Chapter 5
Data and Process Modeling

Chapter Objectives

- Describe data and process modeling concepts and tools, including **Data Flow Diagrams** (資料流程圖), a data dictionary, and process descriptions
- Describe the symbols used in data flow diagrams and explain the rules for their use
- Draw data flow diagrams in a sequence, from general to specific
- Explain how to **level and balance** (分層和平衡) a set of data flow diagrams

Chapter Objectives

- Describe how a **Data Dictionary**(資料字典) is used and what it contains
- Use process description tools, including structured English, decision tables, and decision trees
- Describe the relationship between logical and physical models

學習重點

- 描述邏輯模型和實體模型之間的關係。
- 說明資料流程圖(DFD)。
- 畫出資料流程圖的基本符號。
- 說明繪製資料流程圖時的六大原則。
- 畫出環境圖 (Context Diagram)。
- 畫出圖0的資料流程圖 (Diagram 0)。
- 說明如何對資料流程圖進行分層(level)和平衡(balance)。
- 建立資料字典(DD)。
- 使用流程描述工具, 包括:結構英文, 決策表,決策樹

Logical vs. Physical Models

Introduction

- **Logical Model**邏輯模型:

Shows **what** the system must do, regardless of how it will be implemented physically

- **Physical Model**實體模型:

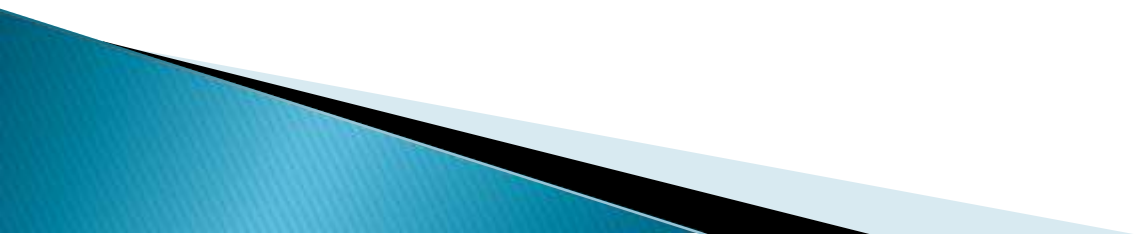
Describes **how** the system will be constructed

In Chapters 5 & 6, you will develop a logical model of the proposed system and document the system requirements

邏輯模型與實體模型

- 許多分析師會依循四模型法(four-model approach)
  - 實體模型 **Physical Model**
  - 邏輯模型 **Logical Model**
  - 新系統邏輯模型 **New System Logical Model**
  - 新系統實體模型 **New System Physical Model**

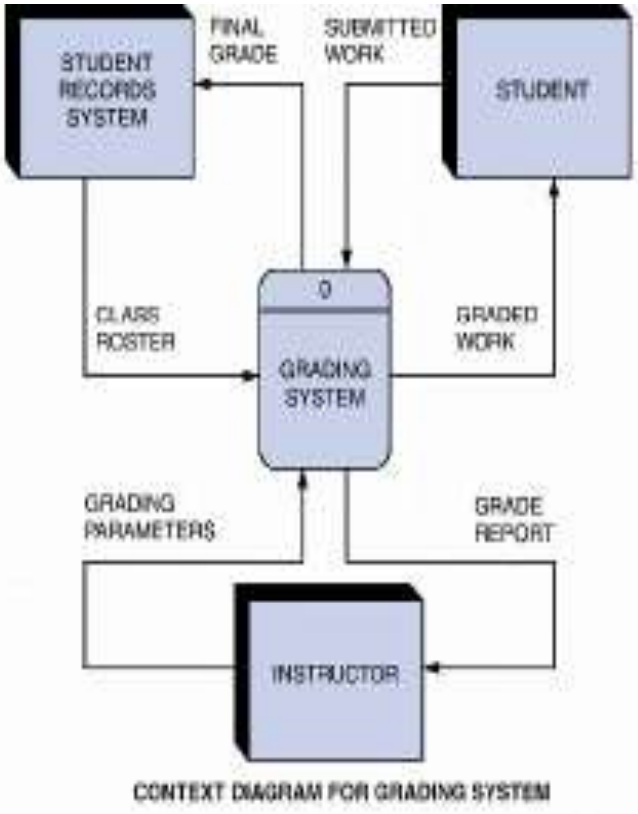
Data Flow Diagrams



Overview of Data and Process Modeling Tools

- Systems analysts use many graphical techniques to describe an information system

- A data flow diagram (DFD) uses various symbols to show how the system transforms input data into useful information



CONTEXT DIAGRAM FOR GRADING SYSTEM

Data Flow Diagrams

- A data flow diagram (DFD) shows how data moves through an information system but does not show program logic or processing steps
- A set of DFDs provides a logical model that shows what the system does, not how it does it

Data Flow Diagrams (Cont. 1)

- DFD Symbols

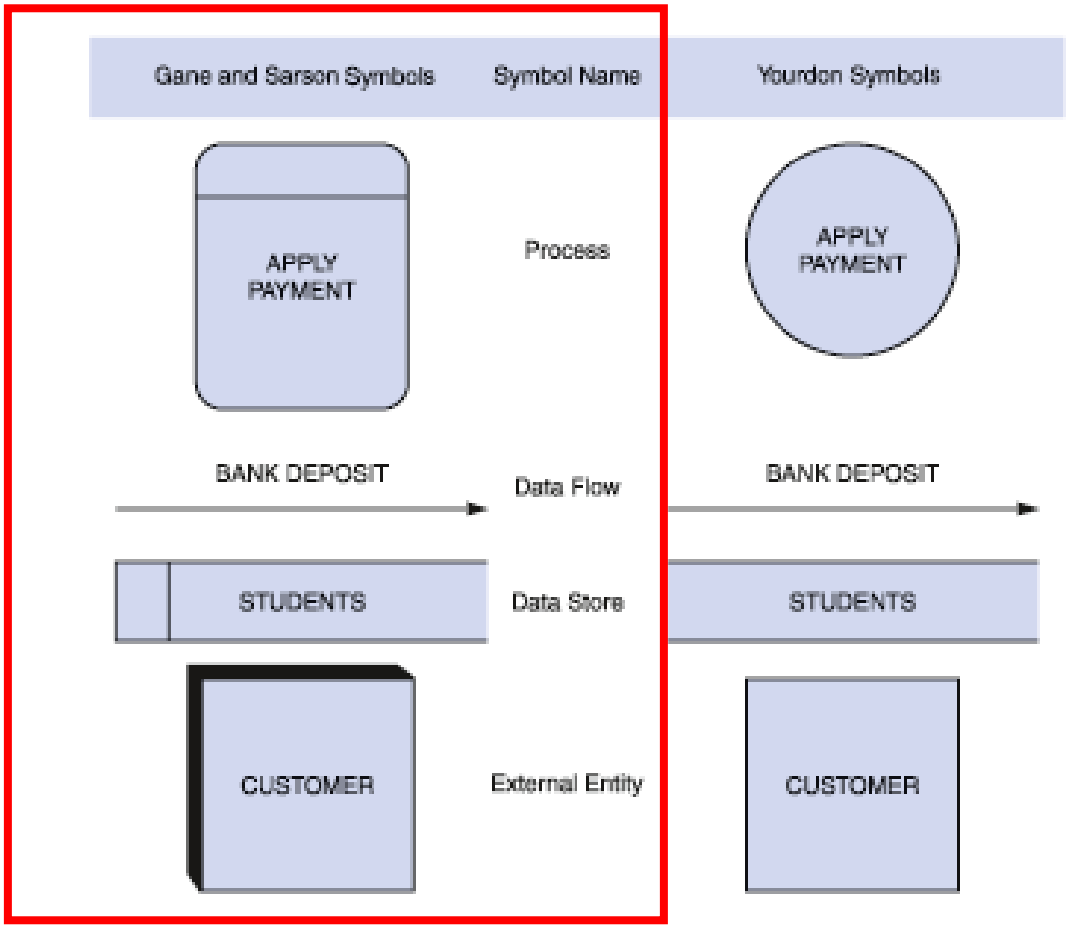


FIGURE 5-1 Data flow diagram symbols, symbol names, and examples of the Gane and Sarson and Yourdon symbol sets

<表示符號>	<名稱>	< 應用對象>
	外部實體 (外部代理人) External Entity	系統外部資料的來源或是目的。主要是人、機器或是其他系統
	資料流 Data Flow	系統內部資料的流動方向，通常是從資料來源或是處理傳送資料至外部實體或資料儲存
	資料處理 Data Process	系統內部的處理程序，例如資料的分類、加工或是計算等作業
	資料儲存 Data Stores	系統內部之資料儲存用途，它與實體關係圖的實體是互相對應

資料流程圖的表示符號

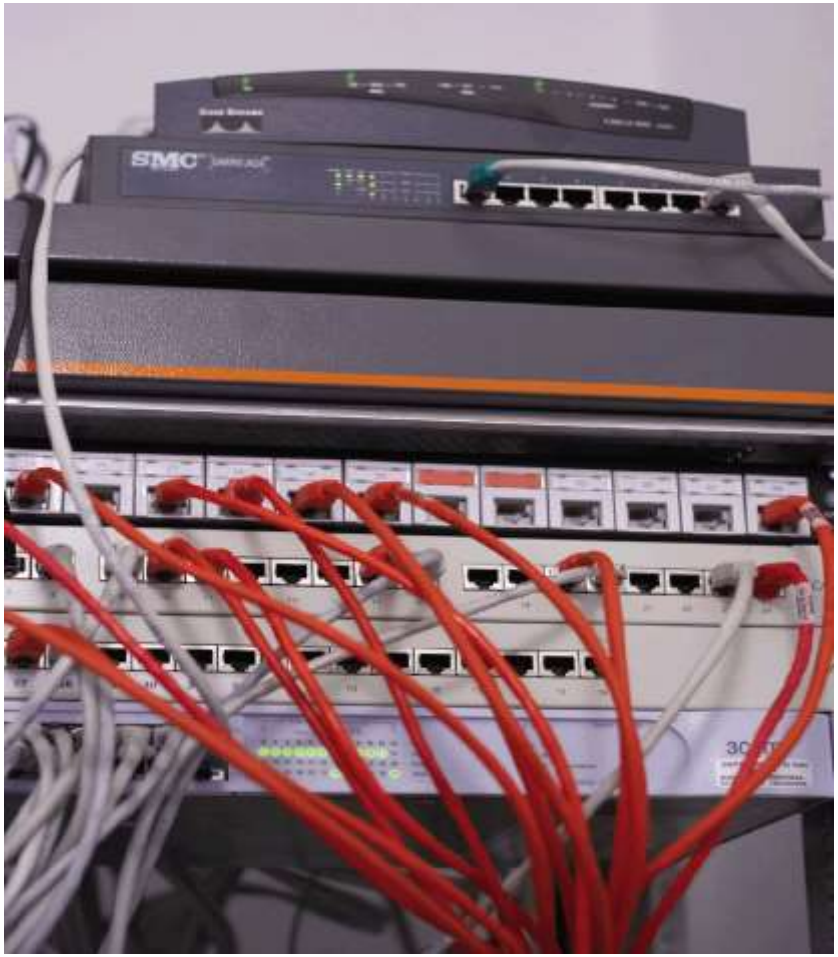
Data Flow Diagrams (Cont. 2)

Process Symbol

- Must have at least one input and at least one output
- Contains business logic that transforms the data
- Process name identifies its function (verb)
- Examples" : "apply rent payment" or "calculate commission
- In DFDs, a process symbol can be referred to as a black box

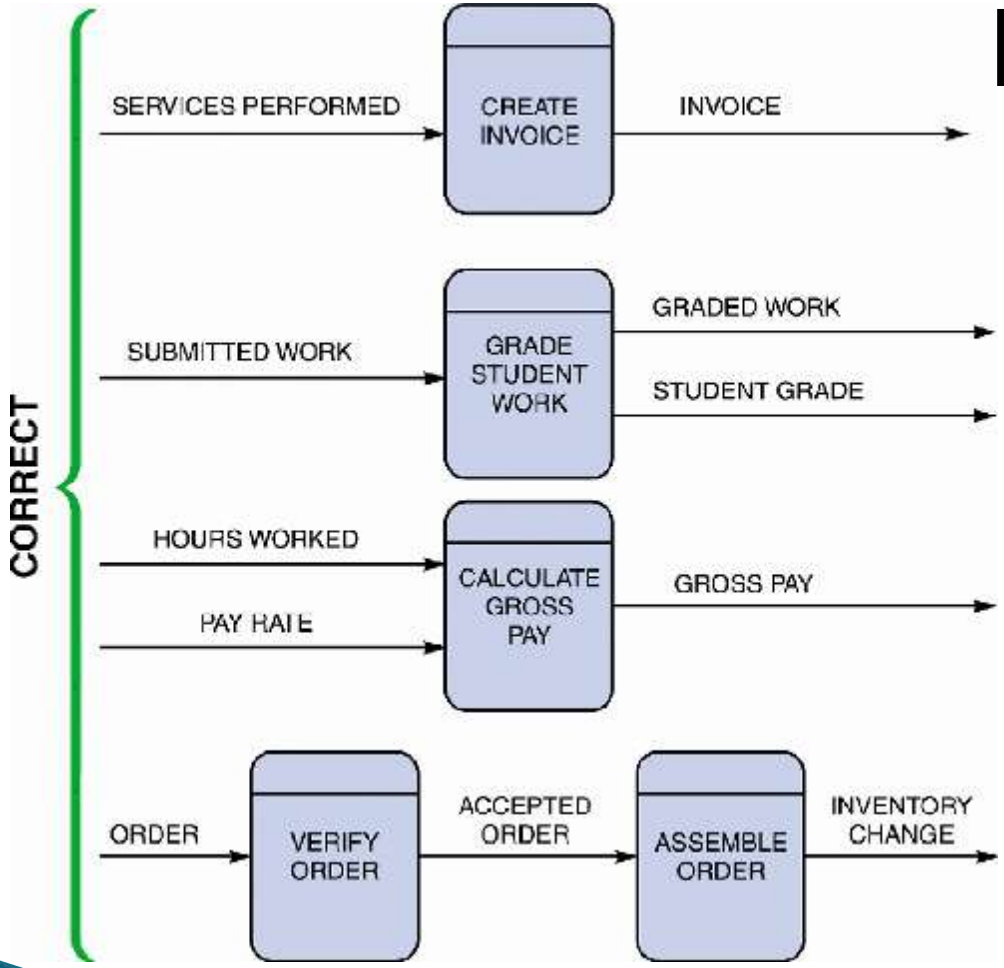
Data Flow Diagrams

Referred to as a
black box



p.199 FIGURE5-4

Data Flow Diagrams (Cont. 3)



DFD Symbols

Data flow symbol

- Represents one o more data items
- The symbol for a data flow is a line with a single or double arrowhea

FIGURE 5-3 Examples of correct combinations of data flow and process symbols

The Difference Between an Invoice and a Receipt

- request payment,
- proof of payment.

Data Flow Diagrams (Cont. 4)

- **Data Flow Symbol**
  - Following data flow and process combinations must be avoided

Spontaneous generation (自發性)

Black holes

Gray holes

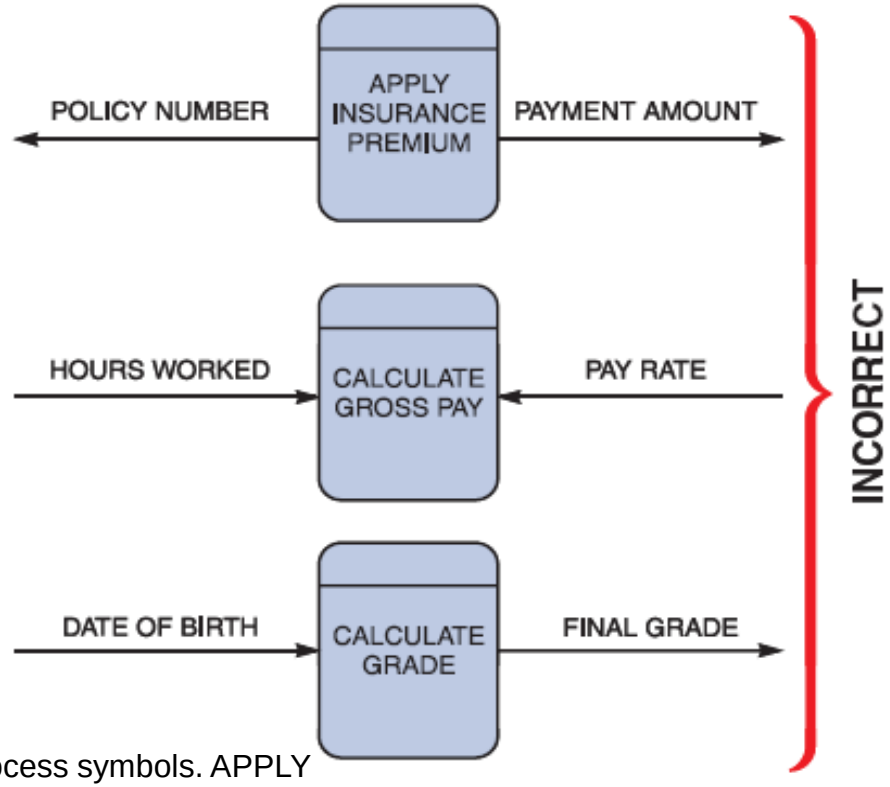


FIGURE 5-4 Examples of incorrect combinations of data flow and process symbols. APPLY INSURANCE PREMIUM has no input and is called a spontaneous generation process. CALCULATE GROSS PAY has no outputs and is called a black hole process. CALCULATE GRADE has an input that is obviously unable to produce the output. This process is called a gray hole

Data Flow Diagrams (Cont. 5)

Data Store symbol

- Represent data that the system stores
- A DFD does not show the detailed contents of a data store — the specific structure and data elements are defined in the **data dictionary**
- A data store must be **connected to a process with a data flow**

Data Flow Diagrams

- DFD Symbols
  - Data store symbol
    - Represent data that the system stores
    - The physical characteristics of a data store are unimportant because you are concerned only with a logical model

Data Flow Diagrams (Cont. 6)

