



October, 2007

Database Systems Engineer Examination (Afternoon, Part 2)

Questions must be answered in accordance with the following:

Question Nos.	Q1 – Q2
Question Selection	Choose 1 question from the 2 questions
Examination Time	14:10 - 16:10 (120 minutes)

Instructions:

1. **Choose 1 question** from the 2 questions, and **encircle the question number you chose** as seen in the example below. Please note that the answers are not scored if you do not encircle any of the question numbers. When both question numbers are encircled, the answers of the first question will be scored.

Select one	[An example when Q1 is chosen]
Q1	
Q2	

2. Use a pencil to write your answers on the answer sheet. When you need to change an answer, erase your previous answer completely and neatly. Wipe away any eraser debris.
3. Mark your examinee information and test answers in accordance with the instructions below. Your test will not be graded if you do not mark properly. Do not mark or write on the answer sheet outside of the prescribed places.
 - (1) **Examinee Number**
Write your examinee number in the space provided, and mark the appropriate space below each digit.
 - (2) **Date of Birth**
Write your date of birth (in numbers) exactly as it is printed on your examination admission card, and mark the appropriate space below each digit.
 - (3) **Answers**
Write each answer in the space specified for that question.
Write your answers clearly and neatly. Answers that are difficult to read will receive a lower score.

Company names and product names appearing in the test questions are trademarks or registered trademarks of their respective companies. Note that the ® and ™ symbols are not used within.

**Do not open the exam booklet until instructed to do so.
Inquiries about the exam questions will not be answered.**

Notation Used in the Questions

The notation for conceptual data models, relation schemas, and relational database table structures is given below. This notation applies unless otherwise noted in the text of a question.

1. Notation for Conceptual Data Models

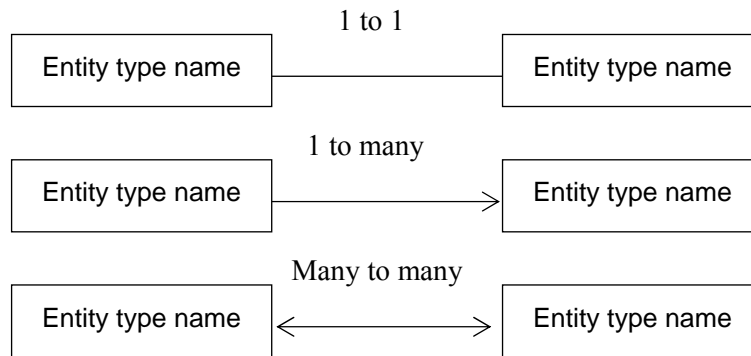


Fig. 1 Notation for Entity Types and Relationships

- (1) Entity types are indicated using rectangles.
- (2) The entity type name is written inside the rectangle.
- (3) The relationship between entity types is indicated using a line.
- (4) For a “1-to-1 relationship,” neither end of the line is an arrow.
For a “1-to-many relationship,” one end of the line is an arrow.
For a “many-to-many relationship,” both ends of the line are arrows.

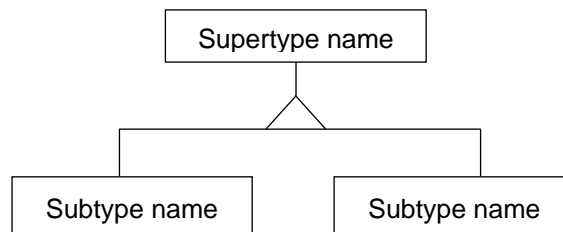


Fig. 2 Notation for Supertypes and Subtypes

- (5) When representing supertypes and subtypes, lines are drawn between the supertype and the subtypes, and a “ \triangle ” is used at the branch point.

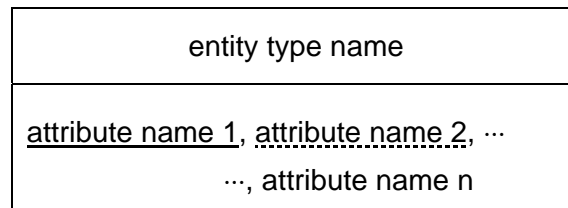


Fig. 3 Notation for the Attributes of Entity Types

- (6) When representing the attributes of an entity type, the rectangle is divided into two sections, upper and lower. The entity name is written in the upper section, while the attribute names are listed in the lower section.
- (7) When representing a primary key, a solid underline is used for the attribute name or group of attribute names that make up the primary key.
- (8) When representing a foreign key, a dotted underline is used for the attribute name or group of attribute names that make up the foreign key. Note, however, that a dotted underline is not used when some of the attributes that make up the primary key are used to make up the foreign key.

2. Notation for Relation Schemas

relation name (attribute name 1, attribute name 2, ..., attribute name n)

Fig. 4 Notation for Relation Schemas

- (1) A relation is represented by a relation name and a list of attribute names surrounded by parentheses to the right of the relation name. This is called a relation schema.
- (2) When representing a primary key, a solid underline is used for the attribute name or group of attribute names that make up the primary key.
- (3) When representing a foreign key, a dotted underline is used for the attribute name or group of attribute names that make up the foreign key. Note, however, that a dotted underline is not used when some of the attributes that make up the primary key are used to make up the foreign key.

3. Notation for Relational Database Table Structures

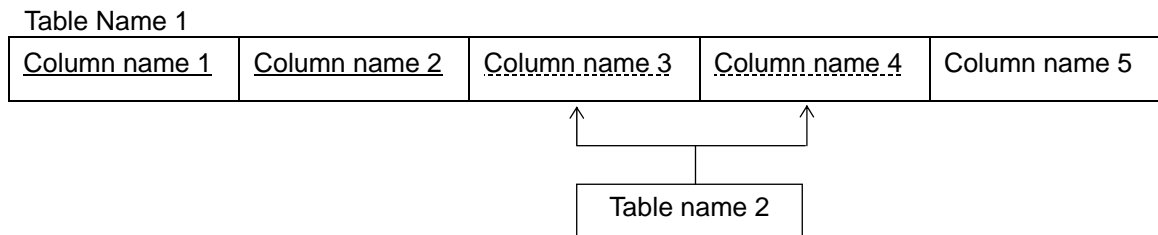


Fig. 5 Notation for Table Structures, Primary Keys, Foreign Keys and Reference Relationships

- (1) A table name is entered followed underneath by the column names that make up the table. Each column name is written inside a rectangle.
- (2) When representing a primary key, a solid underline is used for the column name or group of column names that make up the primary key.
- (3) When representing a foreign key, a dotted underline is used for the column name or group of column names that make up the foreign key. Note, however, that a dotted underline is not used when some of the attributes that make up the primary key are used to make up the foreign key.
- (4) When representing a table to be referenced by the foreign key, a line is drawn either above or below the column name or group of column names that make up the foreign key. A rectangle is drawn at the end and the name of the table to be referenced is entered inside. The end of the line on the foreign key side is an arrow.

