Club code	Club activity
S2023010101	Ando ○○	C1	Dance club
S2023010102	Ishida ○○	C2	Tennis club
S2023010103	Ito ○○	C1	Dance club
S2023010104	Udagawa ○○	C1	Dance club
S2023010105	Ezawa ○○	C2	Tennis club

A Projection **B** Join **C** Selection **D** Normalization

Exercise

1 Cover the **Point!** section on page 114 with a red sheet and test yourself by writing the items in order in your notebook.

2 Answer the following questions.

(1) Choose one correct statement regarding relational databases from the options **A** to **D** below, and answer using the letter.

A The operation of searching for and extracting records that meet specific conditions from a table is called "projection."

B A table consists of records and fields, and allows data to be managed in a table format.

C To maintain data integrity, it is not possible to link data from multiple tables.

D By displaying only specific columns from a table, it is possible to eliminate data redundancy.

(2) Choose one correct statement regarding SQL from the options **A** to **D** below, and answer using the letter.

A Mechanism that ensures the integrity of data stored in a relational database.

B Eliminating duplicate data from a relational database.

C Programming language for manipulating relational databases.

D Operations performed on a relational database such as selection, projection, and join.

(3) Choose one correct statement regarding the "join" operation of a relational database from the options **A** to **D** below, and answer using the letter.

A Creating a new table by linking information from multiple tables based on certain conditions.

B Using a language called SQL to register or delete data in a table.

C Extracting only the records from a table that meet specific conditions.

D Extracting only the fields from information contained in a table that meet specific conditions.

(4) For tables [1] to [3] which were created using the following two tables (Employee table and Branch table), choose the name of the operation that was performed from the options **A** to **D** below, and answer using the letters.

Employee table

Employee number	Name	Department	Branch number
10001	Sato ○○	Sales department	101
10002	Suzuki ○○	General affairs department	101
10003	Sakai ○○	Accounting department	102
10004	Kato ○○	Human resources department	102

Branch table

Branch number	Branch name
101	Tokyo
102	Osaka
103	Kyoto
104	Sapporo

[1]

Employee number	Name	Department	Branch number	Branch name
10001	Sato ○○	Sales department	101	Tokyo
10002	Suzuki ○○	General affairs department	101	Tokyo
10003	Sakai ○○	Accounting department	102	Osaka
10004	Kato ○○	Human resources department	102	Osaka

[2]

Employee number	Name	Department	Branch number
10003	Sakai ○○	Accounting department	102
10004	Kato ○○	Human resources department	102

[3]

Name	Department
Sato ○○	Sales department
Suzuki ○○	General affairs department
Sakai ○○	Accounting department
Kato ○○	Human resources department

A Projection **B** Join **C** Selection **D** Normalization

9-3 Various Information Systems

Point!

1 Information Systems

(1) ([1]**Information system**) : A system that operates by utilizing networks to collect, share, and transmit various data and information.

(2) ([2]**POS system**) : A system for managing product sales information. These are used in convenience stores and other shops to record sales information, allowing various data to be analyzed and utilized.

(3) ([3]**Global Positioning System** (**GPS**)) : A system that uses artificial satellites to determine current locations.

(4) ([4]**Intelligent Transport System** (**ITS**)) : A system for transmitting and receiving road information to resolve issues such as traffic accidents and congestion. The collected data can also be utilized in autonomous driving technology.

2 E-commerce

(1) ([5]**E-commerce**) : Transactions such as contracts and payments conducted over networks such as the internet.

(2) ([6]**E-commerce system**) : A system that serves as a platform for conducting online business transactions.

<Examples> ([7]**Online shopping**) : A service for purchasing products and services via the internet.

([8]**Online auction**) : An auction style of transaction where goods and services are bought and sold over the internet.

([9]**Online banking**) : A service that allows banking transactions to be conducted over the internet.

(3) Forms of E-commerce

[1] ([10]**B to B**) : Business-to-Business transactions.

<Examples> Transaction between a computer manufacturer and a parts manufacturer, etc.

[2] ([11]**B to C**) : Transaction between a business and consumers.

<Examples> Online shopping, restaurants, etc.

[3] ([12]**C to C**) : Transaction between consumers.

<Examples> Online auctions, flea market apps, etc.

(4) ([13]**Electronic money**) : Electronic means of payment that can be used instead of cash.

<Examples> Transportation-based electronic money and retail-based electronic money, etc.

(5) ([14]**Cryptocurrency**) : New form of electronic money that utilizes a technology called blockchain.