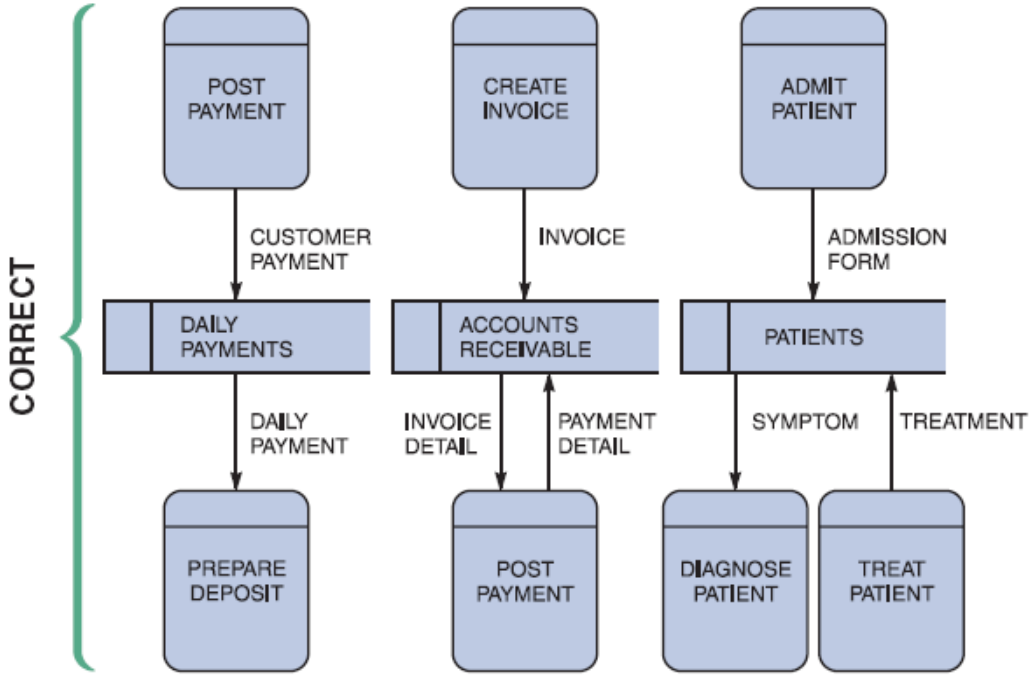
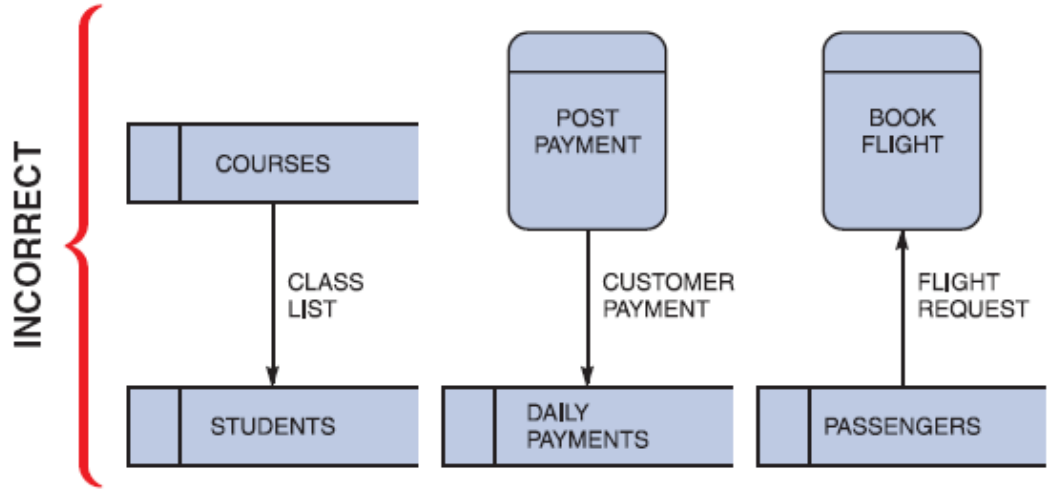
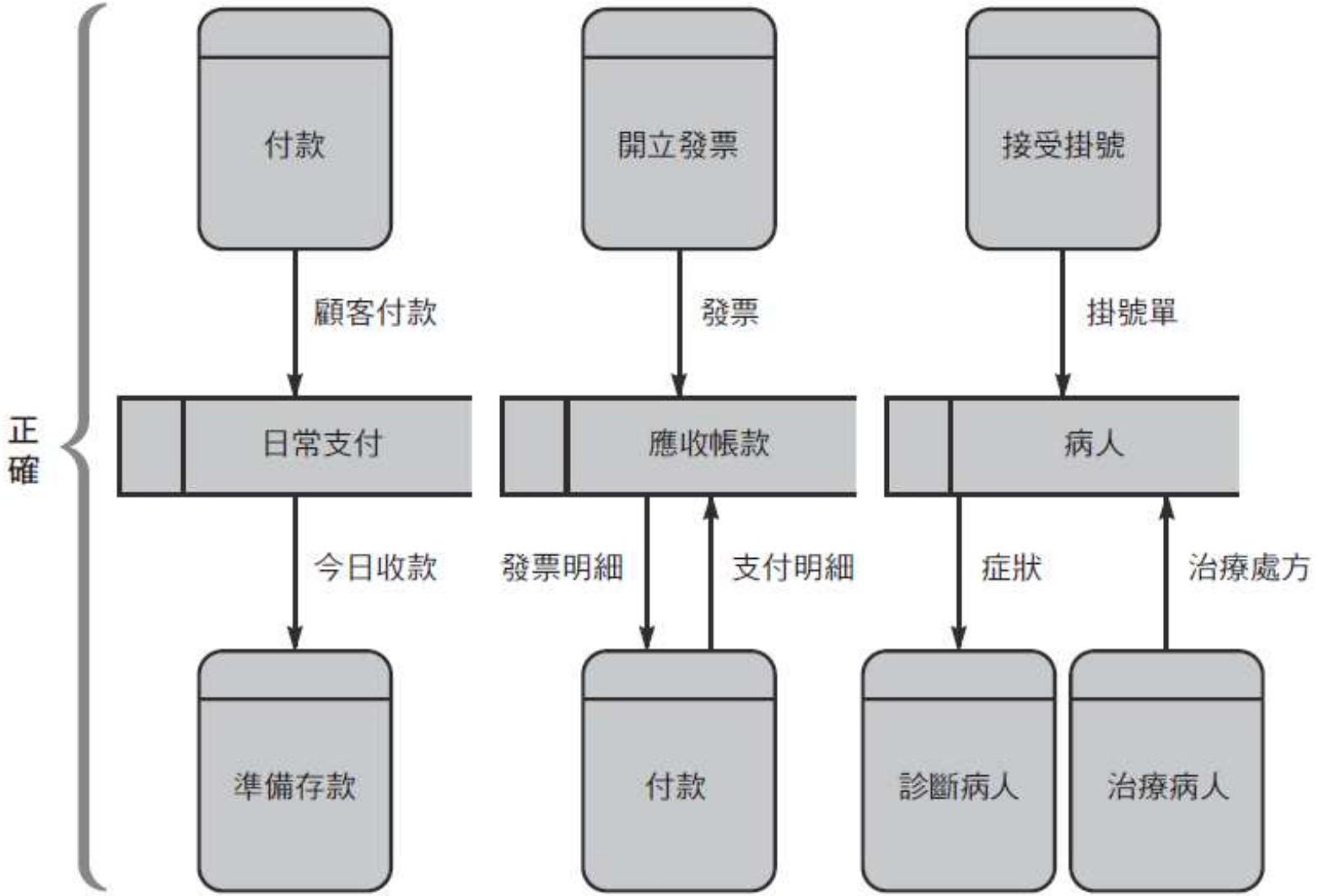


FIGURE 5-5 Examples of correct uses of data store symbols in a data flow diagram

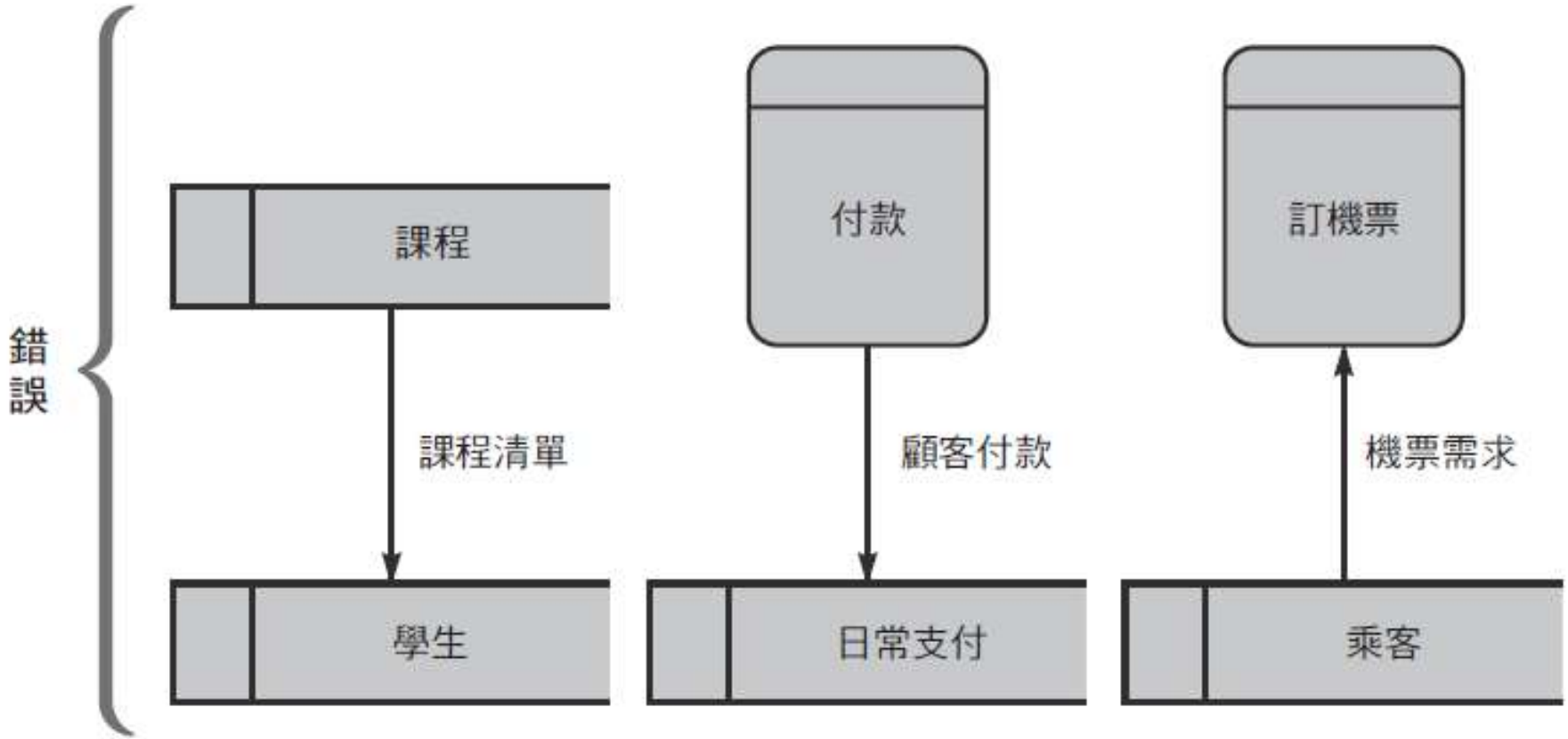
FIGURE 5-6 Examples of incorrect uses of data store symbols: Two data stores cannot be connected by a data flow without an intervening process, and each data store should have an outgoing and incoming data flow



正確使用資料儲存的範例

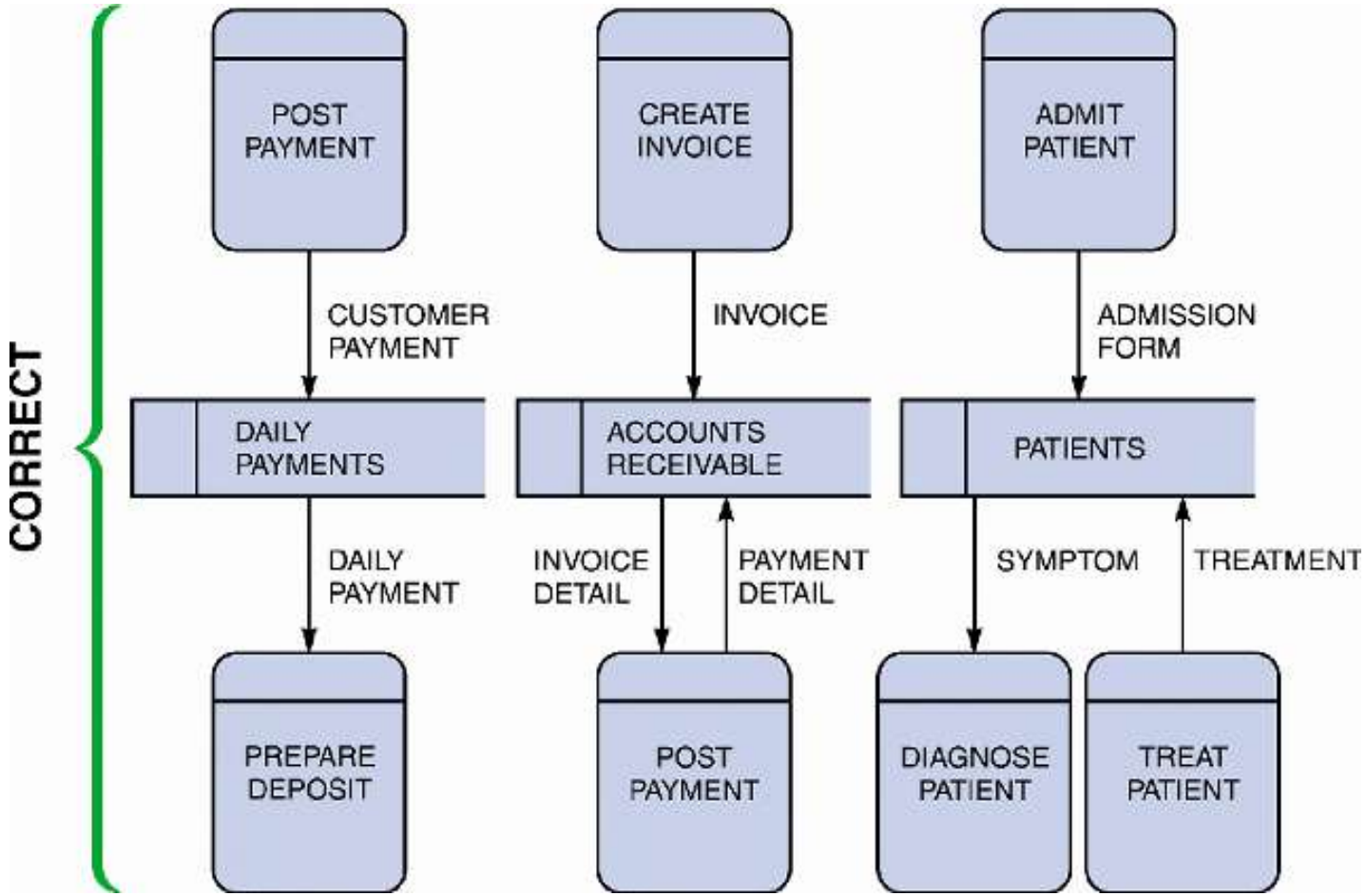


資料儲存的錯誤範例

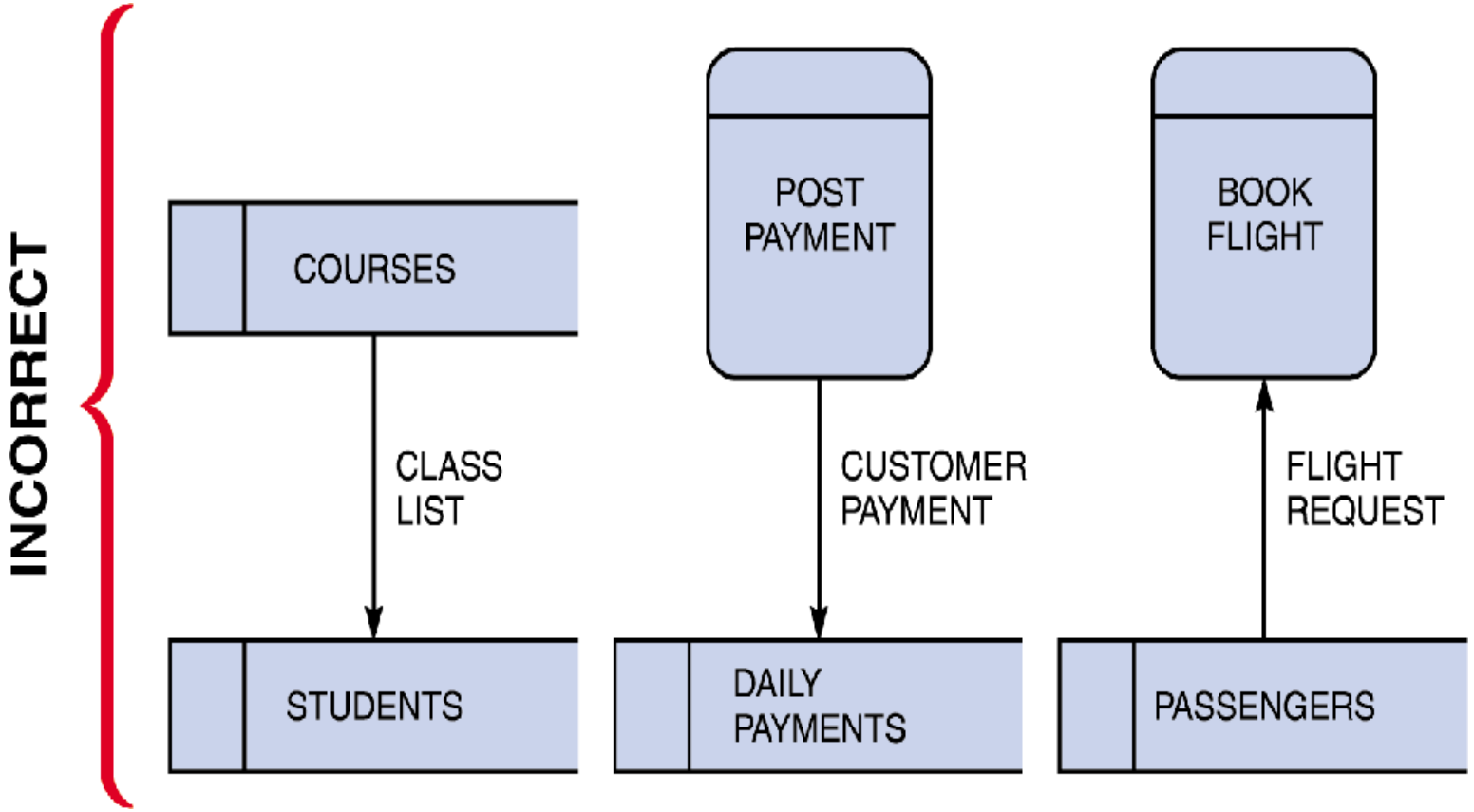


第5章 資料與流程塑模 第160頁

正確使用資料儲存的範例



資料儲存的錯誤範例



p.202 FIGURE5-8

Data Flow Diagrams (Cont. 7)

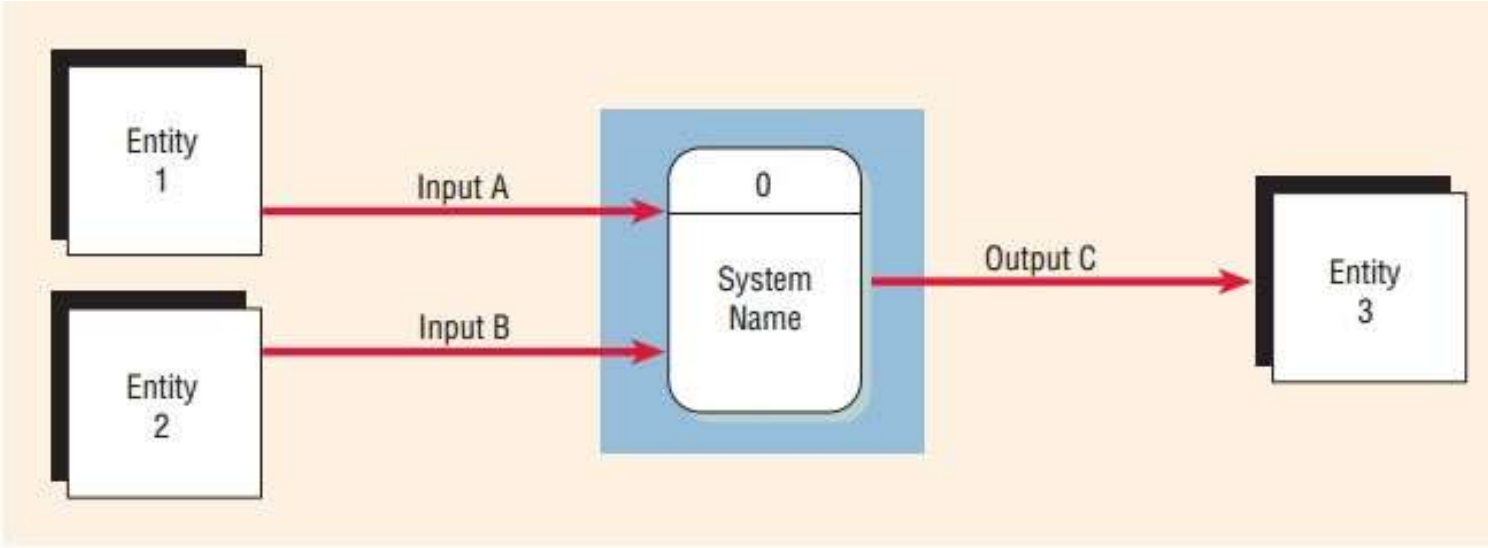
Entity Symbol

- Shows how the system interfaces with the outside world
- A DFD shows only **external entities** that provide data **to** the system or receive output **from** the system
- DFD entities also are called **terminators** because they are data origins or final destinations
- Each entity must be connected to a process by a data flow