Q1. Read the following description of the design of a project record management system, and then answer Subquestions 1 through 3.

Company X, which provides information-processing services, contracts jobs such as system operation and call centers. The company has decided to construct a project record management system to quickly grasp the project record of the company.

[Basic Items of Business]

1. Organizational Structure

The organizational structure of Company X mainly consists of the Management, Business, and Project Divisions, as shown in Figure 1. The Business Division has a department for each business type, and the Project Division has a project department for each project type offered.

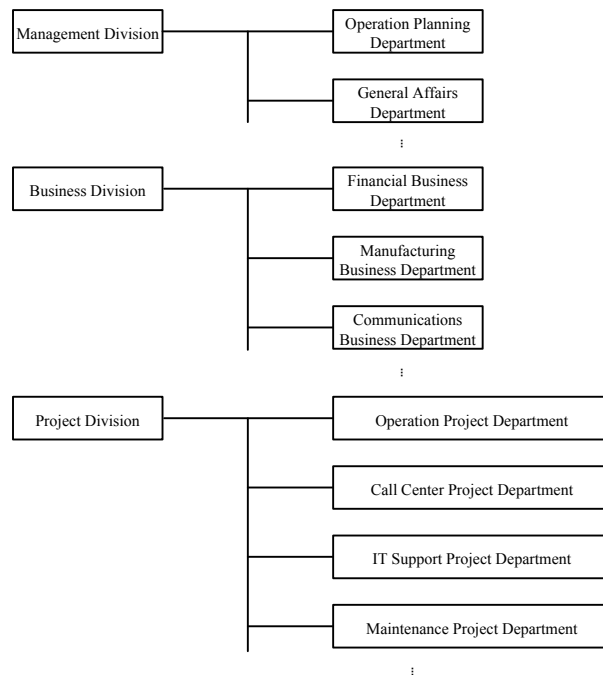


Fig. 1 Organizational Structure of Company X

2 Services

A project type provided by each project department of the Project Division is called a "service class," and the project provided is called a "service." Each service class includes multiple services. For instance, in the Operation Project Department, the service class is operation which includes services such as data center operation, system remote monitoring, and data entry contracts.

Each service is assigned to a project department member of Company X. The service fee is the product of the actual time spent on the service and the "standard service unit price,"

established for each project department member.

3. Clients and Accounts

A business customer and a corporation to which a service is provided by X are called a "client." One or more business unit or service unit can be set up for each client for the management of the project record. Each of these units is called an "account." For example, if a large company has multiple contracts for transactions, each transaction contract can be set up as an account. For each account, one business member is assigned to be in charge of the account. One account manager may be in charge of multiple accounts.

4. Drafts and Proposals, Service Contracts

A service unit of various types, which Company X comes up with in response to a client's request, is called a draft. A draft consists of one service or a combination of multiple services within one service class. The Business Department makes a draft more specific and submits it as a "proposal." Once the proposal is accepted by the client, then a "service contract" is signed. One draft may result in multiple service contracts.

[Draft Management]

A business person in charge is to manage a draft from the time a service-offering opportunity is discovered until the service offering is completed, or until it is clear that the service-offering opportunity is not materialized. The progress of a draft is managed in the procedures similar to the following:

1. Birth of a Draft

When a business person in charge discovers a service-offering opportunity for an account, he considers the service class for the offering, contents of the draft, and the estimated revenue, and he registers the draft as a "prospect" in the status column of the draft notebook (Figure 2). Each draft is assigned a draft number unique throughout the company.

Client	Account	Business Manager	Draft Number	Draft Content	Service Class	Status	Estimated Revenue	Date Created
A Industries	A Industries	XXX	1395320	System operation support	Operation	Prospect	15,000	2005-03-24
Manufacturing Co. B	Manufacturing Co. B	YYY	1544830	Small order-receiving center project	Call Center	Serving	4,500	2005-01-25
			1545000	Order-receiving center job contracted	Operation	Serving	3,500	2004-12-26
Company C	Company C	ZZZ	1391430	Technical support	IT support	Proposed	45,000	2005-03-16
			1391219	OA educational support	IT support	Failed	5,500	2005-04-15
			1391134	OA support	IT support	Serving	67,500	2005-05-12
			1391009	Operation contracted	Operation	Serving	173,800	2004-02-18
D Industries	Manufacturing Dept.	YYY	1493020	Maintenance contracted	Maintenance	Serving	9,000	2005-01-15
			1958390	Data center operation	Operation	Prospect	52,000	2005-07-15
	Procuring Dept.	XXX	2983890	Data entry contracted	Operation	Proposed	30,000	2005-02-15
E Electrics	E Electrics	YYY	3452340	Maintenance support	Maintenance	Failed	25,000	2005-07-29
			3459080	OA help desk	IT support	Accepted	12,000	2005-04-04
F Electrics	F Electrics	YYY	3298990	Product support desk	IT support	Proposed	34,000	2005-09-15

Fig. 2 Conceptual Output of Draft Notebook (partially abbreviated)

2. Proposals

The Business Department finalizes the service to be offered to the account and creates a proposal jointly with the project department in charge of that service. Once this proposal activity has begun, the status in the draft notebook is changed to "proposed." Each proposal is given a proposal number unique throughout the company.

If multiple proposals are developed from initially one draft, then a new draft is added for each proposal and managed as a separate draft.

Since the history of proposal content need not be retained, when the content of a proposal is updated, the change is written over the previous content without changing the proposal number.

3. Estimation

Estimation is carried out based on the proposal content to obtain the estimate figure. Each estimate document attached to the proposal is assigned an estimate number unique throughout the company. An estimate document states the date of estimation, expiration date, estimate figure, service period, and discount rate for the estimate figure.