A type of database technology for recording information that manages data in units called blocks and stores data by linking them together like a chain

Warm Up

Answer the following questions.

(1) Choose the term that best fits into the blanks [1] to [3] in the following sentences from the options **A** to **E** below, and answer using the letters.

> Our daily lives are supported by ([1]) composed of humans, computers, and other information and communication technology equipment. Examples include ([2]) where data is collected and managed at the time a product is sold, and ([3]) where data from satellites is obtained to determine your present location and the operation status of buses and other transportation systems.

A POS system **B** Information systems **C** GPS (Global Positioning System)
D ITS (Intelligent Transport System) **E** Social media

(2) What is the term for the system where products are sold via an online store, payments are processed over the network, and products are delivered by a courier service?

(3) Determine whether the following statement is considered "B to B," "B to C," or "C to C."
Automobile manufacturer Company A places an order with Company B for certain parts.

(4) What is the term for expressing monetary value as digital data?

Explanation

(1) [1] **B** [2] **A** [3] **C**
(2) Online shopping
(3) Business-to-business transaction, therefore B to B
(4) Electronic money

Try

1 Answer the following questions.

(1) Complete the following sentences by filling in the blanks [1] to [4] with the appropriate terms.

> A system that utilizes a network to collect, share, and transmit various data and information is referred to as an ([1]). Examples of ([1]) include ([2]), which is a system that transmits and receives road information to resolve issues such as traffic accidents and congestion. In addition, a ([3]) is a system used in convenience stores and supermarkets to collect and manage data at the point of sales.
>
> Commercial transactions such as contracts and payments conducted over a network such as the internet are referred to as ([4]), and there are multiple forms including online auctions and online banking.

(2) What is the term for the satellite positioning system that collects location information for any place on Earth?

2 Answer the following questions.

(1) Complete the following sentences by filling in the blanks with the appropriate terms.

[1] The mechanism for publicly bidding on a product, such as over the internet, to determine the final purchasing price is referred to as an ( ).

[2] A service that allows for balance inquiries and transfers over the internet is referred to as ( ).

[3] The representation of monetary value as digital data is referred to as ( ).

(2) Read the following passage and answer the following questions.

> A transaction such as buying and selling goods and services through electronic means over the internet or a computer is referred to as (**A**). The forms of (**A**) include (**B**) transactions between businesses and consumers, (**C**) transactions between businesses, and (**D**) transactions between consumers.

[1] Fill in each of the blanks from **A** to **D** with the appropriate answer.

[2] Determine whether the following statements are considered “B to B,” “B to C,” or “C to C.”

A Person A purchased an item listed by Person B on a flea market app.

B Company A, a computer manufacturer, placed an order for some parts with Company B.

C Person A purchased a product from a site operated by Company B via online shopping.

Exercise

1 Cover the **Point!** section on page 118 with a red sheet and test yourself by writing the items in order in your notebook.

2 Choose the most appropriate explanation of a POS system from the options **A** to **D** below, and answer using the letter.

A A system that uses artificial satellites to determine current locations.
B A system that operates by utilizing networks to collect, share, and transmit various data and information.
C A system used in convenience stores and other shops to manage product sales information.
D A system for transmitting and receiving road information to resolve issues such as traffic accidents and congestion.

3 Answer the following questions.

(1) Choose the term that best fits into the blanks [1] to [4] in the following sentences from the options **A** to **E** below, and answer using the letters.

> Commercial transactions such as contracts and payments conducted over a network such as the internet are referred to as ([1]), and the system used to conduct ([1]) is referred to as ([2]). Examples of ([2]) include ([3]), which provides services for purchasing goods or services over the internet, and ([4]), which allows banking transactions such as transfers and balance inquiries over the internet.

A E-commerce system **B** Online banking **C** Information systems
D E-commerce **E** Online shopping

(2) The following describes a form of e-commerce. Choose the ones that best fits into the blanks [1] to [3] in the following sentences from the options **A** to **C** below, and answer using the letters.

> Company A, an apparel manufacturer, placed an order with Company B for a certain material. This type of transaction between companies is referred to as ([1]). Company A then sold the clothes it produced through online shopping, and Person A purchased them. Such transactions between businesses and consumers are referred to as ([2]). Afterward, Person A no longer needed the clothes purchased from Company A, so they listed it on a flea market app, which was bought by Person B. This type of transaction between consumers is referred to as ([3]).

A B to C **B** B to B **C** C to C

(3) What is the term for the new currency that is traded exclusively using electronic data based on blockchain technology?