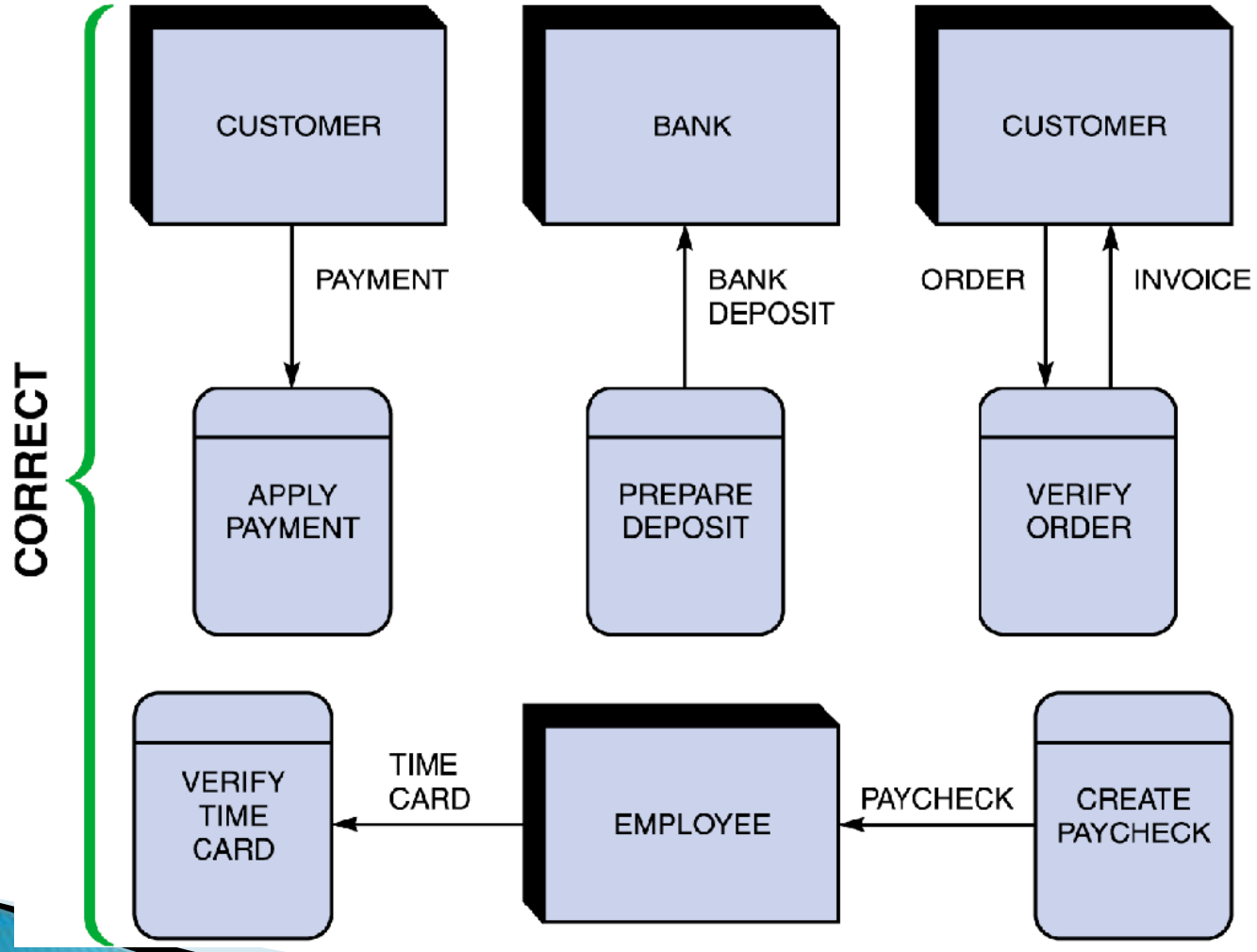
實體(Entity) Symbol
外部實體

Name of the entity appears inside the symbol

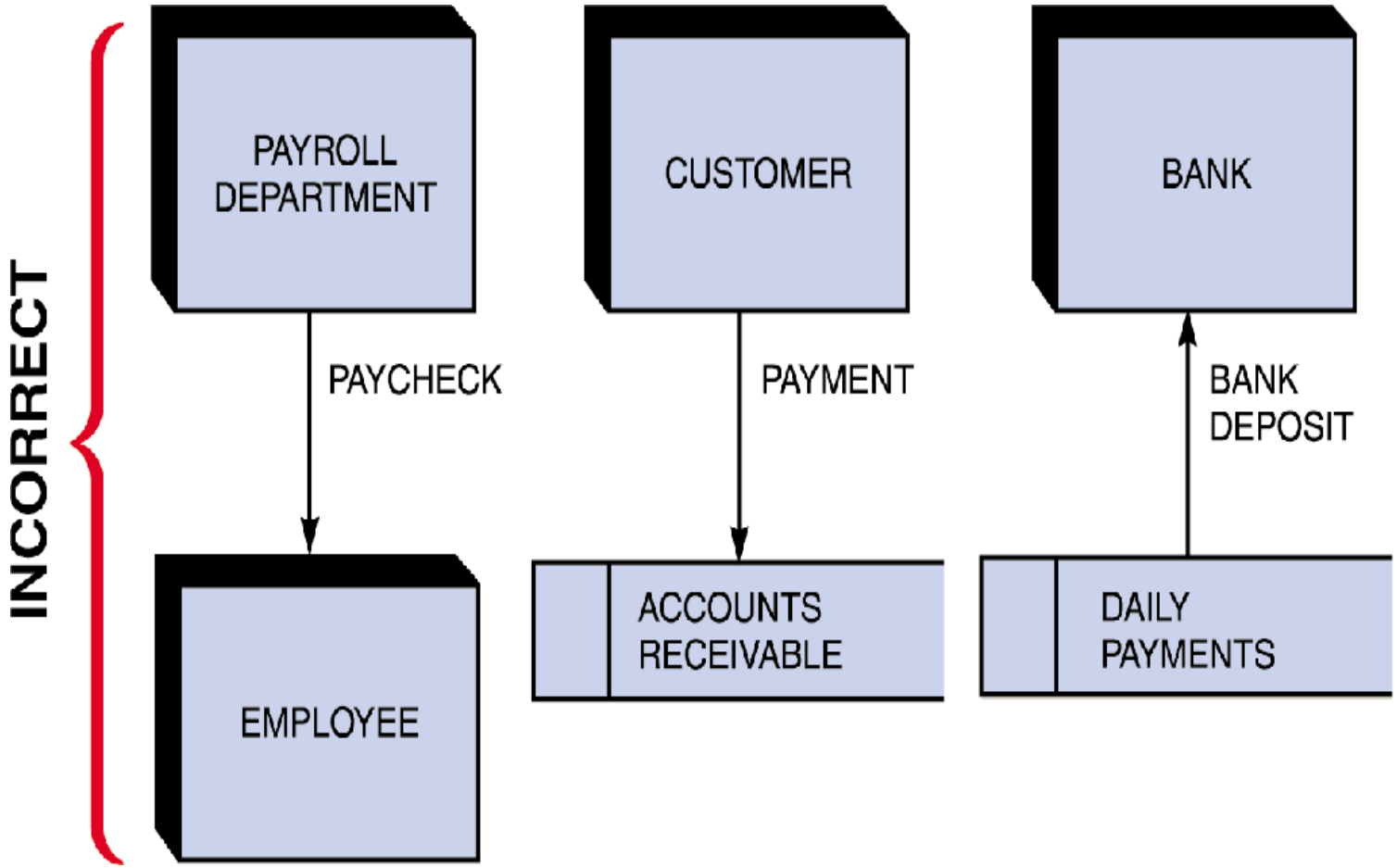
- Terminators終端
- Source來源端
- Sink接收端



Entity的正確範例



Entity的錯誤範例



p.203 FIGURE5-10

課堂練習

判斷DFD符號對錯

Data Flow Diagrams

- Keep in mind:
  - All flow lines must be labeled
  - Large processes can be broken down into smaller components

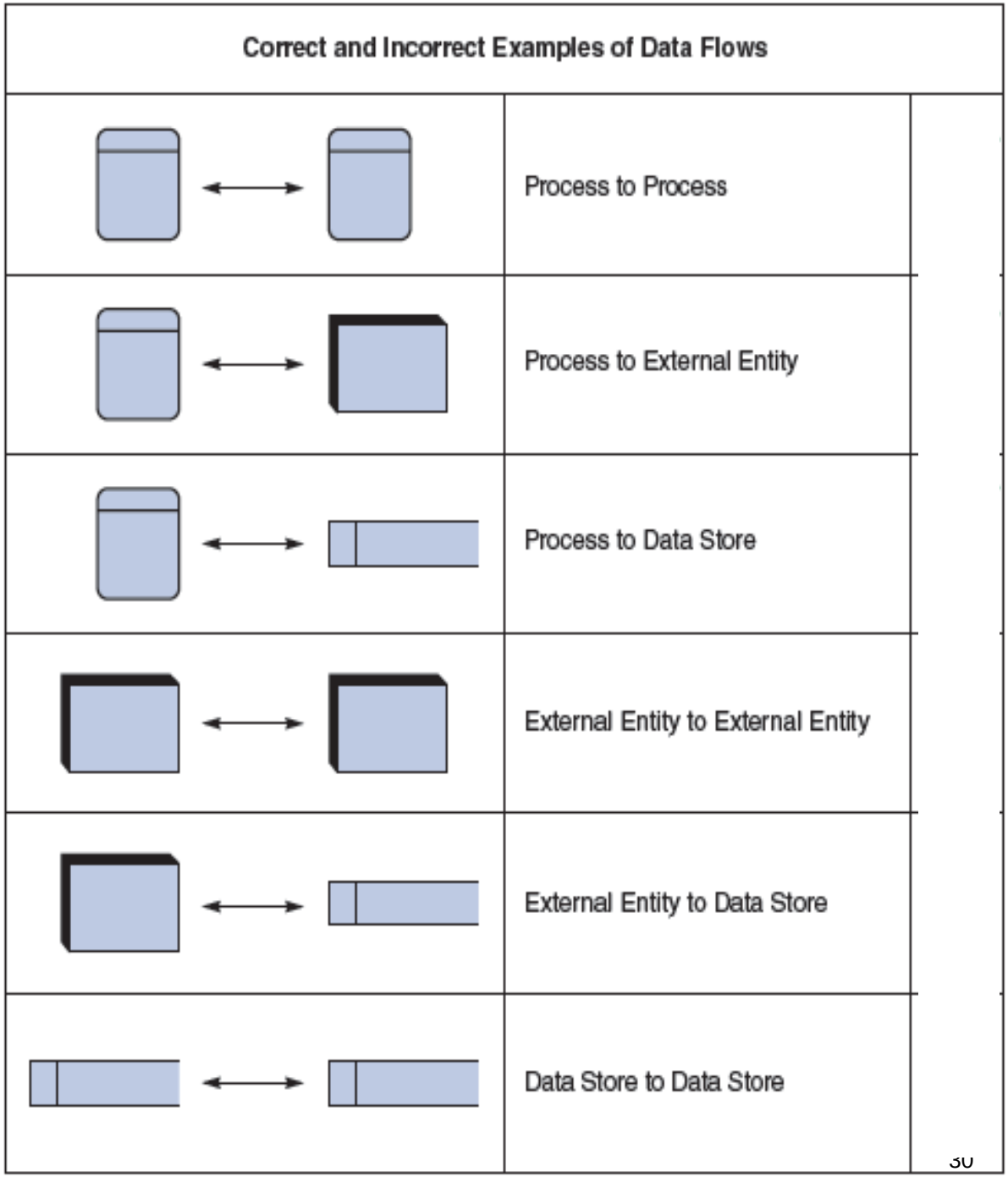
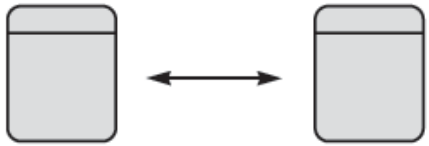
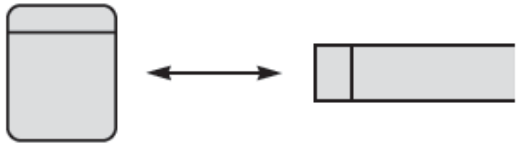
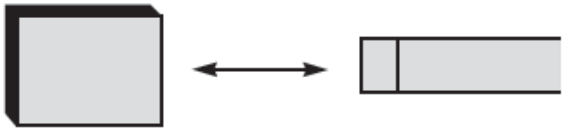


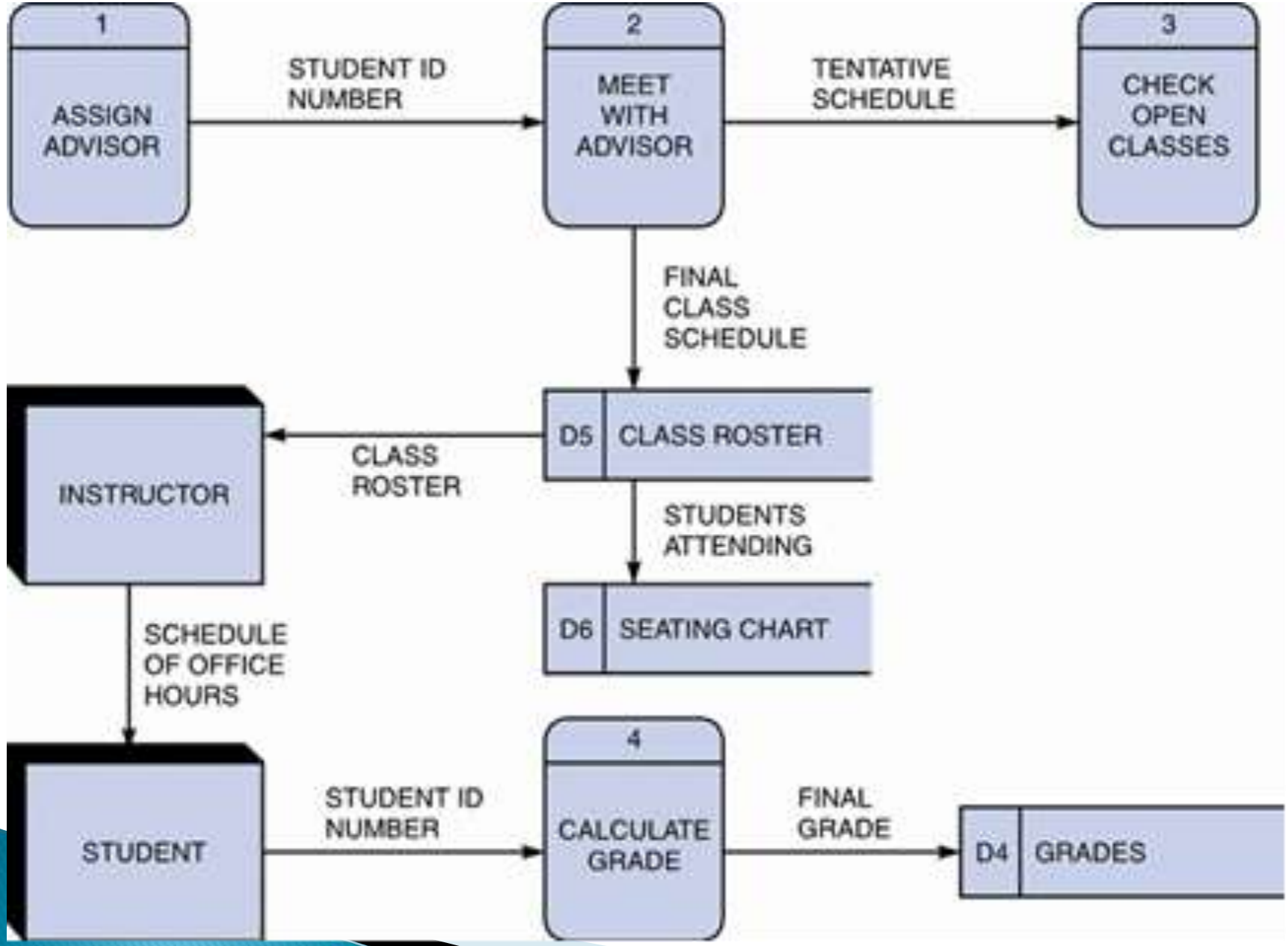
FIGURE 5-9 Examples of correct and incorrect uses of data flows

資料流符號的正確和錯誤使用範例		
	程序與程序之間	✓
	程序與外部實體之間	✓
	程序與資料儲存處之間	✓
	外部實體與外部實體之間	✗
	外部實體與資料儲存處之間	✗
	資料儲存處與資料儲存處之間	✗

課堂練習

大家來找碴

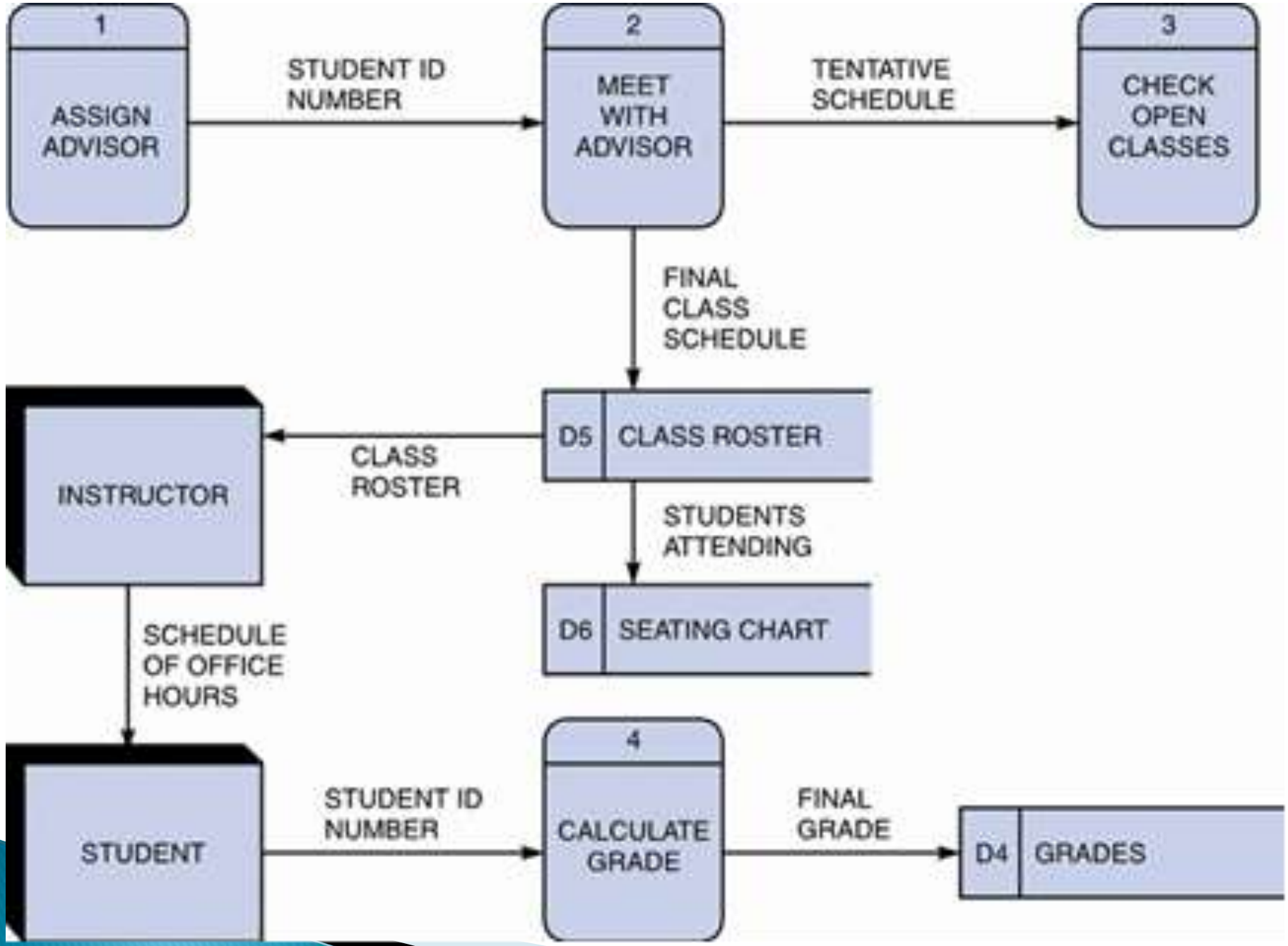
請直接將錯誤標示及說明在圖片上,
將結果拍照或截圖上傳到ZUVIO


1
ASSIGN ADVISOR
STUDENT ID NUMBER
2
MEET WITH ADVISOR
TENTATIVE SCHEDULE
3
CHECK OPEN CLASSES
FINAL CLASS SCHEDULE
INSTRUCTOR
CLASS ROSTER
D5
CLASS ROSTER
STUDENTS ATTENDING
D6
SEATING CHART
SCHEDULE OF OFFICE HOURS
STUDENT
STUDENT ID NUMBER
4
CALCULATE GRADE
FINAL GRADE
D4
GRADES

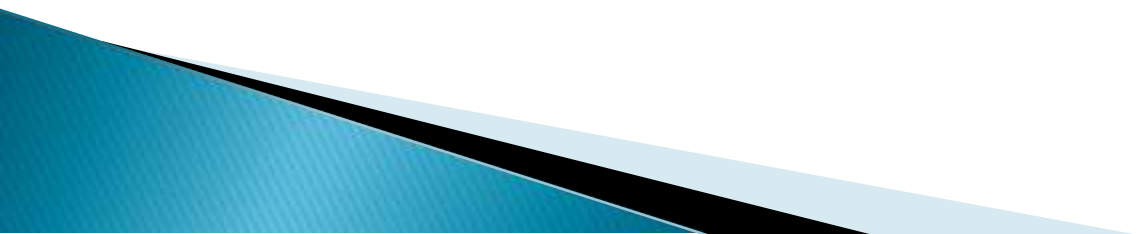
- Big Ten University You are the IT director at Big Ten University. As part of a training program, you decide to draw a DFD that includes some obvious mistakes to see whether your newly hired junior analysts can find them. You came up with the diagram 0 DFD shown in Figure 4-22. Based on the rules explained in this chapter, how many problems should the analysts find?