Each estimate has one or more estimate details; an estimate detail is prepared for each service offered, each estimated item, each unit price estimate, and each year. Each estimate detail is assigned an estimate detail number unique within the estimate, and it states the estimated item, unit price estimate, quantity estimate, and year. The estimate figure for the estimate document is the total sum of the estimate detail figures, each of which is obtained by multiplying the unit price estimate of the estimate detail by the quantity estimate.

Estimates can be submitted more than once during the proposal stage, so whenever an estimate is submitted, the estimate is given a new number and is saved in the record.

4. Order

At the time when the client accepts the proposal and places an order by signing a service contract with Company X, the status changes to "accepted." Then, the status entry in the draft notebook is also changed to "accepted." At this stage, the draft is given an order number unique throughout the company, and thereafter the draft is identified by this order number.

Among the several estimates submitted, the estimate that the client has ultimately accepted becomes the confirmed estimate, and the confirmed estimate figure coincides with the accepted figure.

A service contract is signed with each estimate detail as a unit. The figure of a service contract coincides with the estimate detail figure of the confirmed estimate.

If there is no prospect for acceptance, the word "failed" is entered into the status column in the draft notebook, and the business activity is terminated.

5. Service Offering

Prior to the commencement of the service offering, a plan is established for the operation hours for each service contract and for each month as well as the revenue outlook figure. This plan is called a "service operation plan." When the service has begun, the status entry of the draft notebook is changed to "serving," and when the service has ended, the entry is changed to "finished."

[Setting and Finalizing the Target]

At the end of each fiscal year, Company X sets targets for its annual revenue figure and profit figure for the following year for each project type and for each service class. The Business Department comes up with "project-type targets," which are the goals for various project types, and the targets for the following fiscal year are finalized through adjustment with the Operation Planning Department.

[Operation Project Record Management]

For the record of operation for each service contract, the actual time spent by the project members on the service is totaled. In order to evaluate the project record as soon as possible, the revenue record figure for record management purposes is calculated, based on the "standard service unit price" determined for each business member, operation hours, and discount rate. Also, by multiplying the "standard cost unit price" determined for each business member by the operation hours, and subtracting this product from the revenue record figure, the direct profit is calculated. Company X annually reviews the standard service unit price and the standard cost unit price.

[Profit Management]

Profits are managed for each service contract, each draft, and each account. Personnel costs and other expenses generated after acceptance are totaled for each service contract as sales costs, but the personnel costs and other expenses generated during the prospect or proposal stage are totaled for each draft as business activity costs. Further, the personnel costs and other expenses generated for obtaining a new draft are totaled for each account. Revenue figures are handled similarly for each service contract, for each draft, or for each account, in order to evaluate profits for record management purposes.

In order to manage these profits for record management purposes, a management accounting code is set up for each totaling unit, and a profit management chart as shown in Table 3 is created.

(Account code) Account name	Management account ing code	Status	Revenue	Personnel costs	Expenses	Profit	Profit rate (%)
(Draft number) Draft name							
Service contract name							
(A03579) Company C							
(1391430) Technical support		Proposed					
(Business activity costs for a draft)	400580		-	100	25	-	-
Total			0	100	25	-125	-
(1391219) OA educational support		Failed					
(Business activity costs for a draft)	389910		-	350	50	-	-
Total			0	350	50	-400	-
(1391134) OA support		Serving					
OA help desk	356690		20,000	15,000	1,500	3,500	17.5
OA device installation	356689		5,600	4,200	90	1,310	23.4
(Business activity costs for a draft)	356640		-	300	200	-	-
Total			25,600	19,500	1,790	4,310	16.8
(1391009) Operation contracted		Serving					
Operation contracted 2004	248869		85,600	62,900	1,340	21,360	25.0
Operation contracted 2005	248868		44,000	32,000	450	11,550	26.3
(Business activity costs for a draft)	248690		-	1,200	1,300	-	-
Total			129,600	96,100	3,090	30,410	23.5
(Business activity costs for an account)	108750		-	2,450	250	-	-
Total			155,200	118,500	5,205	31,495	20.3

Fig. 3 Conceptual Output of a Profit Management Chart

If a draft splits into multiple proposals, then the profits need to be managed as follows:

- (1) The business activity costs generated after the split are managed under each draft.
- (2) The business activity costs generated prior to the split are not distributed to drafts after the split.
- (3) All business activity costs before and after the split should be able to be totaled in the unit of the original draft.

[Expected Revenue]

To reach the revenue target for the fiscal year, at the end of each quarter, the outlook of the fiscal year's total revenue figure (hereafter referred to as the annual revenue outlook) is calculated by adding up the revenue record for each draft from the beginning of the fiscal

year up to that point and the revenue outlook from that point on to the end of the fiscal year. This annual revenue outlook is then compared with the revenue plan as of the beginning of the fiscal year (hereafter referred to as the FY plan). To see the fluctuation from quarter to quarter, a revenue outlook chart as shown in Figure 4 is created.

Output Date : 03 Oct, 2005

Unit: \$

Business Department		FY plan	End of First Quarter (01 Apr. 2005 to 30 Jun. 2005)				End of Second Quarter (01 Jul. 2005 to 30 Sep. 2005)				
Draft class	Revenue record		Revenue outlook	Annual revenue outlook	Comparison with annual plan (%)	Revenue record	Revenue outlook	Annual revenue outlook	Comparison with previous quarter (%)	Comparison with annual plan (%)	
Client											
Manufacturing Business Department											
Existing Drafts											
A Industries	15,000	0	15,000	15,000	100	4,505	10,000	14,505	97	97	
Manufacturing Co. B	8,000	5,000	3,000	8,000	100	8,100	0	8,100	101	101	
Company C	133,200	20,000	98,000	118,000	89	44,000	88,000	132,000	112	99	
D Industries	39,000	2,500	36,500	39,000	100	5,000	35,000	40,000	103	103	
Subtotal	195,200	27,500	152,500	180,000	92	61,605	133,000	194,605	108	100	
Existing Account New Drafts											
Company C	73,000	0	67,500	67,500	92	25,600	41,900	67,500	100	92	
D Industries	56,000	0	54,000	54,000	96	0	52,000	52,000	96	93	
Subtotal	129,000	0	121,500	121,500	94	25,600	93,900	119,500	98	93	
New Account Drafts											
(New)	25,000	0	12,000	12,000	-	0	15,000	15,000	-	-	
Company ZZ	0	0	13,500	13,500	-	600	12,800	13,400	-	-	
Company WW	0	-	-	-	-	0	5,000	5,000	-	-	
Subtotal	25,000	0	25,500	25,500	102	600	32,800	33,400	131	134	
Total	349,200	27,500	299,500	327,000	94	87,805	259,700	347,505	106	100	