- *The DFD is presented as diagram 0, and it should follow the rules presented in the text. Some of the errors include the following:*

1. *ASSIGN ADVISOR, process 1, is a miracle.*
2. *CHECK OPEN CLASSES, process 3, is a black hole.*
3. *CALCULATE GRADE, process 4 is a gray hole.*
4. *INSTRUCTOR and STUDENT external entities cannot be connected with a data flow.*
5. *INSTRUCTOR entity does not connect to a process.*
6. *GRADES data store is a black hole.*
7. *SEATING CHART data store is a black hole.*
8. *CLASS ROSTER and SEATING CHART data stores cannot be connected with a data flow.*


1
ASSIGN ADVISOR
STUDENT ID NUMBER
2
MEET WITH ADVISOR
TENTATIVE SCHEDULE
3
CHECK OPEN CLASSES
FINAL CLASS SCHEDULE
INSTRUCTOR
CLASS ROSTER
D5 CLASS ROSTER
STUDENTS ATTENDING
D6 SEATING CHART
SCHEDULE OF OFFICE HOURS
STUDENT
STUDENT ID NUMBER
4
CALCULATE GRADE
FINAL GRADE
D4 GRADES

Creating a Set of DFDs



Creating a Set of DFDs

- Create a graphical model of the information system based on your **fact-finding** results
- First, you will review a set of **guidelines** for drawing DFDs.
- Then you will learn how to apply these guidelines and create a set of DFDs using a three-step process

Creating a Set of DFDs

- Guidelines for Drawing DFDs
  - Draw the context diagram系統環境全景圖
  - so that it
    fits on one page
  - Use the **name of the information system** as the **process name** in the **context diagram**
  - Use **unique** names within each set of symbo

Creating a Set of DFDs

- Guidelines for Drawing DFDs
  - **Do not cross lines**
  - Provide a **unique name and reference number** for each process
  - Obtain as much user input and feedback as possible

Creating a Set of DFDs (Cont.2)

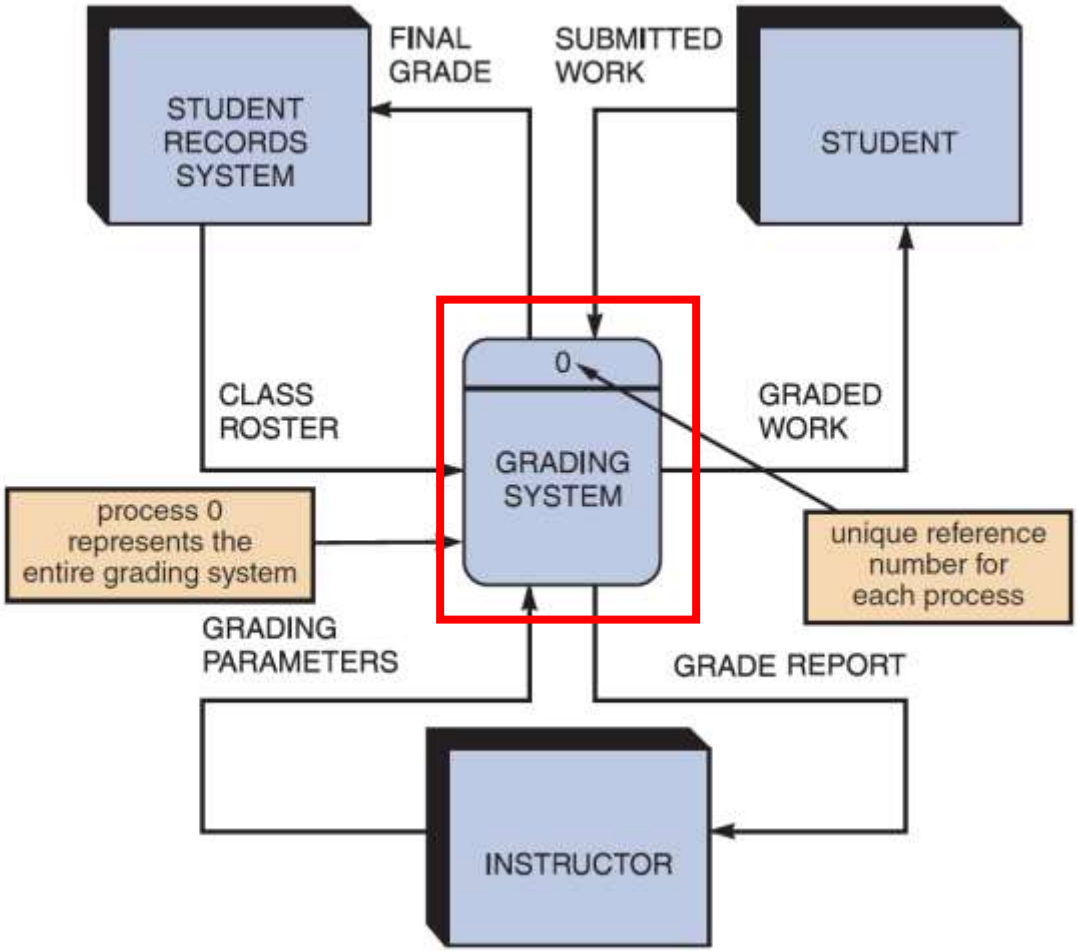


FIGURE 5-10 Context diagram DFD for grading system

Creating a Set of DFDs (Cont. 3)

- Step 1: Draw a **Context Diagram**

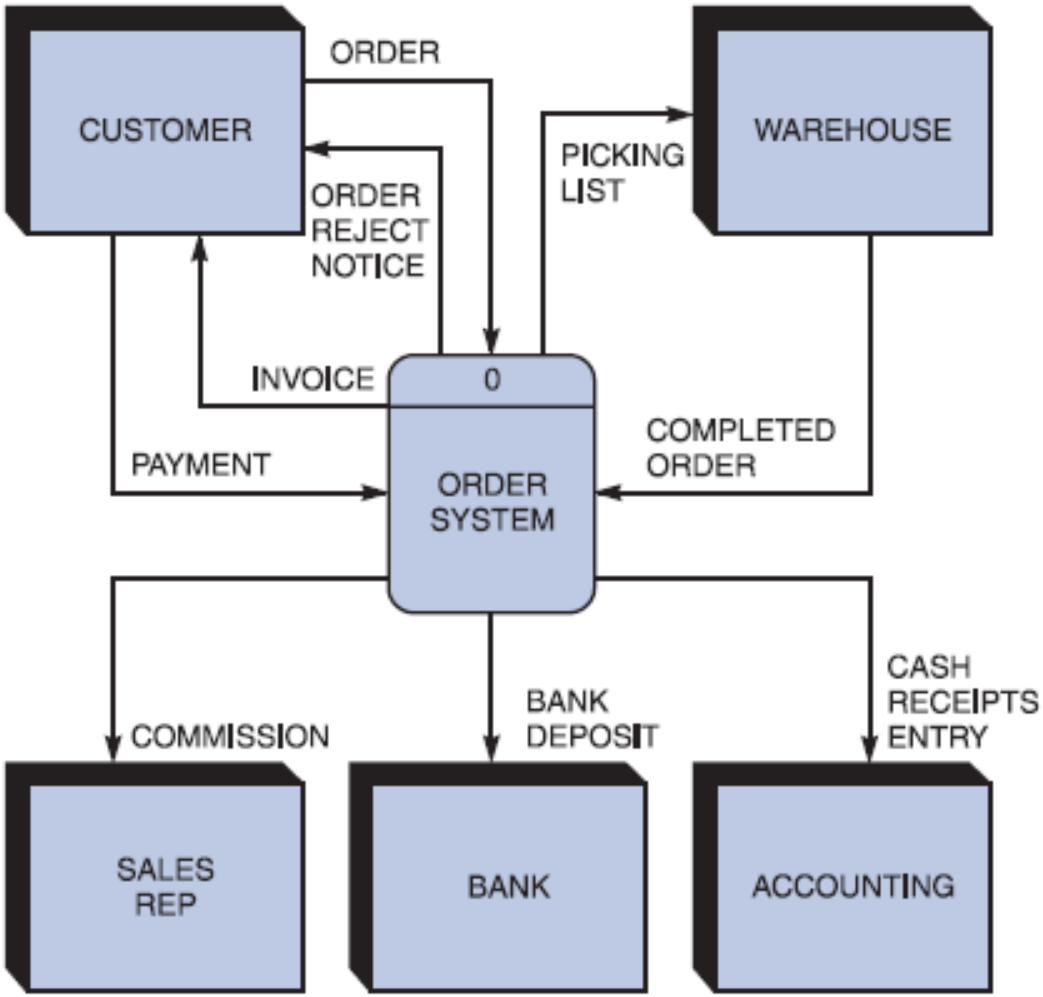


FIGURE 5-11 Context diagram DFD for an order system

Creating a Set of DFDs (Cont. 4)

- **Step 2: Draw a Diagram 0 DFD**
  - If same data flows in both directions, you can use a double-headed arrow
  - Diagram 0 is an exploded view of process 0
  - **Parent** diagram
  - **Child** diagram
  - Functional primitive

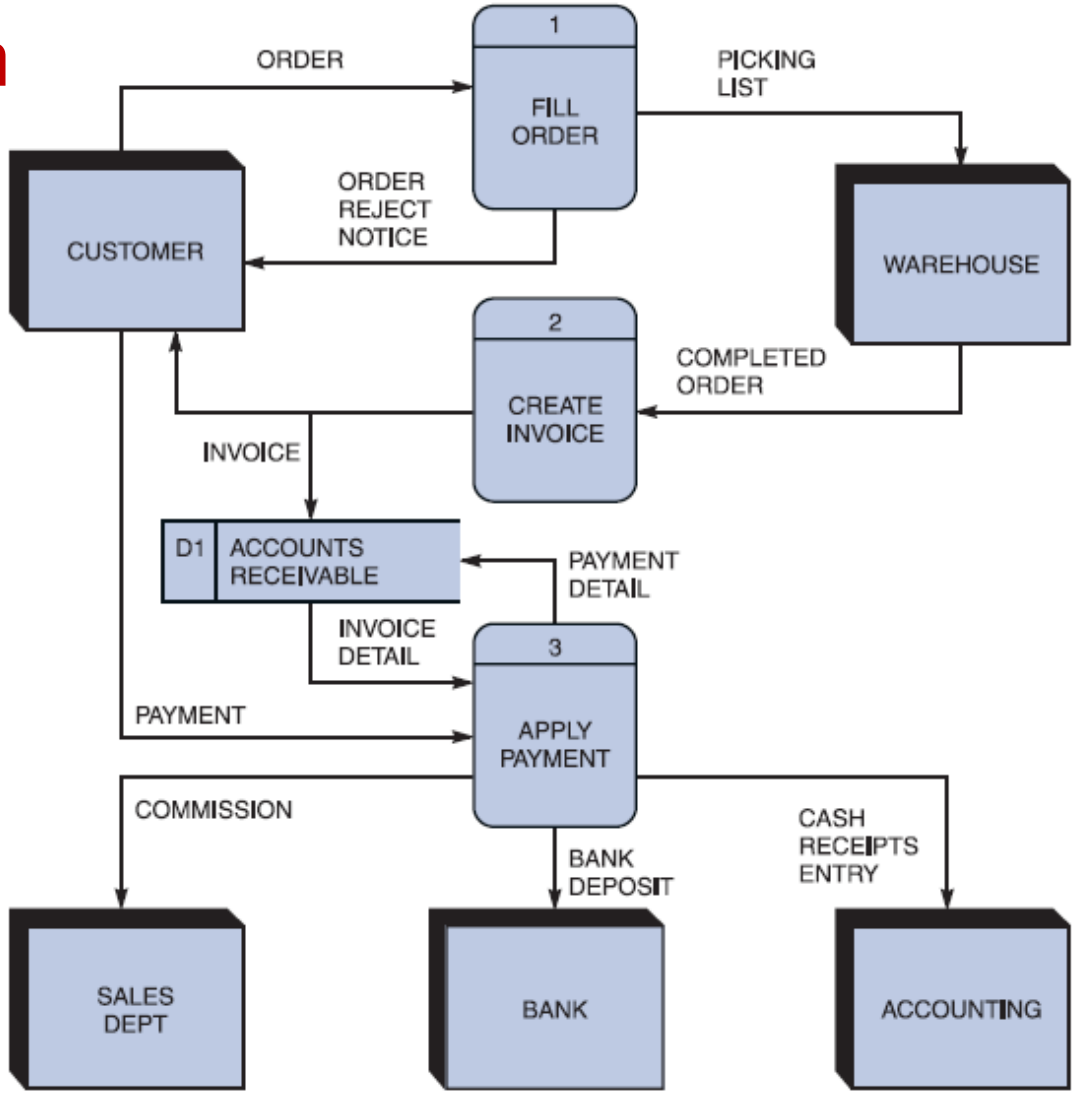


FIGURE 5-13 Diagram 0 DFD for the order system

Creating a Set of DFDs (Cont. 5)

- **Step 3: Draw the Lower Level Diagrams**

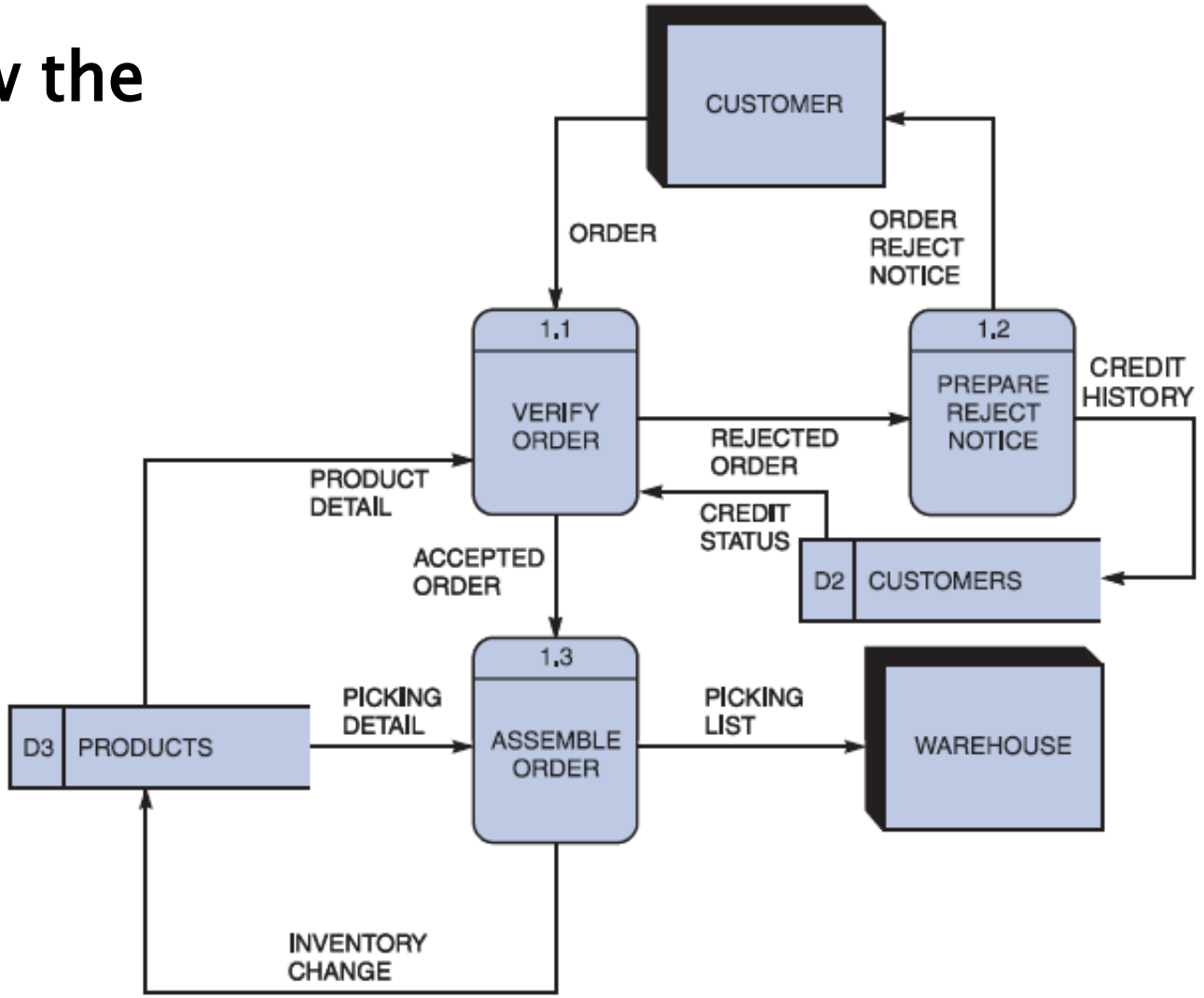


FIGURE 5-14 Diagram 1 DFD shows details of the FILLORDER process in the order system

Creating a Set of DFDs

(Cont. 6)

- Must use **leveling** and **balancing** techniques
- Leveling examples
  - Uses a series of increasingly detailed DFDs to describe an information system
  - **Exploding**, **partitioning**, or **decomposing**

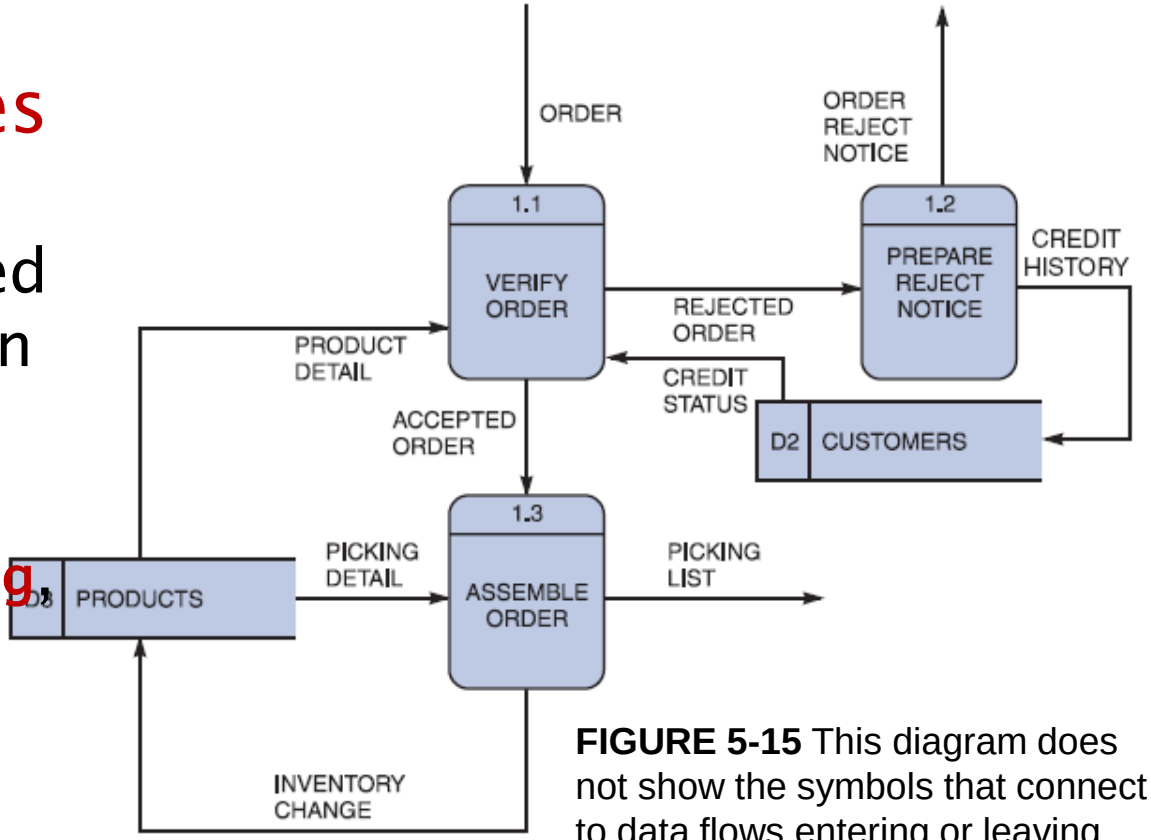
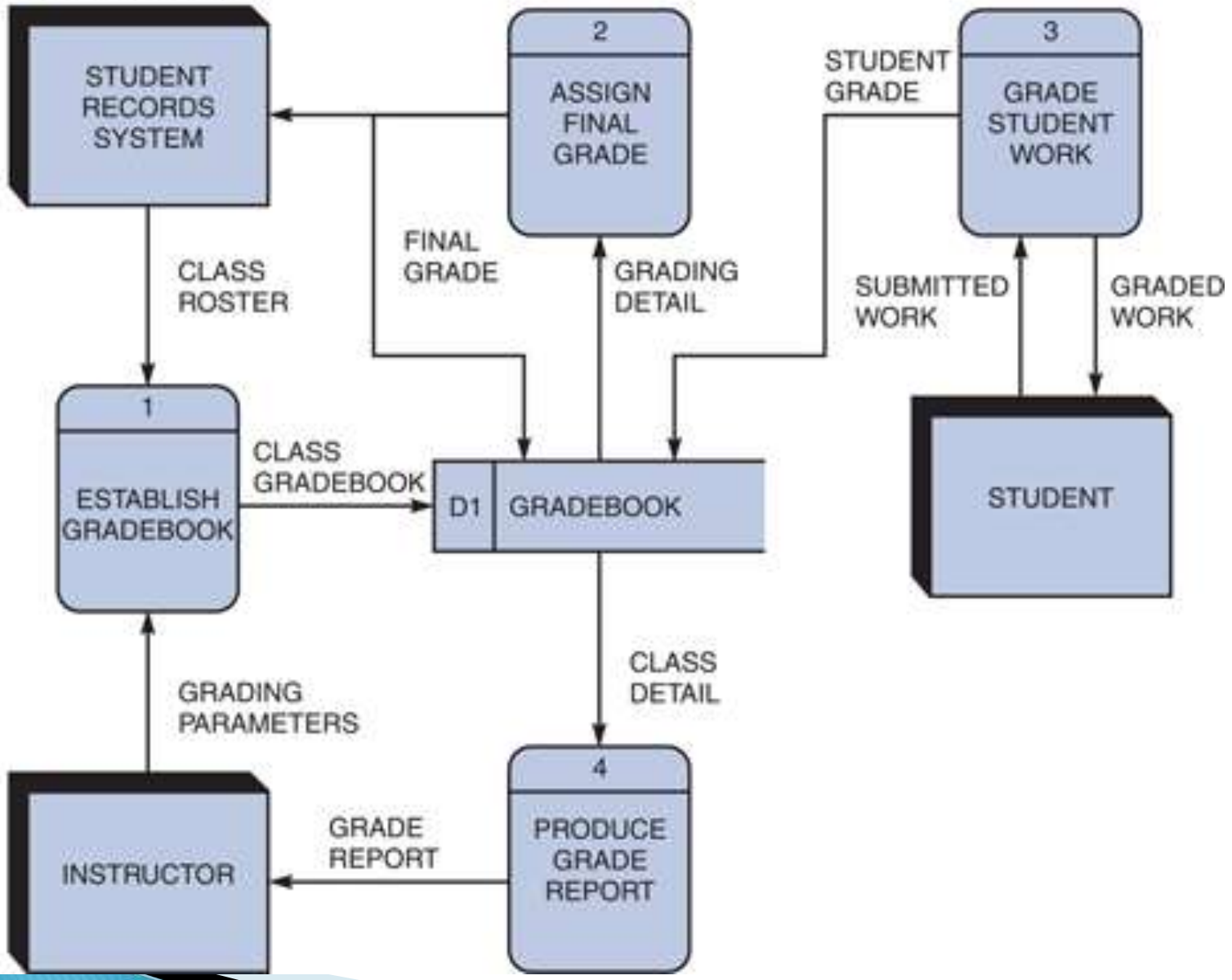


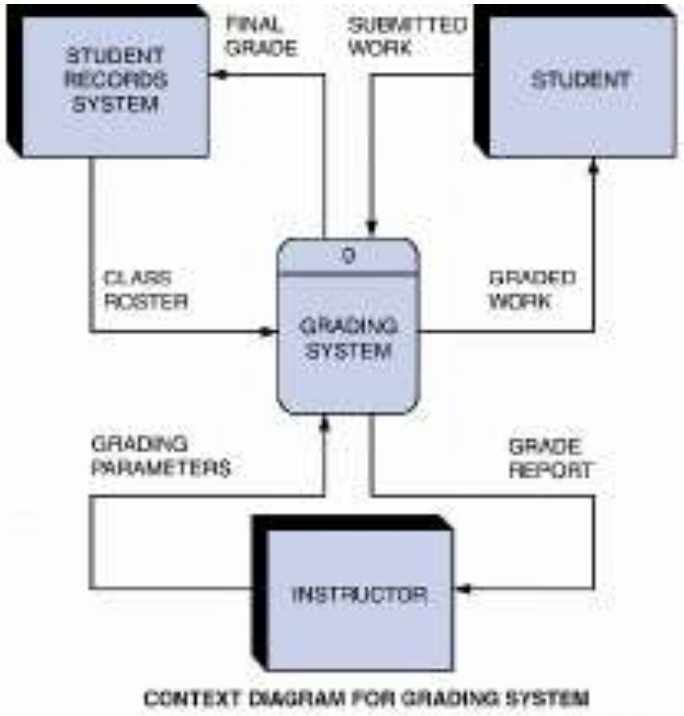
FIGURE 5-15 This diagram does not show the symbols that connect to data flows entering or leaving FILL ORDER on the context diagram

Diagram 0 for Grading System



Creating a Set of DFDs

- Step 2: Draw a Diagram 0 DFD



CONTEXT DIAGRAM FOR GRADING SYSTEM

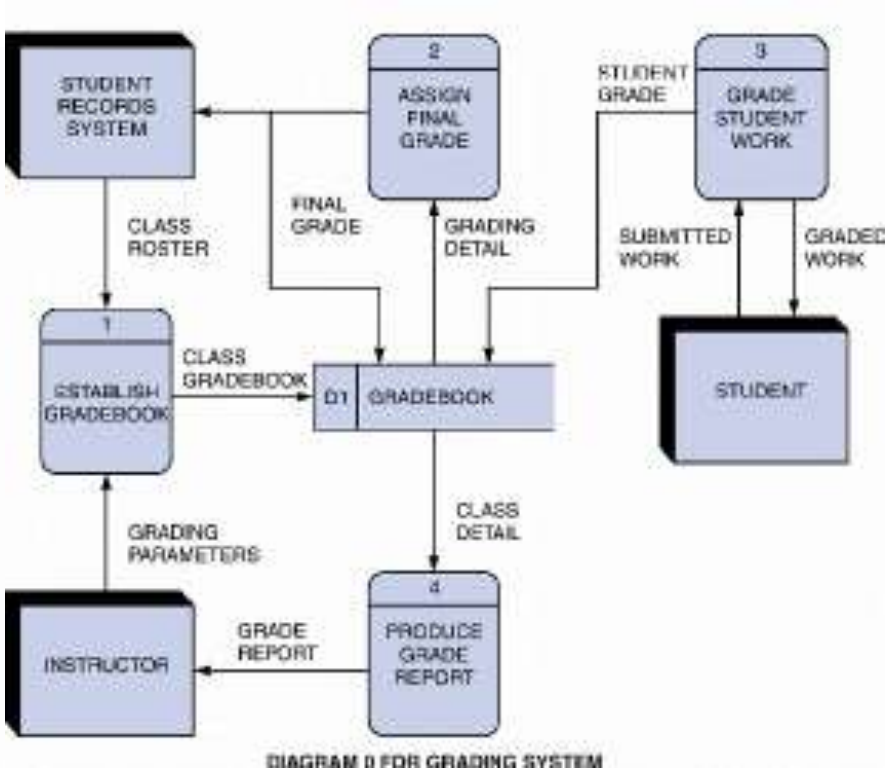


DIAGRAM 0 FOR GRADING SYSTEM

Creating a Set of DFDs (Cont. 4)

- **Step 2: Draw a Diagram 0 DFD**
  - If same data flows in both directions, you can use a double-headed arrow
  - Diagram 0 is an exploded view of process 0
  - **Parent** diagram
  - **Child** diagram
  - Functional primitive

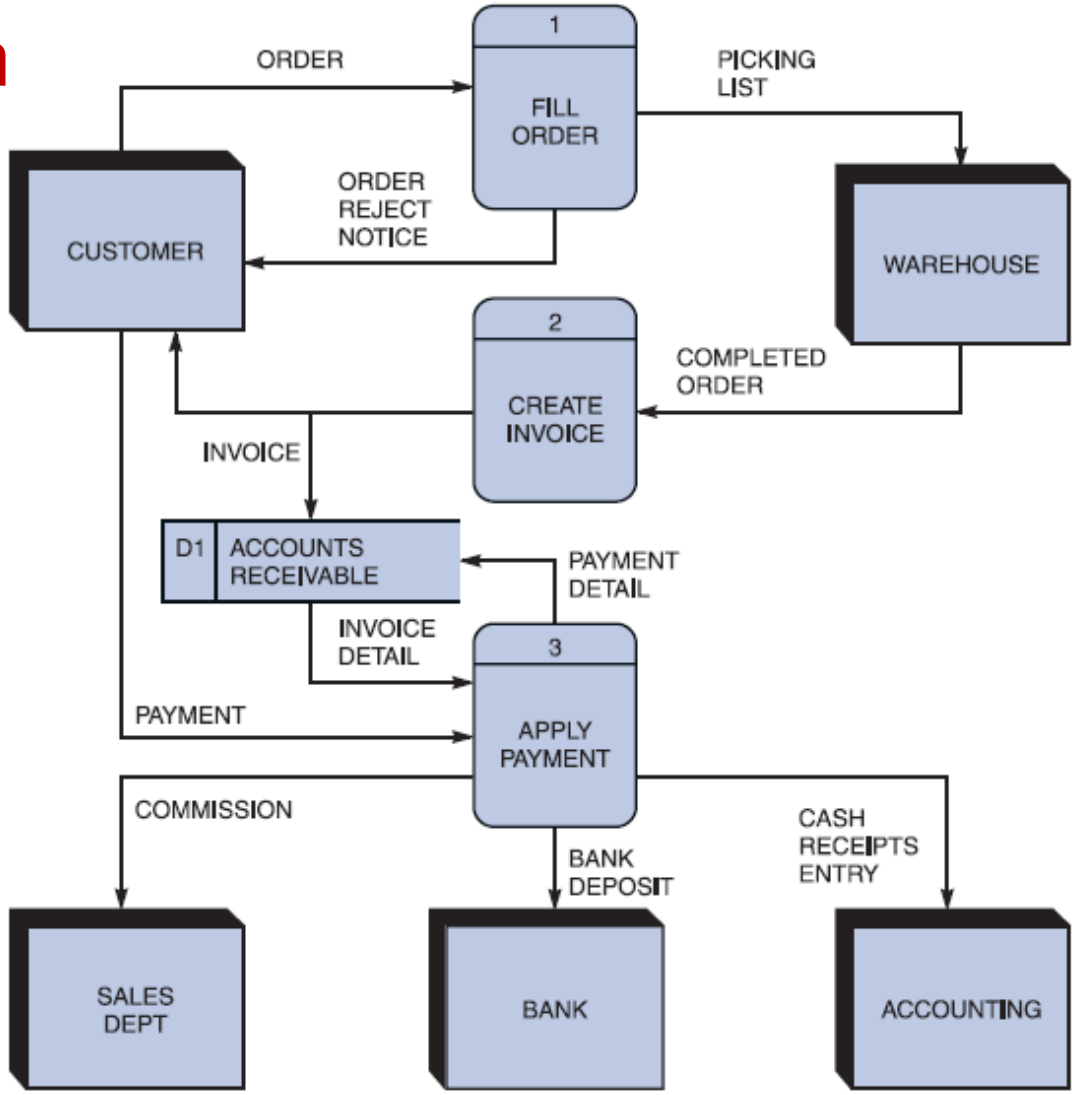


FIGURE 5-13 Diagram 0 DFD for the order system

Creating a Set of DFDs (Cont. 5)

- **Step 3: Draw the Lower Level Diagrams**

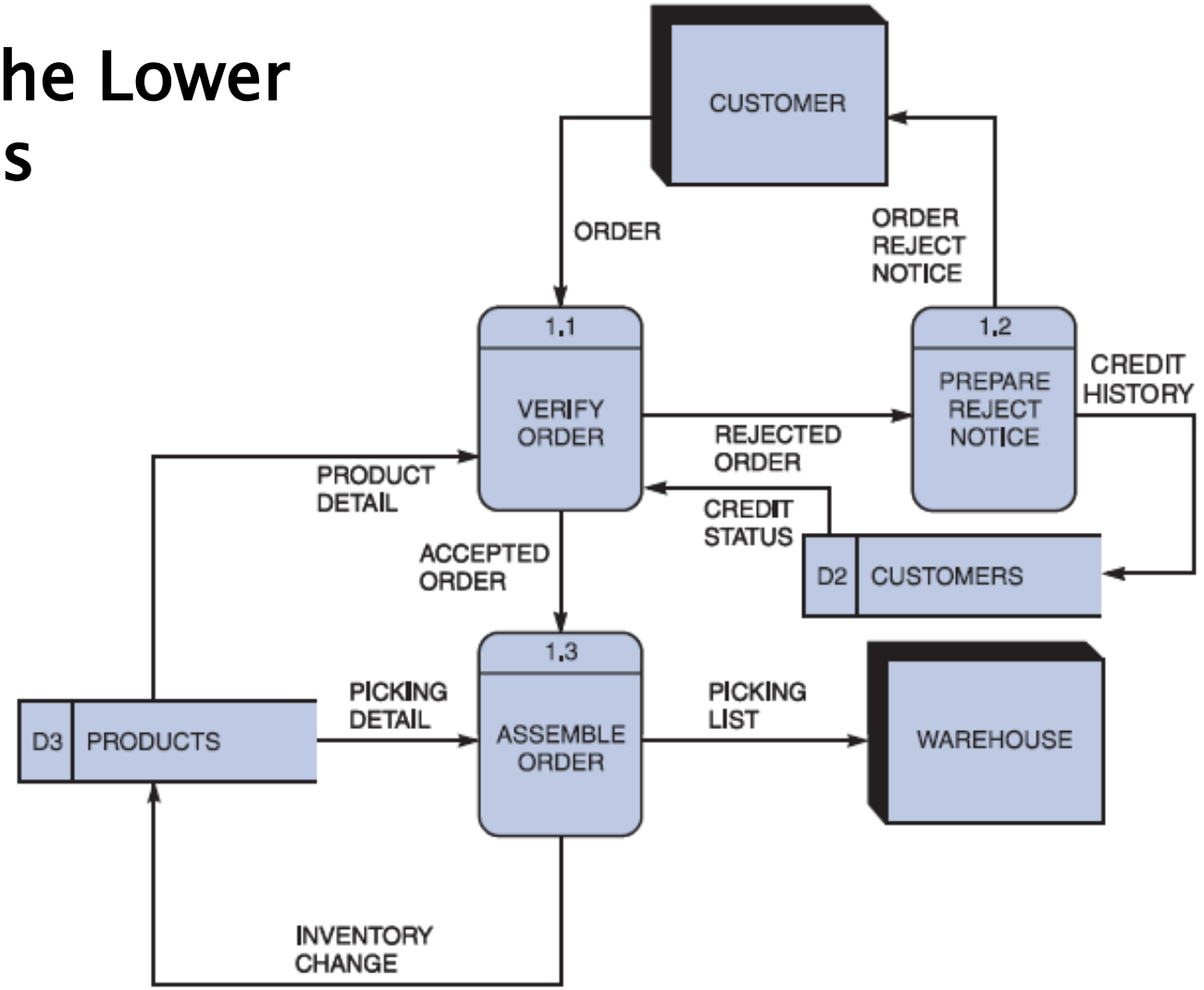


FIGURE 5-14 Diagram 1 DFD shows details of the FILLORDER process in the order system

Creating a Set of DFDs

(Cont. 6)

- Must use **leveling** and **balancing** techniques
- Leveling examples
  - Uses a series of increasingly detailed DFDs to describe an information system
  - **Exploding**, **partitioning**, or **decomposing**

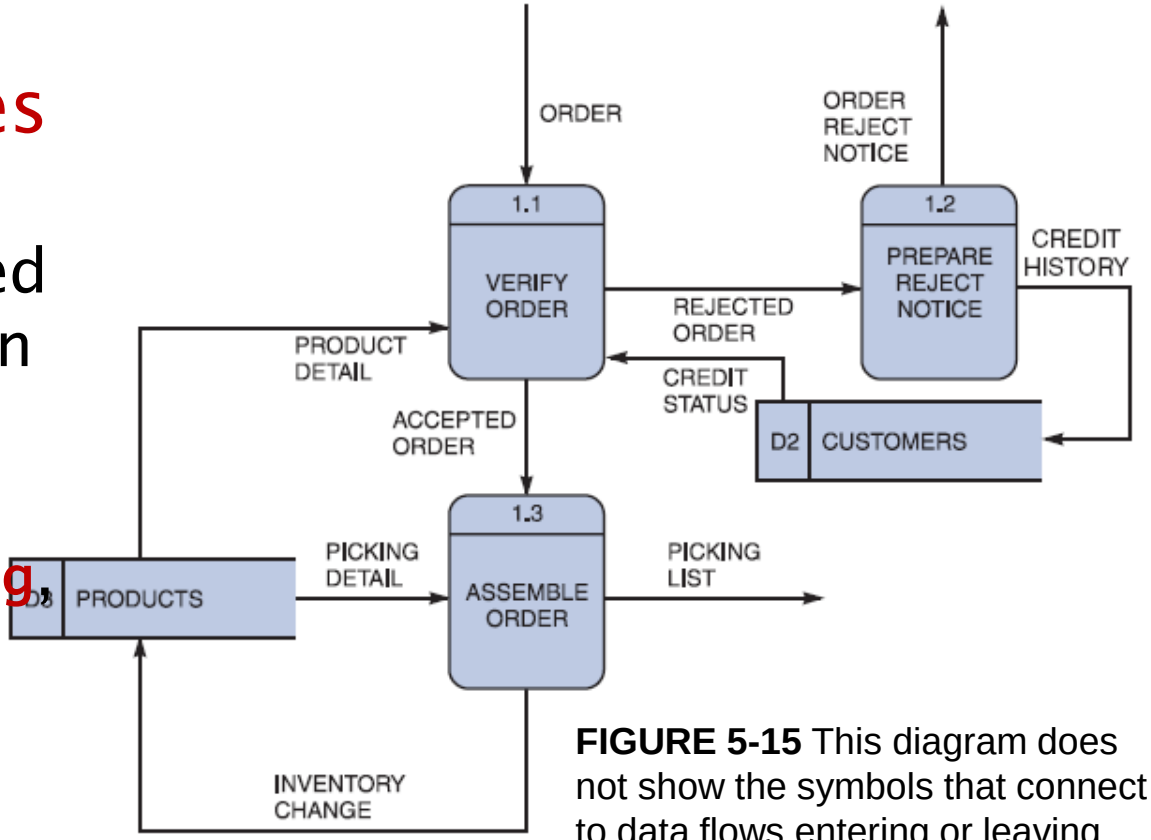
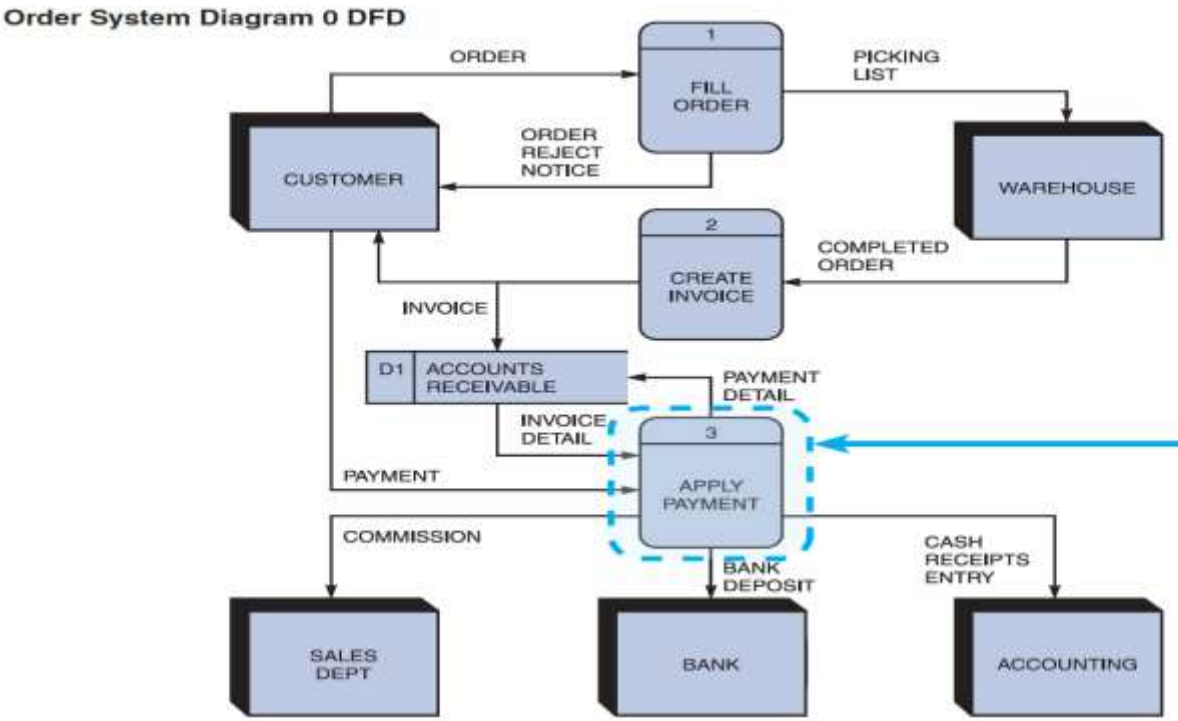