**Fig. 4 Conceptual Output of a Revenue Outlook Chart
(as of the end of the second quarter)**

1. Annual Plan

At the end of a fiscal year, the annual plan for the following fiscal year is prepared. The procedures for preparing an annual plan are as follows:

(1) Existing Drafts

A project that is already managed as a draft at the time when the annual plan is prepared is called an "existing draft." The annual plan for an existing draft is prepared as follows:

- (i) For a draft already accepted, the revenue outlook figures in the "service operation plans" for the following fiscal year are to be totaled.
- (ii) For a draft being proposed, the revenue outlook figures for the following fiscal year are calculated and totaled, based on the most recent estimate figures and the discount rate.
- (iii) For a draft before becoming a proposal, the revenue outlook figures for the following fiscal year for the draft are totaled.

(2) Existing Account New Drafts

An account in which at least one draft has been registered in the past at the time when the annual plan is prepared is called an "existing account." A draft that has not been registered as a draft at the time when the annual plan is prepared but will be a new draft for an existing account within the fiscal year is called an "existing account new draft."

For an annual plan, if there is a possibility for a new draft for an existing account, the revenue outlook figures are totaled for each account and for each service class. For convenience, one draft is registered in the draft notebook for each account and for each service class, a temporary draft number is assigned, and the draft is named "(new draft)." When the draft is made more specific, the draft is registered in the draft notebook anew. At this point, the revenue outlook figures are reviewed and adjusted for the draft "(new draft)."

(3) New Account Draft

An account in which there is no draft registered in the past at the time when the annual plan is prepared but is planned to be pioneered as an account within the fiscal year is called a "new account." A draft that will be generated in such a "new account" within the fiscal year is called a "new account draft."

For an annual plan, a target for pioneering a new account is set, and its revenue targets are totaled. Because the account is unclear, for convenience, this type of draft is handled on the draft notebook as one draft for one account, and the revenue outlook figures for each project type and for each service class are to be totaled. A temporary account code is assigned, and the account name is left as "(new)." Further, a temporary draft number is also given, and the draft name is left as "(new draft)." When the draft is made more specific, the draft is registered in the draft notebook anew. At this point, the revenue outlook figures are reviewed and adjusted for the draft "(new draft)."

2. Evaluation and Revenue Outlook at the End of Each Quarter

At the end of each quarter, the revenue outlooks for all existing drafts are updated. The targets for existing account new drafts and new account drafts are also updated. These updates are summarized in the revenue outlook chart.

(1) Existing Drafts

For existing drafts, the revenue records are totaled for each draft. As for the revenue outlook, it is obtained for the fiscal year after the first quarter by the method used for annual plans. For drafts being implemented already, the monthly plans in the "service operation plans" are updated; the sum of the figures in these plans is the revenue outlook figure.

Only the drafts existing at the time when the annual plan is prepared are included in the total for the draft class of the existing drafts for the fiscal year.

(2) Existing Account New Drafts

When a new draft is registered for an existing account, its revenue outlook is entered in the existing account new draft column. The method for calculating the revenue outlook for drafts in each status is the same as for existing drafts.

Now, the total of the annual revenue outlooks of existing drafts (except for the drafts that have failed) and the existing account new drafts is compared with the annual plans created for each account, and the revenue outlook for "(new draft)" is reviewed and adjusted.

(3) New Account Drafts

When a new draft is registered for a new account, its revenue outlook is entered as a new account draft. The method for calculating the revenue outlook for drafts in each status is the same as for existing drafts.

Now, the total of the annual revenue outlooks of all drafts except for the drafts that have failed is compared with the revenue target for each project type, and the revenue outlook for "(new draft)" for an account to be pioneered anew is reviewed and adjusted.

[Analysis of the Project Record Management System]

In constructing this project record management system, we have analyzed work related to project record management and existing notebooks and created the following conceptual data model (Figure 5) and relation schema (Figure 6).

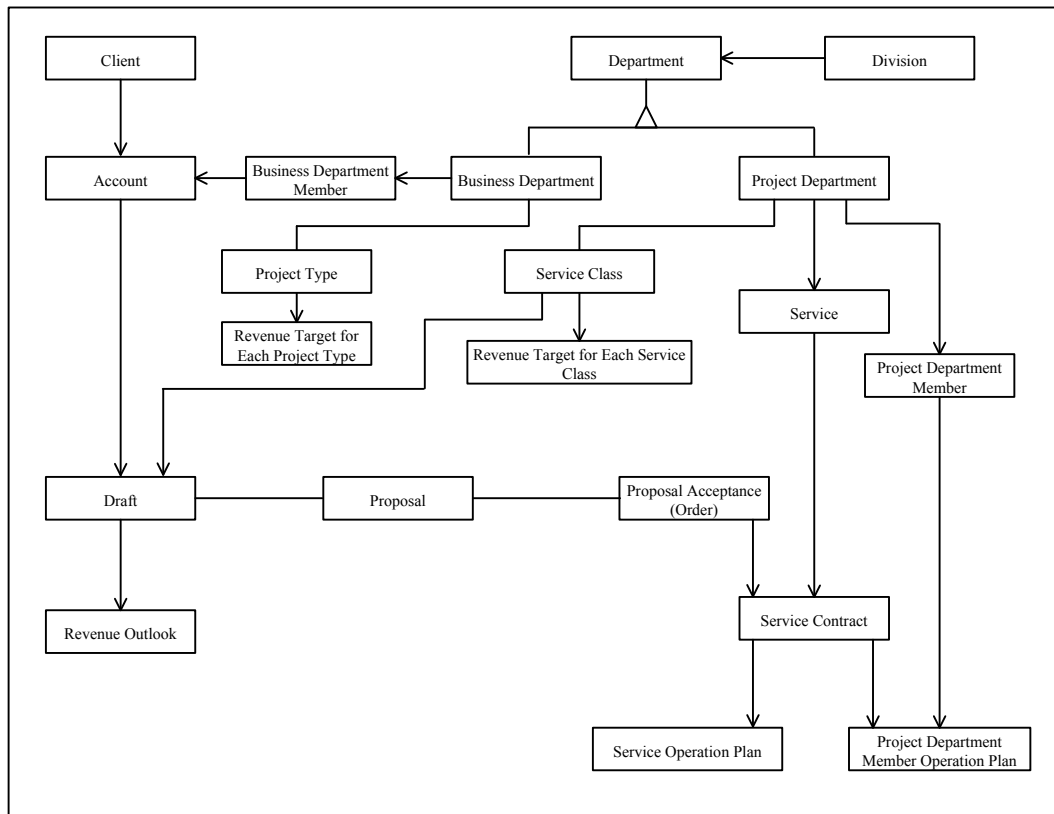


Fig. 5 Conceptual Data Model of the Work of Project Record Management (partially incomplete)

Client (<u>ClientCode</u> , ClientName, HeadquartersLocation, ProjectOverview)
Division (<u>DivisionCode</u> , DivisionName)
ServiceClass (<u>ServiceClassCode</u> , ServiceClassName)
Type (<u>TypeCode</u> , TypeName)
Dpt (<u>DptCode</u> , DptName, <u>DivisionCode</u>)
ProjectDpt (<u>ProjectDptCode</u> , <u>ServiceClassCode</u>)
BusinessDpt (<u>BusinessDptCode</u> , <u>TypeCode</u>)
BusinessMember (<u>BusinessMemberNo</u> , <u>BusinessDptCode</u> , Name, ...)
Account (<u>AccountCode</u> , <u>ClientCode</u> , <u>BusinessMemberNo</u> , AccountName, ContactDpt, ContactPerson, Contact)
RevenueTargetForProjectType (<u>TypeCode</u> , <u>FY</u> , TargetRevenue, TargetProfit)
RevenueTargetForServiceClass (<u>ServiceClassCode</u> , <u>FY</u> , TargetRevenue, TargetProfit)
Service (<u>ServiceCode</u> , ServiceName, <u>ProjectDptCode</u>)
Draft (<u>DraftNo</u> , <u>AccountCode</u> , <u>ServiceClassCode</u> , DraftContent, DateCreated, PlannedStartDate, PlannedEndDate, Status, RevenueOutlookTotal, FYRevenueOutlook, FYOutlookProfitRate)
Proposal (<u>ProposalNo</u> , <u>DraftNo</u> , ProposalContent, ProposalDate, PlannedStartDate, PlannedEndDate, OutlookProfitRate)
Order (<u>OrderNo</u> , <u>ProposalNo</u> , OrderDate)
RevenueOutlook (<u>DraftNo</u> , <u>FY</u> , <u>DraftYear</u> , RevenueOutlook, Status)
ServiceContract (<u>ServiceContractNo</u> , <u>OrderNo</u> , <u>ServiceCode</u> , ContractCondition, EndDate)
ServiceOperationPlan (<u>A</u>)
ProjectMember (<u>ProjectMemberNo</u> , <u>ProjectDptCode</u> , Name, StandardServiceUnitPrice, StandardCostUnitPrice)
ProjectMemberOperationRecord (<u>ServiceContractNo</u> , <u>ProjectMemberNo</u> , <u>OperationDates</u> , OperationHours)

Fig. 6 Relation Schema for the Work of Project Record Management (partially incomplete)

When giving answers on the conceptual data model and relation schemata, follow the notation rules found at the beginning of this booklet, including the notation for main keys and external keys. You need not denote whether or not to include 0 in the correspondence relations between entity types.

Subquestion 1

Answer (1) and (2) concerning the addition of an entity type related to the estimating work.

- (1) Add an entity type related to the estimating work in the conceptual data model of Figure 5, and describe its relationship with other entity types.
- (2) Show the relation schema of the entity type added in (1) above. If the relation schema of Figure 6 has to be changed by the addition in (1), name all the relations affected and how they need to be changed. If no change is needed, write "NULL."

Subquestion 2

To satisfy the requirements of profit management, we are going to add the entity types "Management Accounting Code" and "Business Activity Details." Figure 7 shows the conceptual data model for the profit management work. Additionally, Figure 8 shows the attributes and instances of "Business Activity Details" and "Management Accounting Code," the two entity types to be added for profit management. Answer (1) through (3) below, assuming that the change in Subquestion 1 (2) has not been made to the relation schema of Figure 6.

- (1) Complete Figure 7 by adding the entity type(s) and relationship(s) needed to show the relation between the entity type "Management Accounting Code" and other entity types. If you are adding a new entity type, choose an appropriate name for the entity type.
- (2) Following the example of the entity type "Business Activity Details" in Figure 8, write all the attribute names of the entity type "Management Accounting Code" in the blanks on the answer sheet. Use appropriate names for the attributes.
It may not be necessary to fill in all of the blanks on the answer sheet.
- (3) If the draft "Technical support" with draft number "1391430" in the Profit Management Chart of Figure 3 is split, what would the instances of the entity type "Management Accounting Code" be like? Concerning all of the instances related to this draft after the split, follow the example of the entity type "Business Activity Details" in Figure 8 and enter a value in each column. If codes and/or numbers are added due to the addition of instances, use codes or numbers that naturally follow the

codes or numbers before the split. If no value is to be entered in a column, write "NULL."

You need not consider the reference relations with the instances of the entity type "Business Activity Details" in Figure 8. It may not be necessary to fill all the blanks on the answer sheet.