FIGURE 5-15 This diagram does not show the symbols that connect to data flows entering or leaving FILL ORDER on the context diagram

Creating



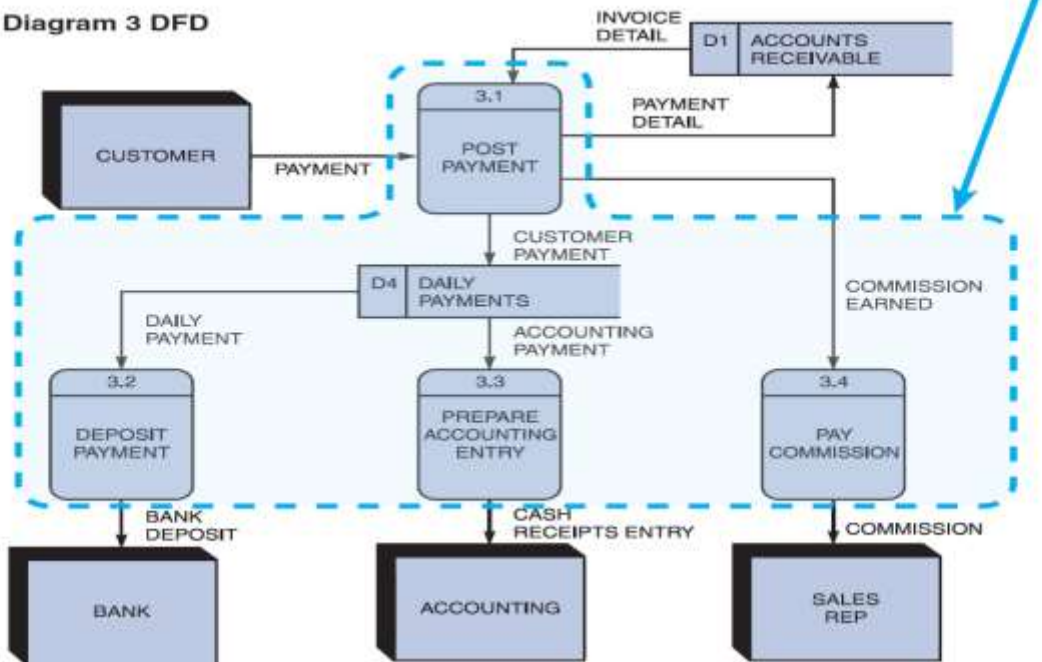


FIGURE 5-16 The order system diagram 0 is shown at the top of the figure, and exploded diagram 3 DFD (for the APPLY PAYMENT process) is shown at the bottom. The two DFDs are balanced because the child diagram at the bottom has the same input and output flows as the parent process 3 shown at the top

Creating a Set of DFDs (Cont. 8)

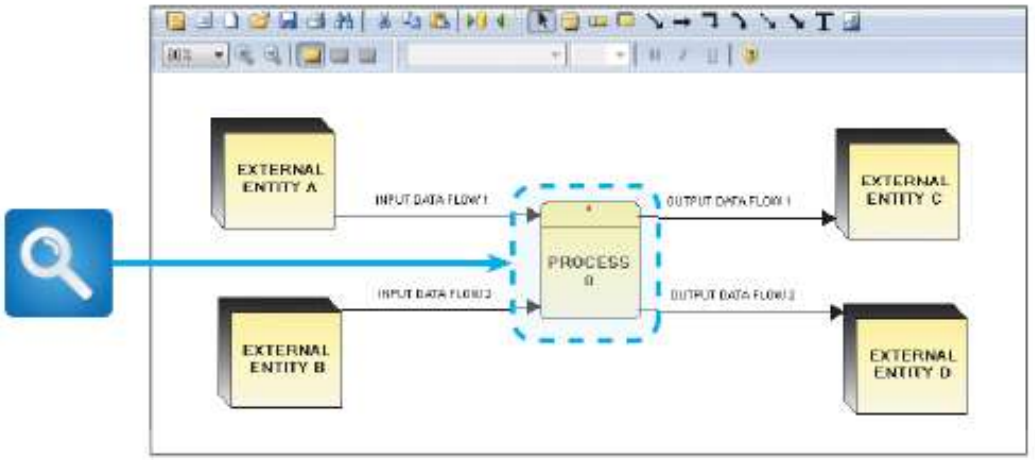


FIGURE 5-17 Example of a parent DFD diagram, showing process 0 as a black box

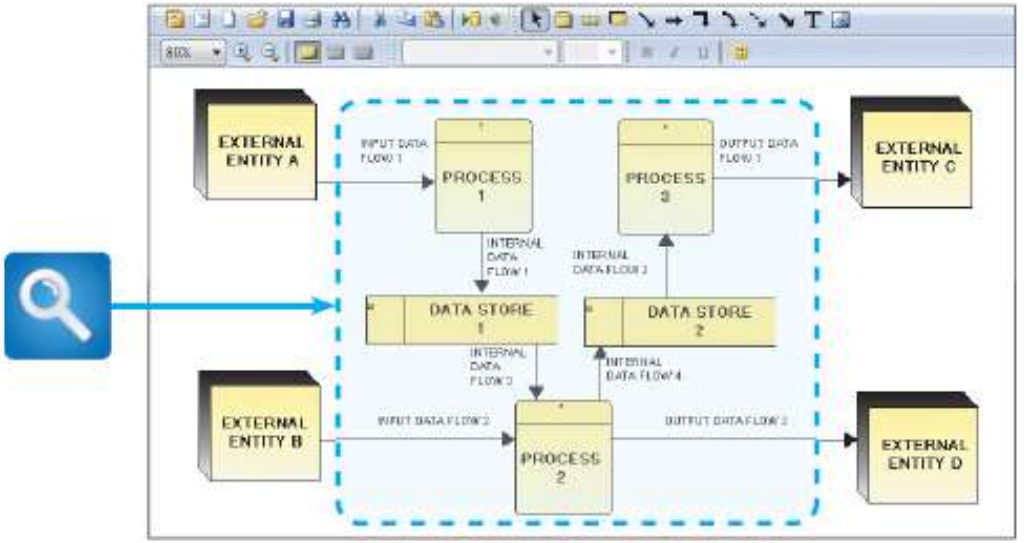


FIGURE 5-18 In the next level of detail, the process 0 black box reveals three processes, two data stores, and four internal data flows — all of which are shown inside the dashed line

Apply Your Skills

HANDLE ORDER

process

HANDLE ORDER process

- **Background Information**
- You have been assigned to develop a DFD for an order processing system.
- When you interviewed users, you learned that
  - an entity called **CUSTOMER;**
  - three processes called **HANDLE ORDER, GENERATE INVOICE,** and **HANDLE PAYMENT;**
  - two data stores called **PRICE FILE** and **INVOICE FILE.**

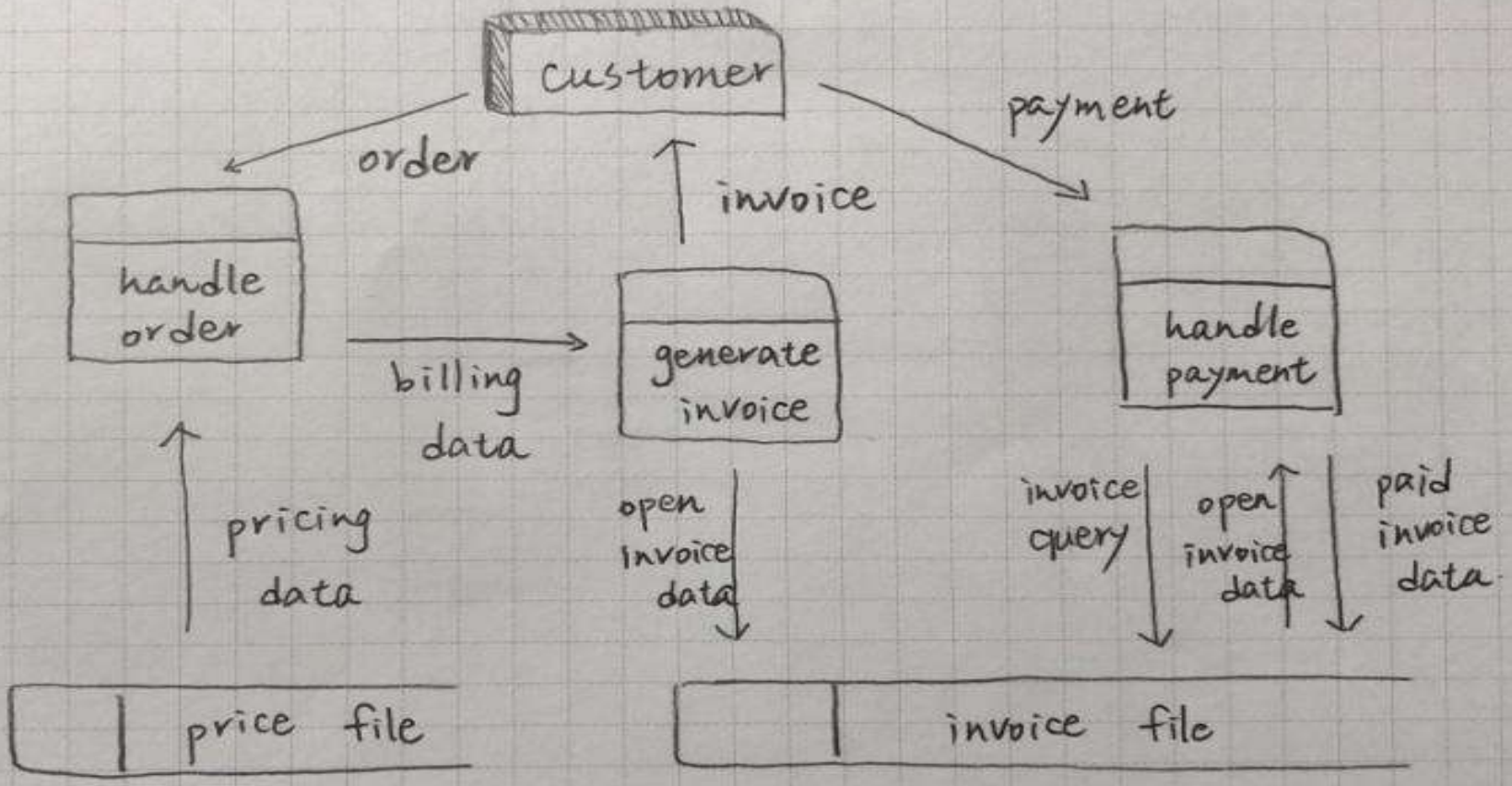
Description	Name	From	To
A CUSTOMER places an **ORDER**, which is received by the HANDLE ORDER process.	ORDER	CUSTOMER entity	HANDLE ORDER process
The PRICE FILE data store sends **PRICING DATA** to the HANDLE ORDER process.	PRICING DATA	PRICE FILE data store	HANDLE ORDER process
The HANDLE ORDER sends **BILLING DATA** to the GENERATE INVOICE process.	BILLING DATA	HANDLE ORDER process	GENERATE INVOICE process
The GENERATE INVOICE process creates an **INVOICE** and sends it to the CUSTOMER.	INVOICE	GENERATE INVOICE process	CUSTOMER entity
The GENERATE INVOICE process also sends **OPEN INVOICE DATA** to the INVOICE FILE data store.	OPEN INVOICE DATA	GENERATE INVOICE process	INVOICE FILE data store
When the CUSTOMER receives the invoice, he or she sends a **PAYMENT**, which is received by the HANDLE PAYMENT process.	PAYMENT	CUSTOMER entity	HANDLE PAYMENT process
When a payment is received, the HANDLE PAYMENT process sends an **INVOICE QUERY** to the INVOICE FILE data store.	INVOICE QUERY	HANDLE PAYMENT process	INVOICE FILE data store
In response to the invoice query, the INVOICE FILE data store sends **OPEN INVOICE DATA** to the HANDLE PAYMENT process.	OPEN INVOICE DATA	INVOICE FILE data store	HANDLE PAYMENT process
The HANDLE PAYMENT process matches the payment with the open invoice data and sends **PAID INVOICE DATA** to the INVOICE FILE.	PAID INVOICE DATA	HANDLE PAYMENT process	INVOICE FILE data store
The HANDLE PAYMENT process also sends a **PAYMENT RECEIPT** to the CUSTOMER.	PAYMENT RECEIPT	HANDLE PAYMENT process	CUSTOMER entity

Apply Your Skills

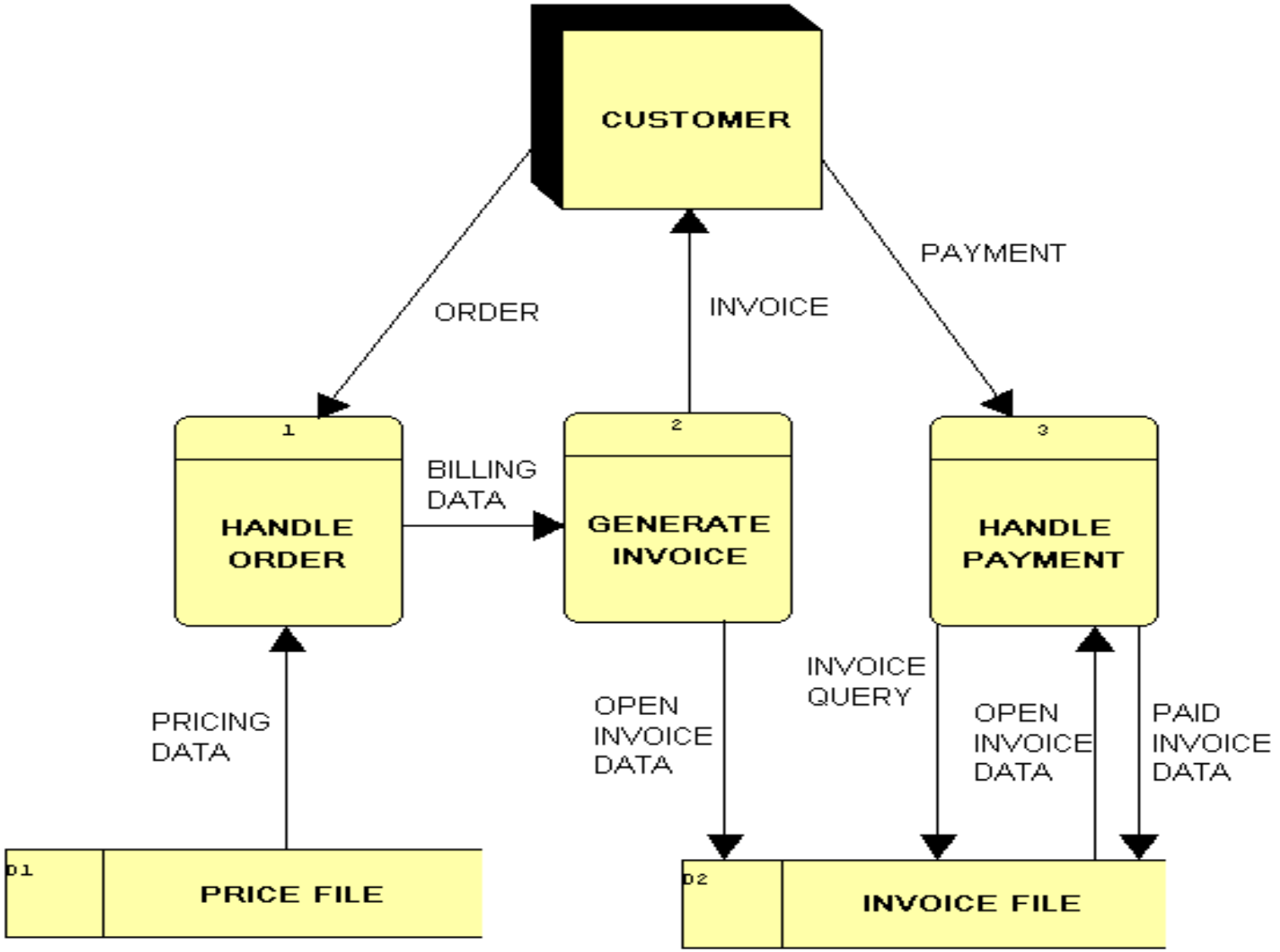
- Task A. Draw symbols for the entity, the three processes, and the two data stores that you identified. You can use a software application, or just a pencil and paper.

- Task B. Using the information in the Data Flow Information table, add the ten data flows and label them. You might want to print the table for easy reference.

HANDLE ORDER process

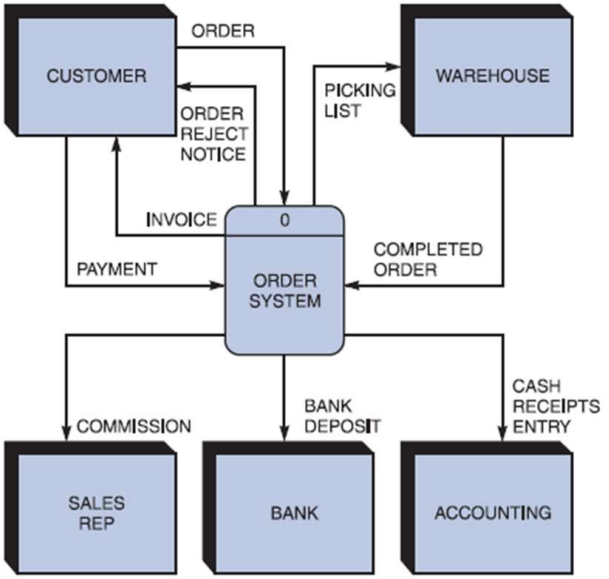

customer
order
invoice
payment
handle order
billing data
generate invoice
handle payment
pricing data
open invoice data
invoice query
open invoice data
paid invoice data
price file
invoice file