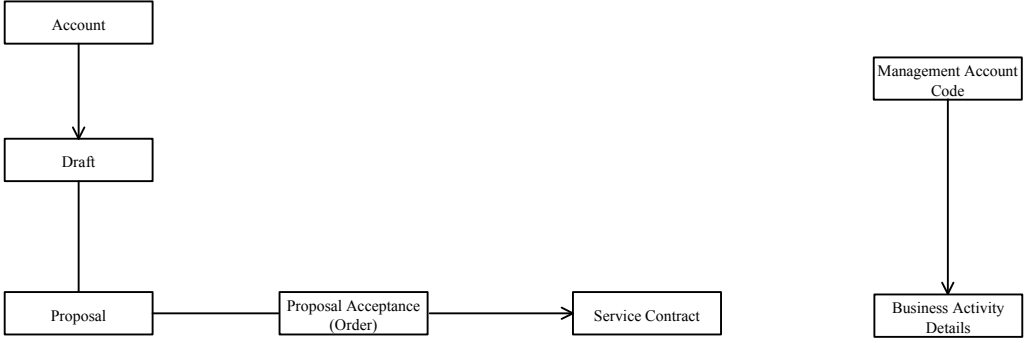


Fig. 7 Conceptual Data Model of the Profit Management Work (partially incomplete)

Business Activity Details						
Attributes	Business Activity Detail No	Management Accounting Code	Date	Personnel Costs	Expenses	Description
Instances	6794738	400580	2005-06-03	20,000	1,500	Meeting
	6794753	400580	2005-06-05	0	35,000	Social
	6795742	400580	2005-07-10	46,000	2,800	Proposal Creation
	⋮	⋮	⋮	⋮	⋮	⋮

Management Accounting Code						
Attributes	Management Accounting Code					
Instances	400580					

Fig. 8 Attributes and Instances of the Entity Type to Be Added for Profit Management (partially incomplete)

Subquestion 3

Answer (1) through (3) below concerning the revenue outlook chart of Figure 4. Assume that the relation schemata of Figure 6 are used without change as tables.

- (1) Give all of the column names to be entered in the blank in the table "ServiceOperationPlan" in Figure 6 which are necessary to produce revenue outlook charts as output, and identify only the main key(s).
- (2) On the revenue outlook chart, if the table structure of Figure 6 is used as is, the total figure of the revenue records may be different from the correct actual value. Explain briefly the reason for this.
- (3) We now discuss inquiries for creating revenue outlook charts. The table below shows, in an organized form, the tables subject to totaling, columns subject to totaling and the calculation formulas, periods for totaling, and other extracted conditions to be added individually, for each draft, concerning inquiries made to compute the FY revenues for existing account new drafts during the second quarter. Describe briefly the conditions to be extracted that are commonly applied to all tables subject to totaling in order to extract existing account new drafts. Also, using the sample entries in the table as references, enter the correct condition for totaling in each of the blanks through .

Table Draft Statuses and Conditions for Totaling for Revenue Outlook Charts

Objects to Be Totaled, Conditions to Be Extracted	Tables Subject to Totaling	Columns Subject to Totaling and the Calculation Formulas	Period for Totaling	Extracted Conditions Added Individually
Prospect	<input type="text" value="B"/>	<input type="text" value="C"/>	<input type="text" value="D"/>	
Proposed			<input type="text" value="E"/>	<input type="text" value="F"/>
Accepted				<input type="text" value="G"/>
Serving	<input type="text" value="H"/>	<input type="text" value="I"/>	<input type="text" value="J"/>	
	Project Department Member Operation Record	Standard Service Unit Price×Operation Hours×Discount Rate	From the beginning of current FY to the present	None

Note) is not shown.

Q2. Read the following description of a construction equipment rental business, and then answer Subquestion.

The company is a construction equipment rental firm with a headquarters and 86 branch offices nationwide. The construction equipment and materials it rents out include items such as high-pressure compressors and pipes (hereinafter, "equipment").

To identify branch offices and customers, the company has established branch office codes and customer codes that are unique company-wide.

[Overview of Equipment Management]

An overview of the equipment managed by the company and the management methods are as follows.

The equipment is broadly broken down into "machines" and "materials". Based on functional and/or dimensional specifications, each piece of equipment is assigned a unique equipment code.

(1) In addition to the specifications-based method, machines are managed individually. The base unit is termed a "machine item" and is assigned a company-wide unique number. A list of some machine item numbers is shown in Figure 1. The branch office code (as shown in Fig. 1) represents the branch office where the machine item is registered as an asset.

Machine item number	Equipment code	Equipment name	Functional specifications	Branch office code
10001	712301	High-pressure compressor	15 HP, ...	101
10002	712301	High-pressure compressor	15 HP, ...	102
10003	712302	High-pressure compressor	20 HP, ...	101
10004	833001	Welding machine	Rated at 350 A, ...	101
⋮	⋮	⋮	⋮	⋮

Fig. 1 Machine List

(2) Figure 2 lists materials managed by the company. Materials are managed solely on the basis of these specifications.

Equipment code	Equipment name	Dimensional specifications
112301	Portable toilet A	1,530 x 900 x 2,615; 450 L, ...
112302	Portable toilet B	1,130 x 780 x 2,400; 200 L, ...
112501	Flame retardant sheet	1.82 m x 5.1 m, ...
⋮	⋮	⋮

Fig. 2 Materials List

[Overview of Business Processes at Branch Offices]

Branch offices conduct four business processes: reservations, equipment rentals, equipment returns, and equipment transfers. Each business processes can be summarized as follows.

(1) Reservation Process

This is a process for taking customer reservations for machines. The number of machines is limited, so as a rule, customers must make reservations beforehand. If a customer wants to rent a machine without a reservation, this reservation process will be conducted before the machine is rented out. Branch offices receive reservations from customers, check the required specifications, check the pick-up and return date, and determine which machine item is to be assigned before producing a machine rental reservation slip (Figure 3). The reservation number on the reservation slip is a unique number company-wide. If a customer cancels their reservation, the cancellation date is printed on the reservation slip. Similarly, if the planned pick-up or return date is changed, the reservation slip is updated. If a customer wants a machine with different functional specifications, the original machine reservation is canceled and a new reservation is made.

<u>Machine Rental Reservation Slip</u>	
Customer code:	1011010
Customer name:	XXXXXXXXXX
Telephone number:	045-XXX-XXXX
	Branch office code: 101
	Branch office name: Yokohama
<hr/>	
Details of Machine Rental Reservation	
Reservation number	100011
Date reservation made	May 10, 2004
Name of equipment requested	High-pressure compressor
Functional specifications	20 HP, ...
Equipment code	712302
Machine item number	10003
Rental date	June 5, 2004
Scheduled return date	July 5, 2004
Cancellation date	

Fig. 3 Sample Machine Rental Reservation Slip

(2) Rental Process

This business process is for renting out equipment based on the reservations.

For materials: Branch offices receive reservations from customers, check the availability of the required material, check the dimensional specifications and pick-up date, and produce a rental slip when the request is received (Figure 4).

For machines: On the day of the rental, the branch office transcribes the details of the machine rental reservation slip to the rental slip. However, there may be cases where the machine item assigned at the time of reservation is unavailable. In such case, an alternative machine item of the same functional specifications may be rented as a substitute.

If a customer requests to rent multiple pieces of equipment with the same rental and return dates, these are listed on a single rental slip.

The rental number on a rental slip is a number that is unique company-wide. The rental number and rental date are filled in on the day of rental. A copy of the rental slip for each rental is sent to headquarters.

<u>Rental Slip</u>					
Customer code: 1011010		Rental number: 200111			
Customer name: XXXXXXXXXXXX		Rental date: June 5, 2004			
Address: YYYY Yokohama, Kanagawa Pref.		Scheduled return date: July 5, 2004			
Telephone number: 045-XXX-XXXX		Branch office code: 101			
		Branch office name: Yokohama			
Line number	Equipment code	Equipment name	Functional or dimensional specifications	Machine item number	Reservation number or rental quantity
01	712302	High-pressure compressor	20 HP, ...	10003	100011
02	112302	Portable toilet B	1,130 x 780 x 2,400; 200 L, ...	-	2
03	112501	Flame retardant sheet	1.82 m x 5.1 m, ...	-	10

Fig. 4 Sample Rental Slip

(3) Rental Return Process

This business process is for receiving returned equipment based on a return notification from a customer.

Branch offices produce return slips when equipment is returned from customers (Figure 5). The return number on a return slip is unique company-wide. A copy of the return slip for each return is sent to headquarters.

<u>Return Slip</u>					
Customer code:	1011010	Return number:	300121		
Customer name:	XXXXXXXXXX	Return date:	July 5, 2004		
Address:	YYYYY Yokohama, Kanagawa Pref.	Branch office code:	101		
Telephone number:	045-XXX-XXXX	Branch office name:	Yokohama		
Line number	Equipment code	Equipment name	Functional or dimensional specifications	Machine item number	Return quantity
01	712301	High-pressure compressor	15 HP, ...	10002	-
02	712302	High-pressure compressor	20 HP, ...	10003	-
03	112302	Portable toilet B	1,130 x 780 x 2,400; 200 L, ...	-	5
04	112501	Flame retardant sheet	1.82 m x 5.1 m, ...	-	15

Fig. 5 Sample Return Slip

(4) Equipment Transfer Process

This business process is for transferring equipment to other branch offices to balance equipment inventory.

The branch office transferring a piece of equipment draws up a transfer slip at the time of transfer. The transfer number is a number that is unique company-wide. A copy of the transfer slip for each transfer is sent to headquarters.

A sample of a machine transfer slip and a material transfer slip is shown in Figure 6 and Figure 7.

<u>Machine Transfer Slip</u>	
Transfer number:	400123
Source office code:	101
Source office name:	Yokohama
Destination office code:	102
Destination office name:	Kawasaki
Equipment code:	712301
Equipment name:	High-pressure compressor
Machine item number:	10002
Transfer date:	July 30, 2004

Fig. 6 Sample Machine Transfer Slip

<u>Material Transfer Slip</u>	
Transfer number:	400124
Source office code:	101
Source office name:	Yokohama
Destination office code:	103
Destination office name:	Yokosuka
Equipment code:	112302
Equipment name:	Portable toilet B
Transfer quantity:	30
Transfer date:	July 30, 2004

Fig. 7 Sample Material Transfer Slip

[Overview of Business Processes at Headquarters]

The headquarters keeps track of where machines are located and manages material inventory based on the rental, return, and transfer slips sent from the branch offices. Each business process can be summarized as follows.

(1) Process for Keeping Track of Machines

Machines are the key element in the company's operation. The headquarters prepares a tracking list for all the machines, using information from the rental, return, and transfer slips (Figure 8). If a particular machine item is not rented out, the branch office code of the office where the machine is now located is entered into the branch office code of present location. If the rental information indicates that the machine is currently being rented, the customer code of the customer renting it is entered in the customer code field.

Machine item number	Equipment code	Equipment name	Functional specifications	Home branch office code	Branch office code of present location	Customer code of the current renter
10001	712301	High-pressure compressor	15 HP, ...	101	-	1011010
10002	712301	High-pressure compressor	15 HP, ...	102	-	1011020
10003	712302	High-pressure compressor	20 HP, ...	101	101	-
10004	833001	Welding machine	Rated at 350 A, ...	101	102	-
⋮	⋮	⋮	⋮	⋮	⋮	⋮

Fig. 8 Machine Location List

(2) Material Inventory Management Process

Two lists are prepared from materials information on the rental, return, and transfer slips: a materials inventory list classified by branch office (Figure 9) and a list indicating materials currently in use by customers (Figure 10).

Branch office code	Equipment code	Equipment name	Dimensional specifications	Quantity in inventory
101	112301	Portable toilet A	1,530 × 900 × 2,615; 450 L, ...	50
101	112302	Portable toilet B	1,130 × 780 × 2,400; 200 L, ...	15
101	112501	Flame retardant sheet	1.82 m × 5.1 m, ...	350
⋮	⋮	⋮	⋮	⋮

Fig. 9 Materials Inventory List, Classified by Branch Office

Customer code	Customer name	Equipment code	Equipment name	Dimensional specifications	Quantity rented
1011010	XXXXXXXXXX	112302	Portable toilet B	1,130 × 780 × 2,400; 200 L, ...	2
1011010	XXXXXXXXXX	112501	Flame retardant sheet	1.82 m × 5.1 m, ...	15
⋮	⋮	⋮	⋮	⋮	⋮

Fig. 10 List of Materials Currently in Use by Customers

In your answers, please follow the Notation Rules given at the beginning of the exam. Also follow the instructions below.

- (i) If identifiable subtypes exist, describe both supertypes and subtypes. In this case, describe relationships with other entity types, whether with supertypes or subtypes.**
- (ii) Ensure that a set of attributes comprising each entity type satisfies the conditions of the third normal form.**

Subquestion

Answer the following questions on rental business processes for construction equipment.