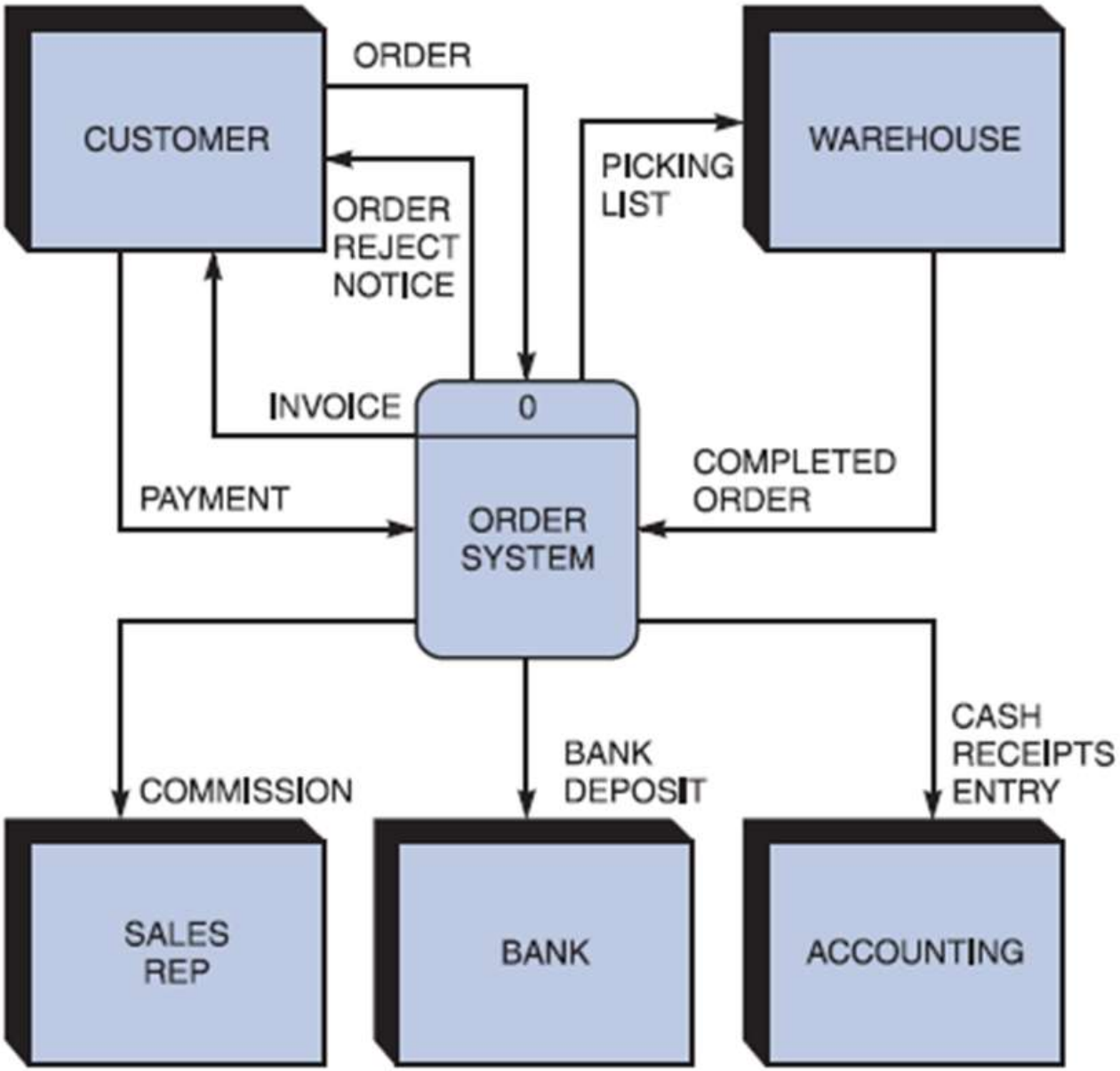
Tasks A and B: Sample DFD

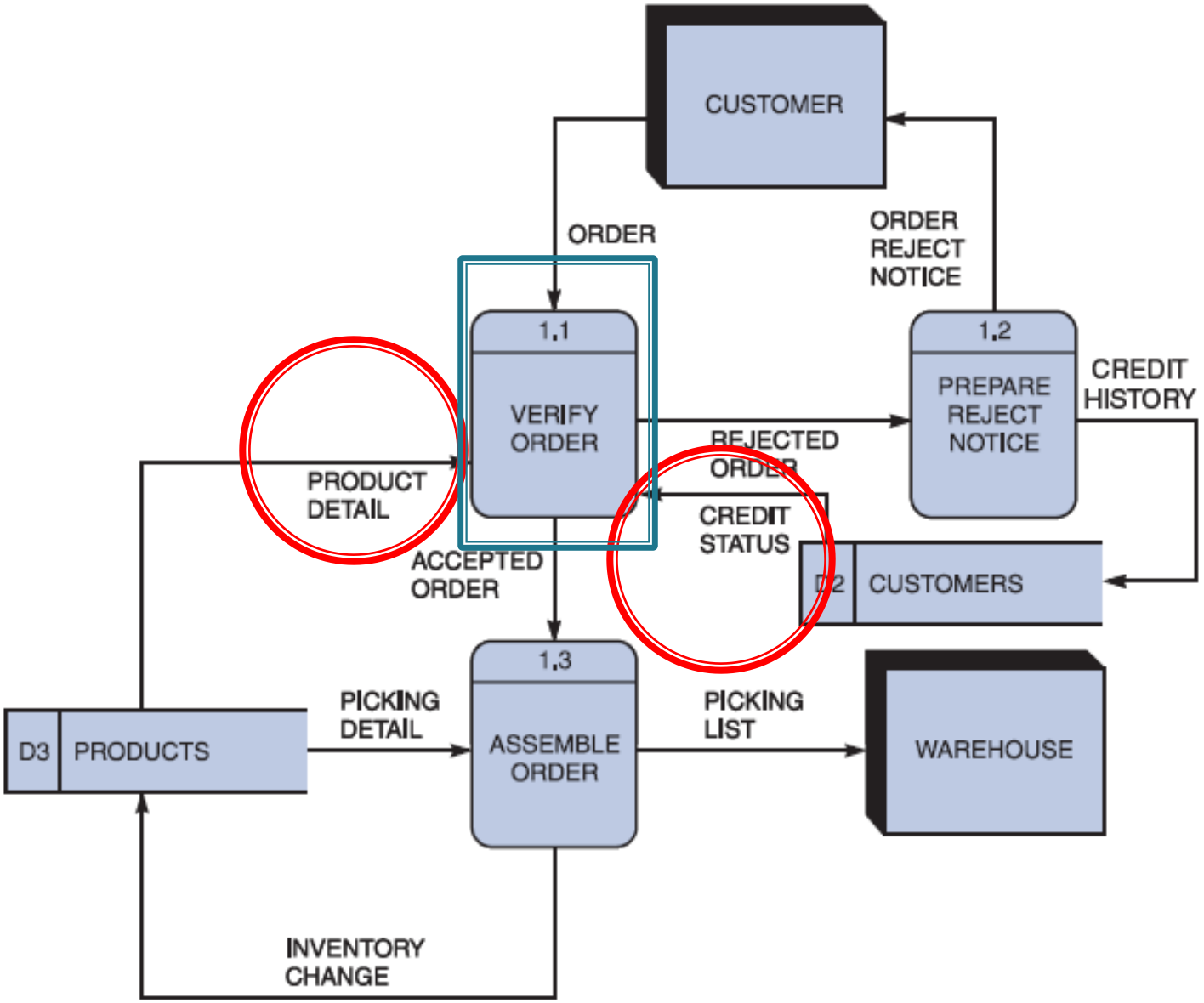


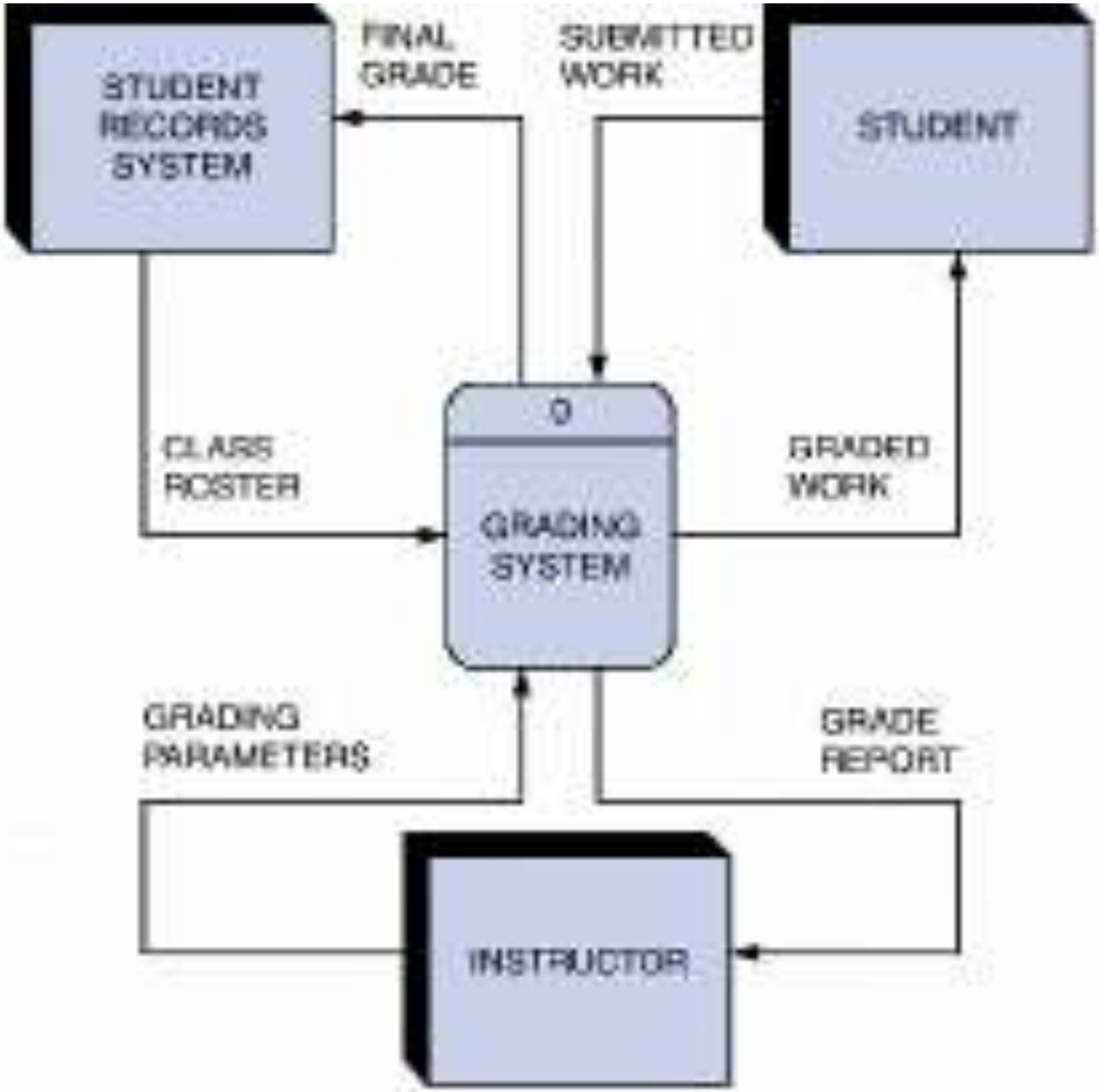
分組練習

請畫出分組專案資訊系統的DFD之Context Diagram




CUSTOMER
ORDER
ORDER REJECT NOTICE
PICKING LIST
WAREHOUSE
INVOICE
0
PAYMENT
ORDER SYSTEM
COMPLETED ORDER
COMMISSION
BANK DEPOSIT
CASH RECEIPTS ENTRY
SALES REP
BANK
ACCOUNTING


CUSTOMER
ORDER
ORDER REJECT NOTICE
1.1
VERIFY ORDER
1.2
PREPARE REJECT NOTICE
CREDIT HISTORY
PRODUCT DETAIL
REJECTED ORDER
CREDIT STATUS
ACCEPTED ORDER
D2 CUSTOMERS
1.3
ASSEMBLE ORDER
PICKING DETAIL
PICKING LIST
D3 PRODUCTS
WAREHOUSE
INVENTORY CHANGE



CONTEXT DIAGRAM FOR GRADING SYSTEM

Creating a Set of DFDs (Cont.2)

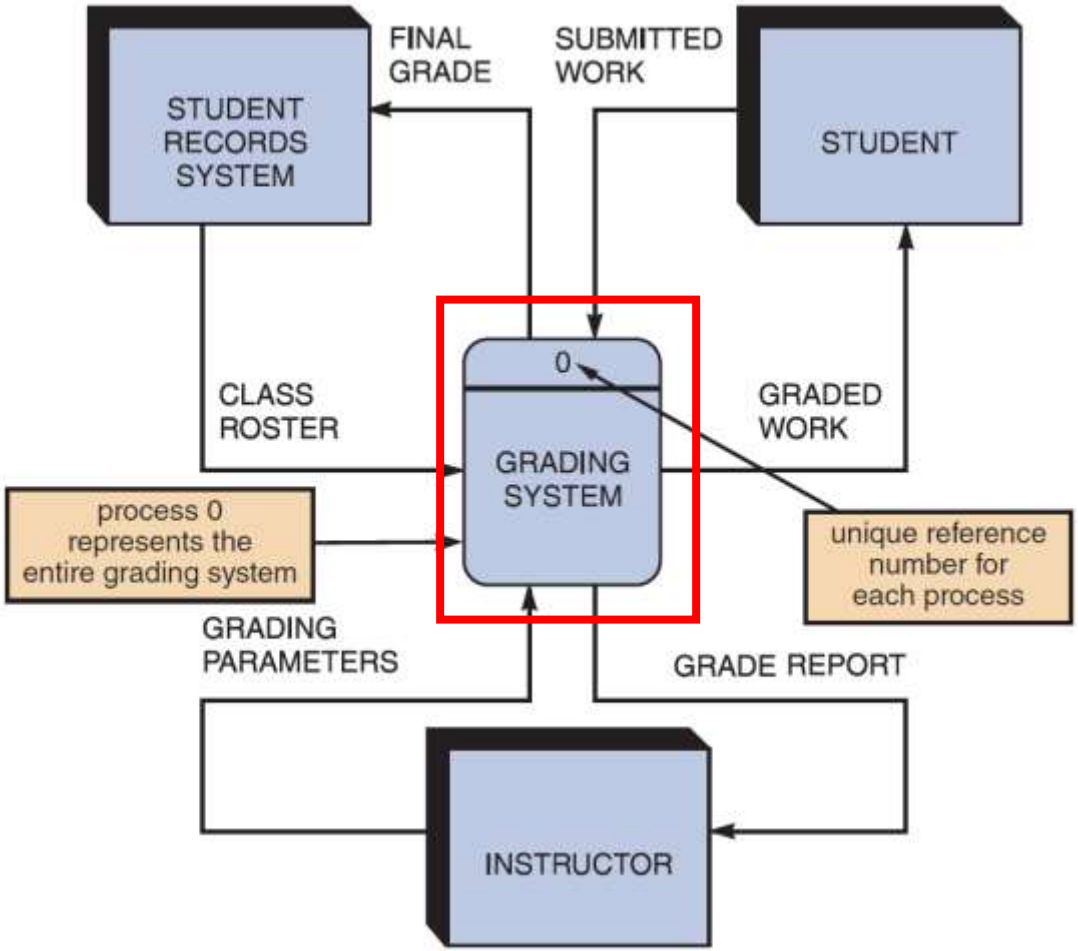


FIGURE 5-10 Context diagram DFD for grading system

Creating a Set of DFDs (Cont. 3)

- Step 1: Drav

Context Dia

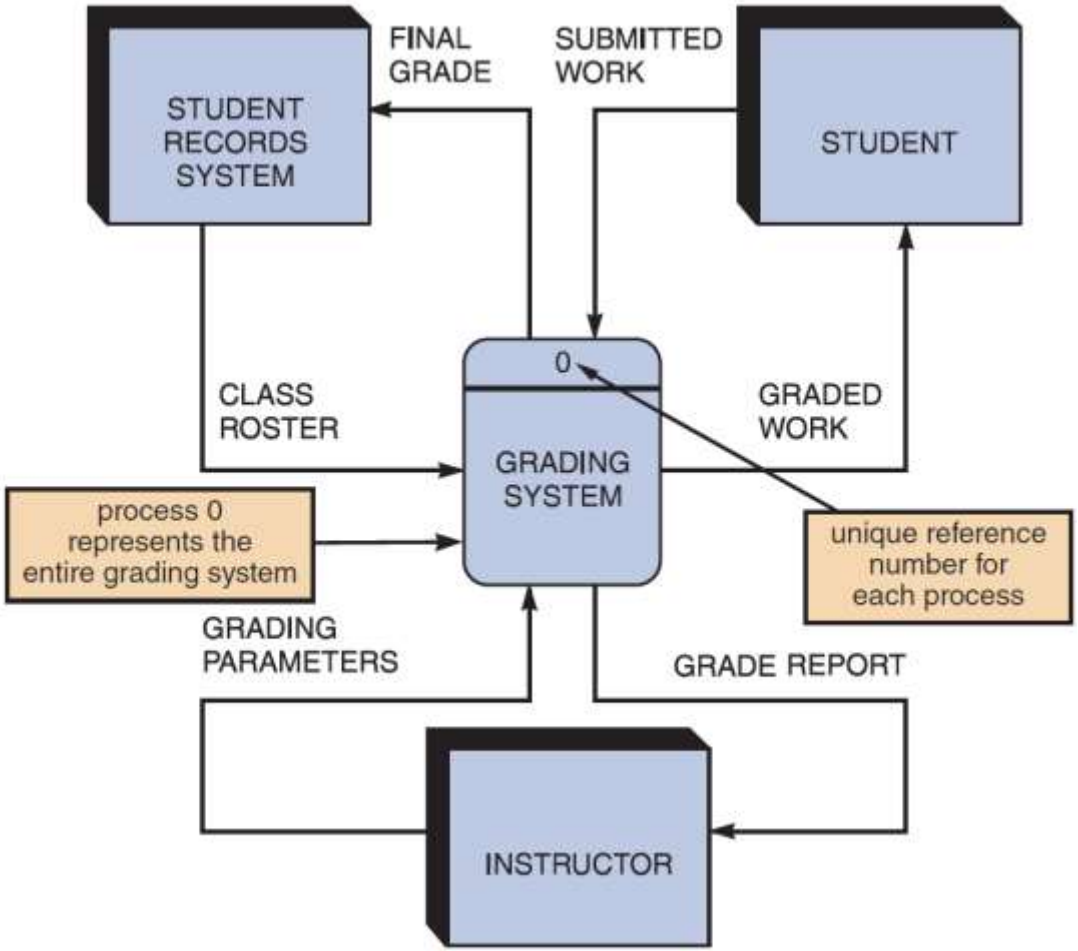
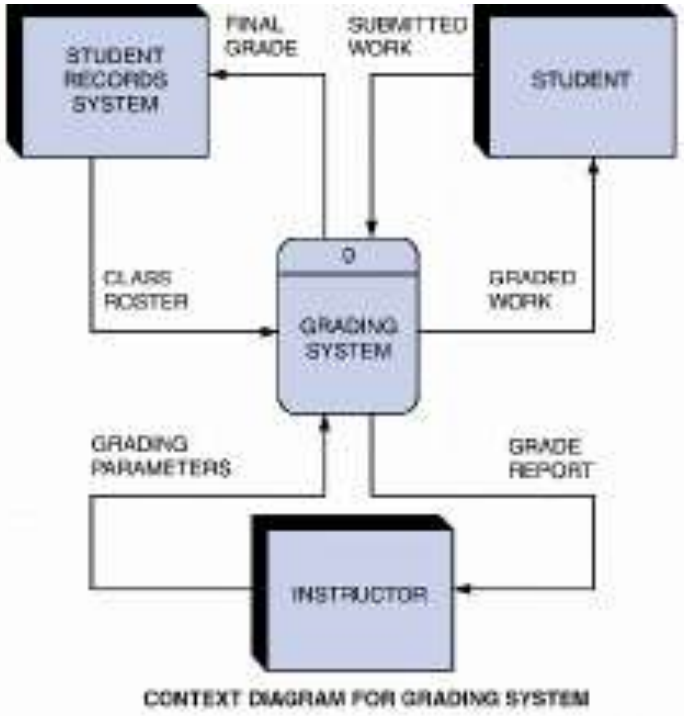