- (1) Complete the conceptual data model shown in Figure 11 below, meeting the following conditions.
 - (i) List additional entity types inside the corresponding stitched line rectangular frames for reserving, renting, returning, and transferring of equipment.
 - (ii) For entity types other than the above four business processes, list them within the stitched line rectangular frame for the “master and inventory related”.
As you do this, fill in the correct entity type names in the blank rectangular entity type boxes. Note that there are also other entity types inside the stitched line rectangular frame for the “master and inventory related” that are not indicated with blank rectangles.
 - (iii) Omit relationships for entity types "branch office" and "customer."
- (2) Regarding the attributes of the conceptual data model completed in (1) above, complete the entity type attribute lists (Tables 1 through 5 below) meeting the following conditions, using the portion that is partially filled in Table 1 as an example.
 - (i) The attributes of entity types given as examples are complete, except for the referenced entity type name.
 - (ii) Complete tables 1 through 5 for the entity types in Fig. 11: table 1 for master and inventory related, table 2 for reservation process, table 3 for rental process, table 4 for return process and table 5 for transfer process.
 - (iii) If you use attribute names other than the names given in this question, or figures, define them in the description field.
 - (iv) List attributes of the same entity type on consecutive lines. Skip at least one line to separate them from attributes of other entity types.
Note that entity type names that are repeated on the following line may be abbreviated. Use a ditto mark ["] to indicate this abbreviation.

- (v) Indicate with circles in the primary key field for attributes that are primary keys, and foreign key fields for foreign keys. If they are both primary and foreign, circle both fields.
- (vi) For attributes that are foreign keys, write the referenced entity type name.
- (vii) Also fill in foreign-key attributes of entity types "branch office" and "customer" in the attribute list.

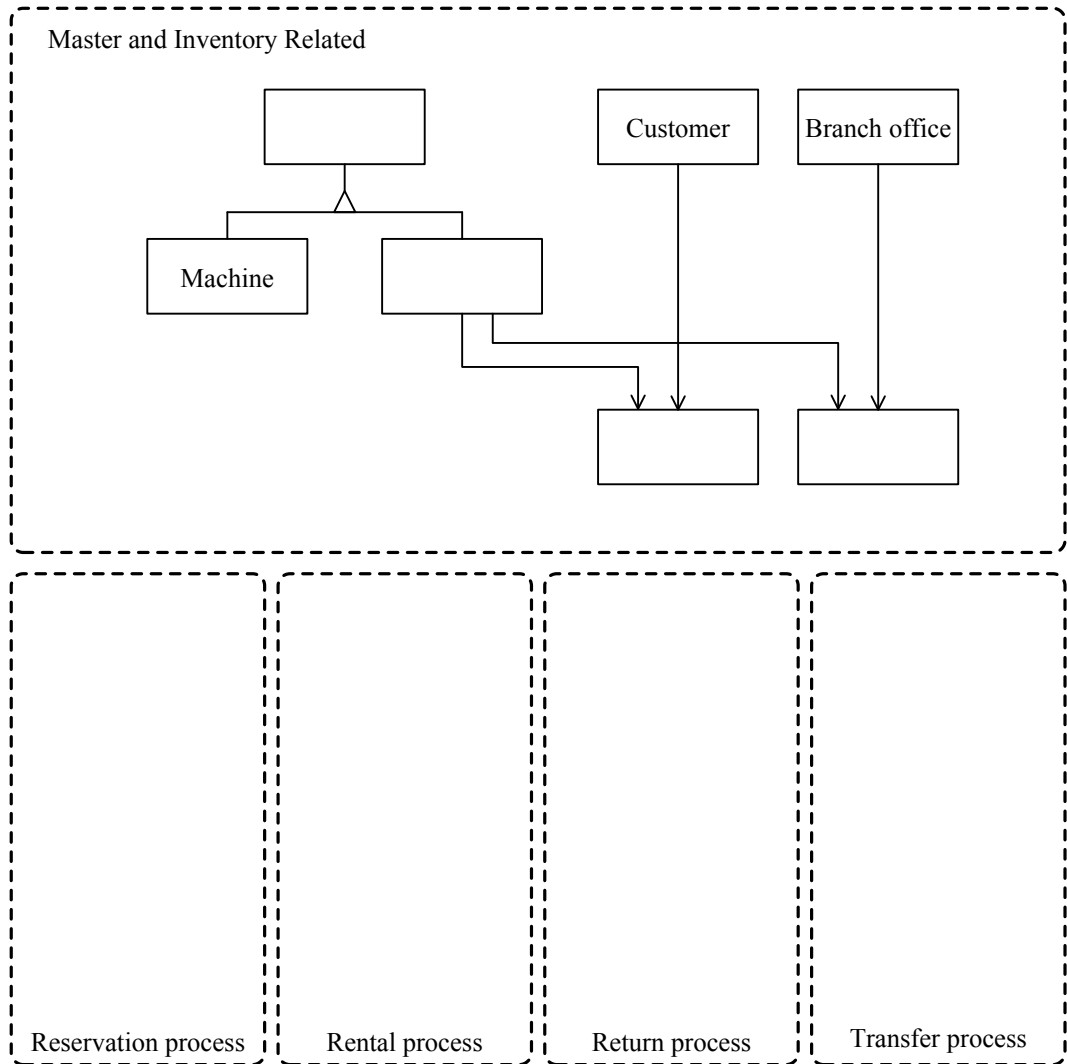


Fig. 11 Conceptual Data Model (partial)

Table 1 List of Attributes of Entity Types (Master and Inventory Related)

Entity type name	Attribute name	Primary key	Foreign key	Referenced entity type name	Description
Branch office	Branch office code	○			
"	Branch office name				
Customer	Customer code	○			
"	Customer name				
"	Address				
"	Telephone number				
Machine	Equipment code	○	○		
"	Functional specifications				
⋮	⋮	⋮	⋮	⋮	⋮

Note: The shaded portion is already complete.

Table 2 List of Attributes of Entity Types (Reservation Process)

Entity type name	Attribute name	Primary key	Foreign key	Referenced entity type name	Description

Table 3 List of Attributes of Entity Types (Rental Process)

Entity type name	Attribute name	Primary key	Foreign key	Referenced entity type name	Description

Table 4 List of Attributes of Entity Types (Return Process)

Entity type name	Attribute name	Primary key	Foreign key	Referenced entity type name	Description

Table 5 List of Attributes of Entity Types (Transfer Process)

Entity type name	Attribute name	Primary key	Foreign key	Referenced entity type name	Description