FIGURE 5-11 Context diagra
for an order system

Creating a Set of DFDs

- Step 2: Draw a Diagram 0 DFD



CONTEXT DIAGRAM FOR GRADING SYSTEM

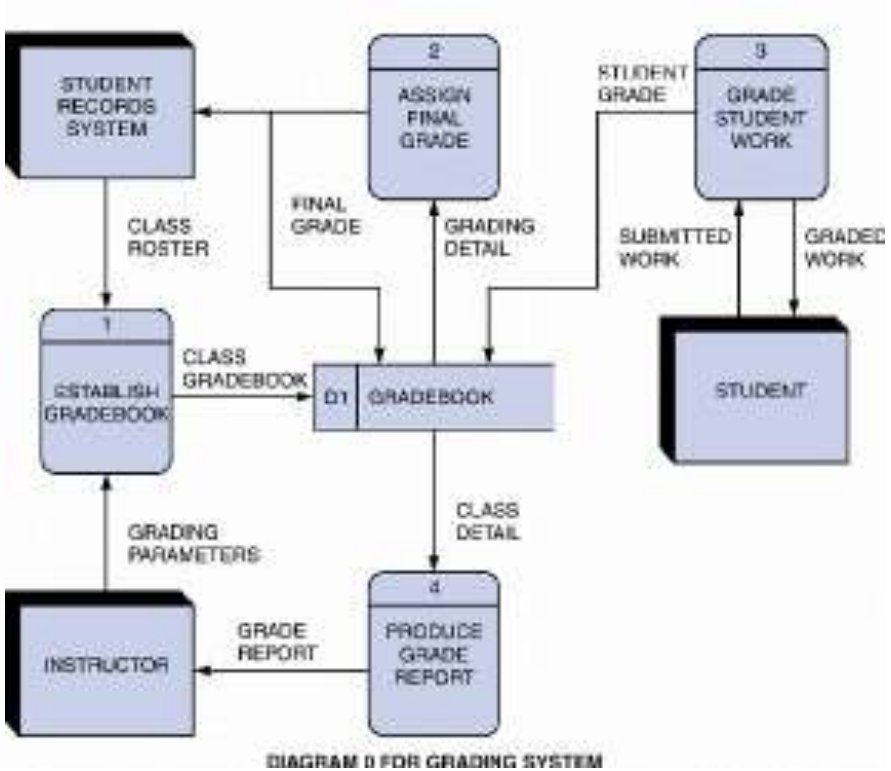
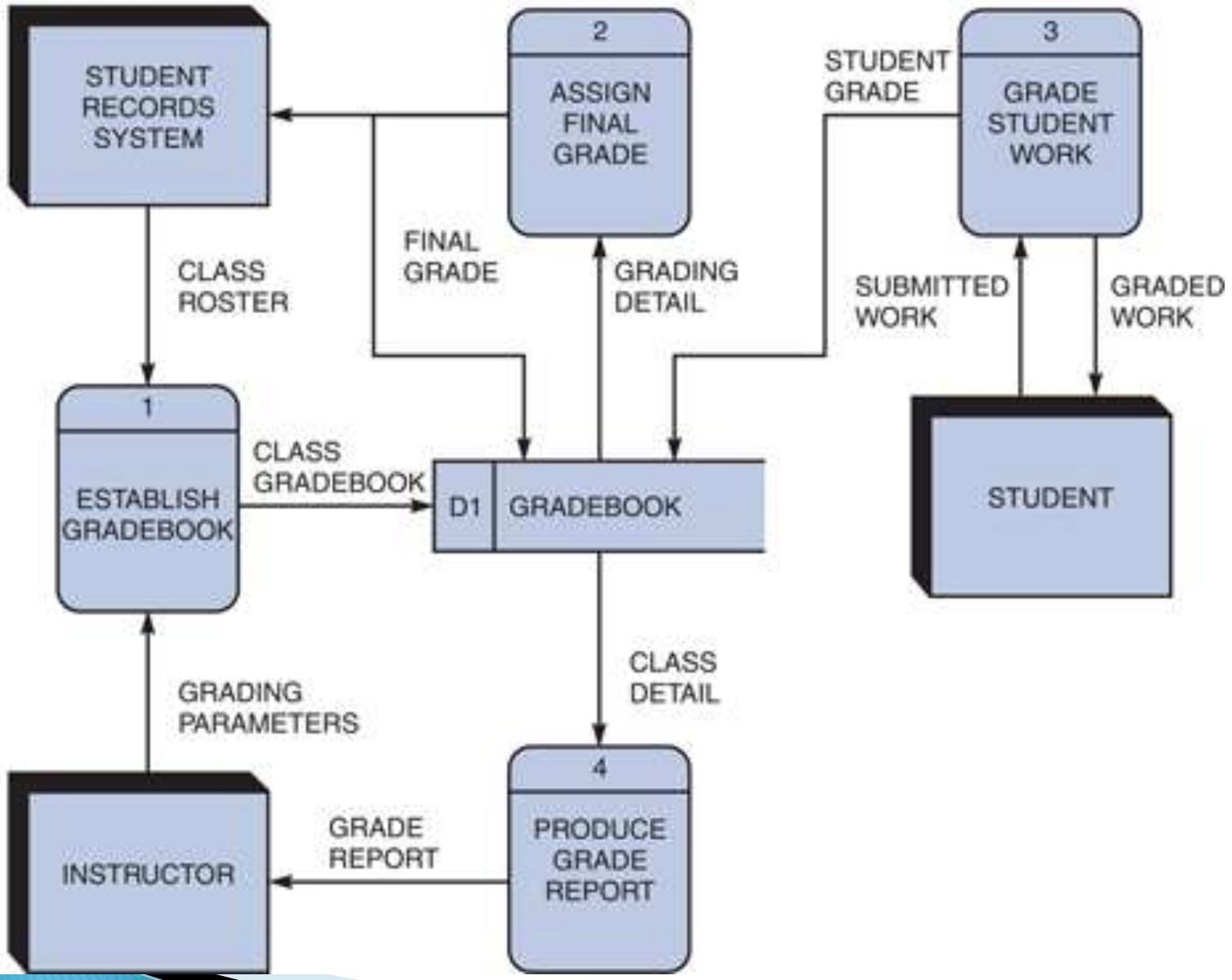


DIAGRAM 0 FOR GRADING SYSTEM

Diagram 0 for Grading System



Part 2

Data Dictionary

Process Description Tools

Decision TABLES

Decision Trees

Data Dictionary

Data Dictionary

- A data dictionary, or data repository, is a central storehouse of information about the system's data
- An analyst uses the data dictionary to collect, document, and organize specific facts about the system
- Also defines and describes all data elements and meaningful combinations of data elements

Data Dictionary

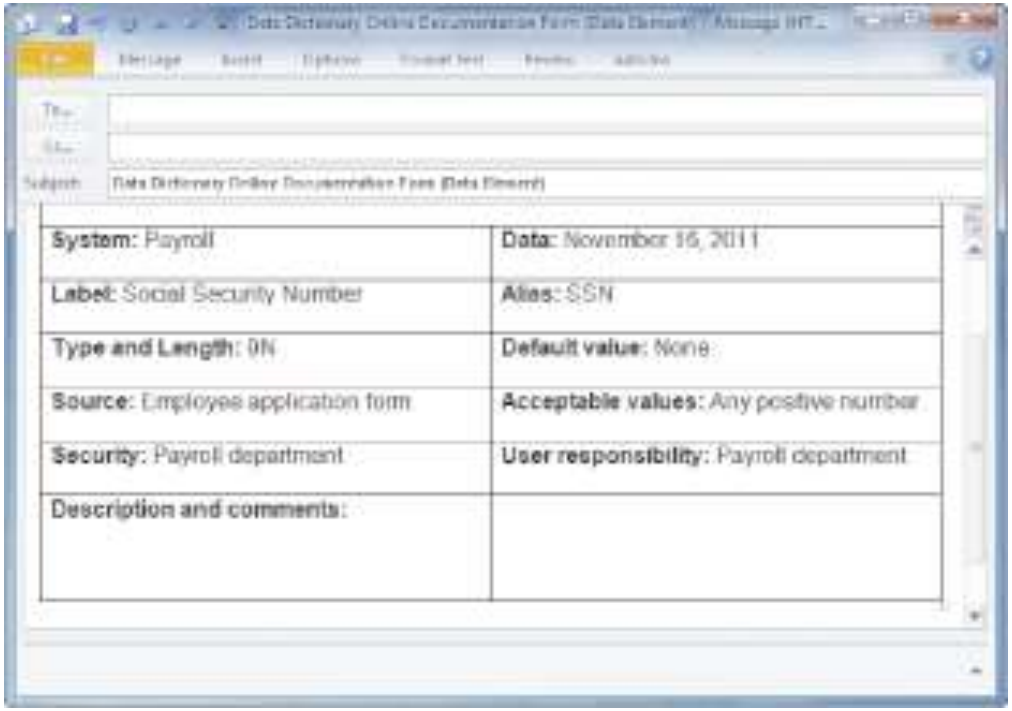
- A data element, also called a data item or field, is the smallest piece of data that has meaning
- Data elements are combined into records, also called data structures
- A record is a meaningful combination of related data elements that is included in a data flow or retained in a data store

Data Dictionary

- Using CASE Tools for Documentation
  - The more complex the system, the more difficult it is to maintain full and accurate documentation
  - Modern CASE tools simplify the task
  - A CASE repository ensures data consistency
  - You will learn more about CASE tools in Part 2 of the Systems Analyst's Toolkit

Data Dictionary

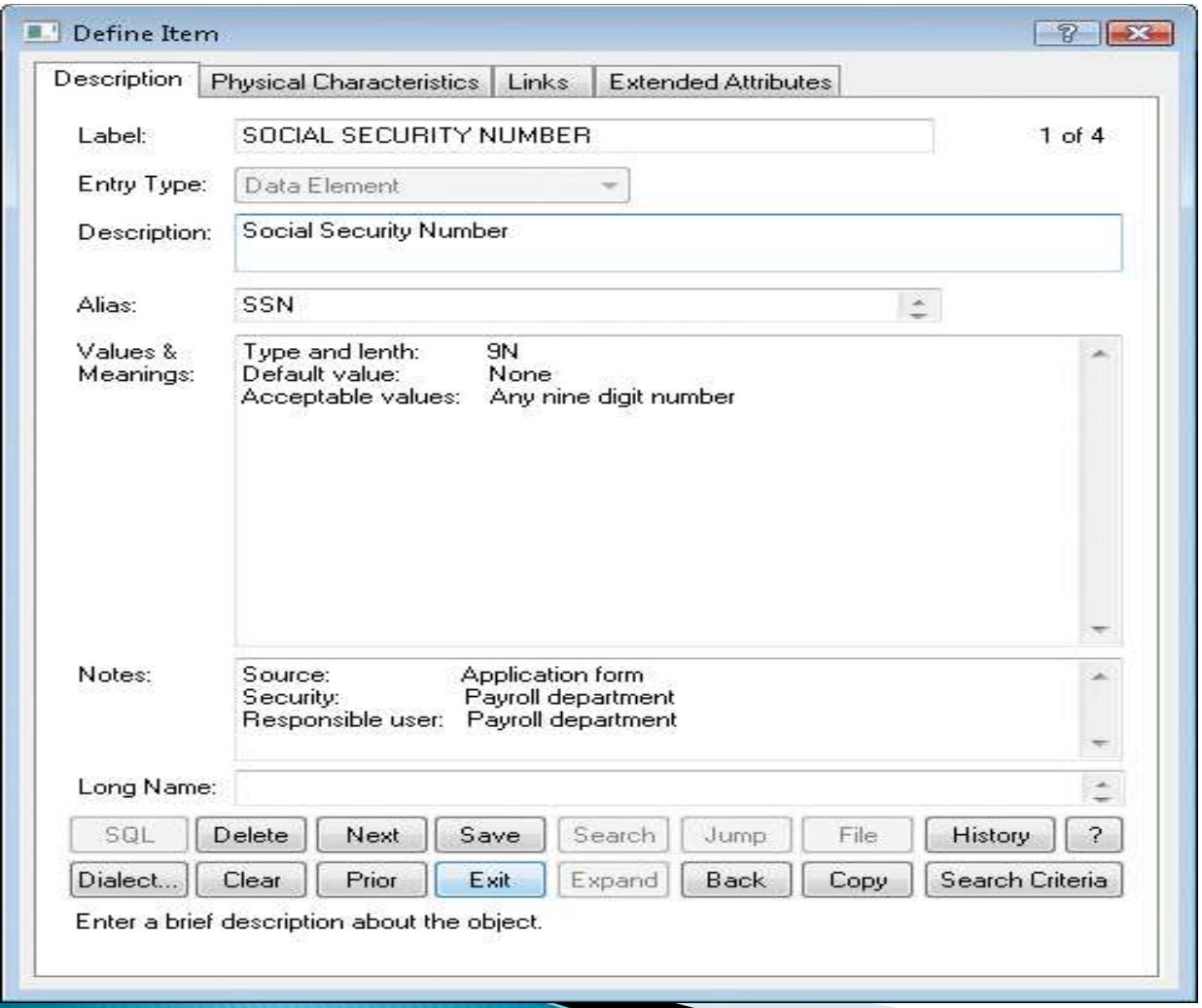
- Documenting the **Data Elements**
  - You must document every data element in the data dictionary
  - The objective is the same: to provide clear, comprehensive information about the data and processes that make up the system



Data Dictionary

- Documenting the **Data Elements**
  - The following attributes usually are recorded and described
    - Data element name and label
    - Alias
    - Type and length
    - Default value
    - Acceptable values – Domain and validity rules

Data Dictionary

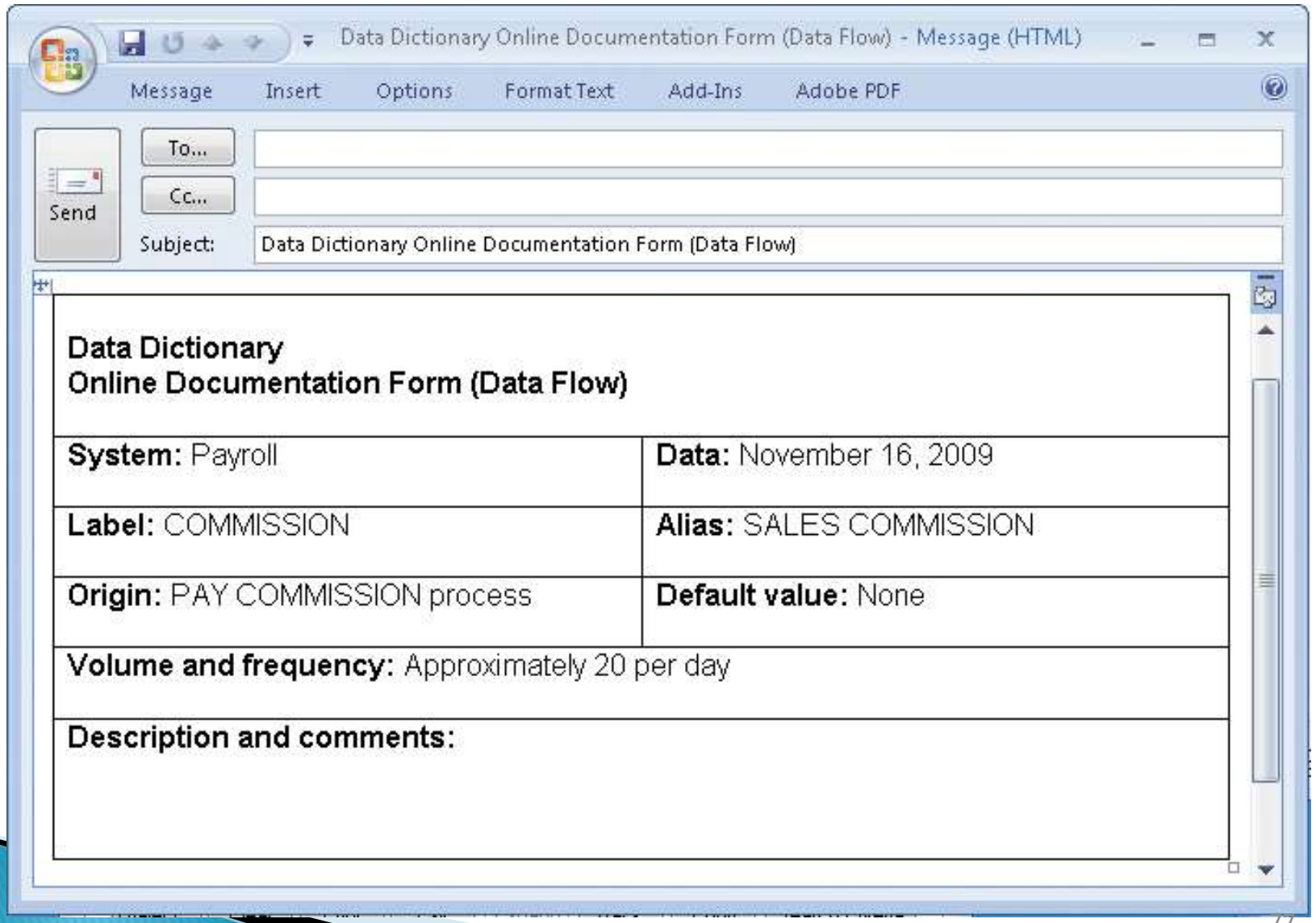


p.217 FIGURE5-24

Data Dictionary

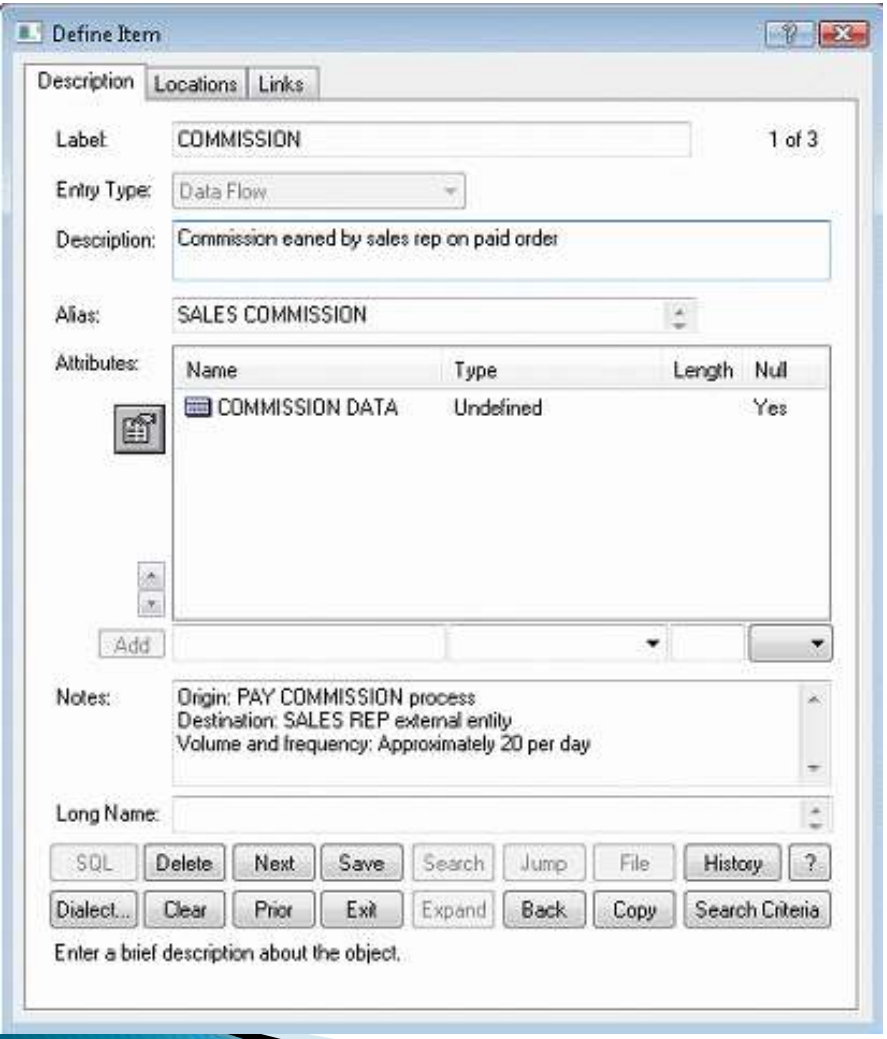
- Documenting the **Data Elements**
  - The following attributes usually are recorded and described
    - Source
    - Security
    - Responsible user(s)
    - Description and comments

Data Dictionary



p.219 FIGURE5-25a

Data Dictionary

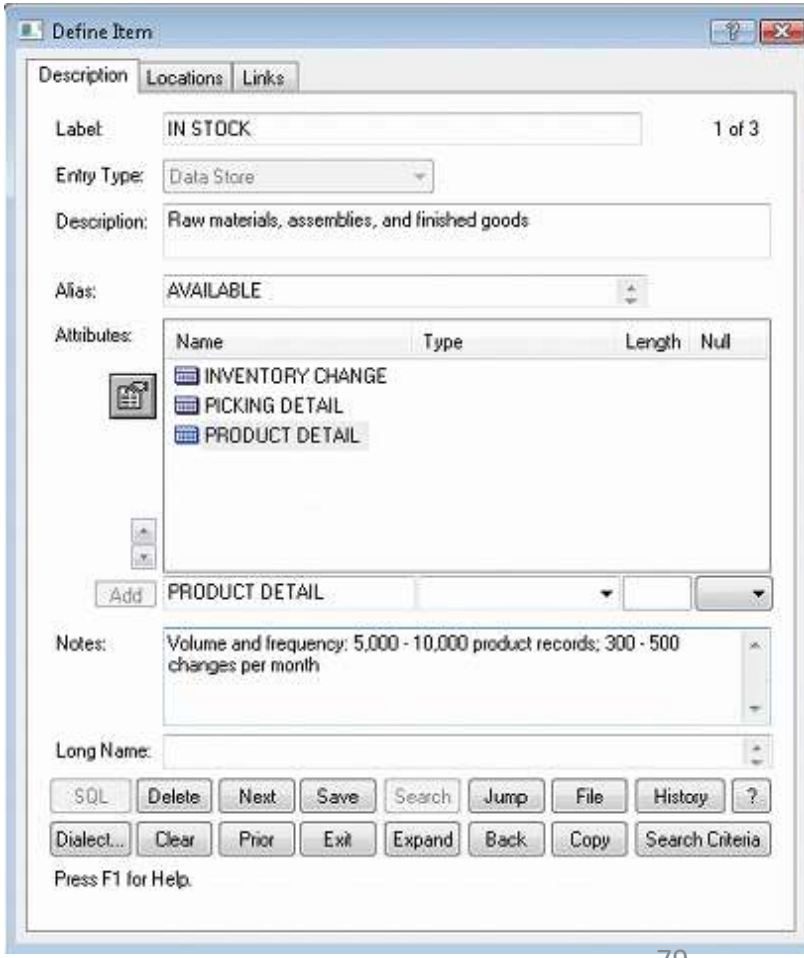


- Documenting the **Data Flows**
  - The typical attributes are as follows
    - Data flow name or label
    - Description
    - Alternate name(s)
    - Origin
    - Destination
    - Record
    - Volume and frequency

p.219 FIGURE5-2

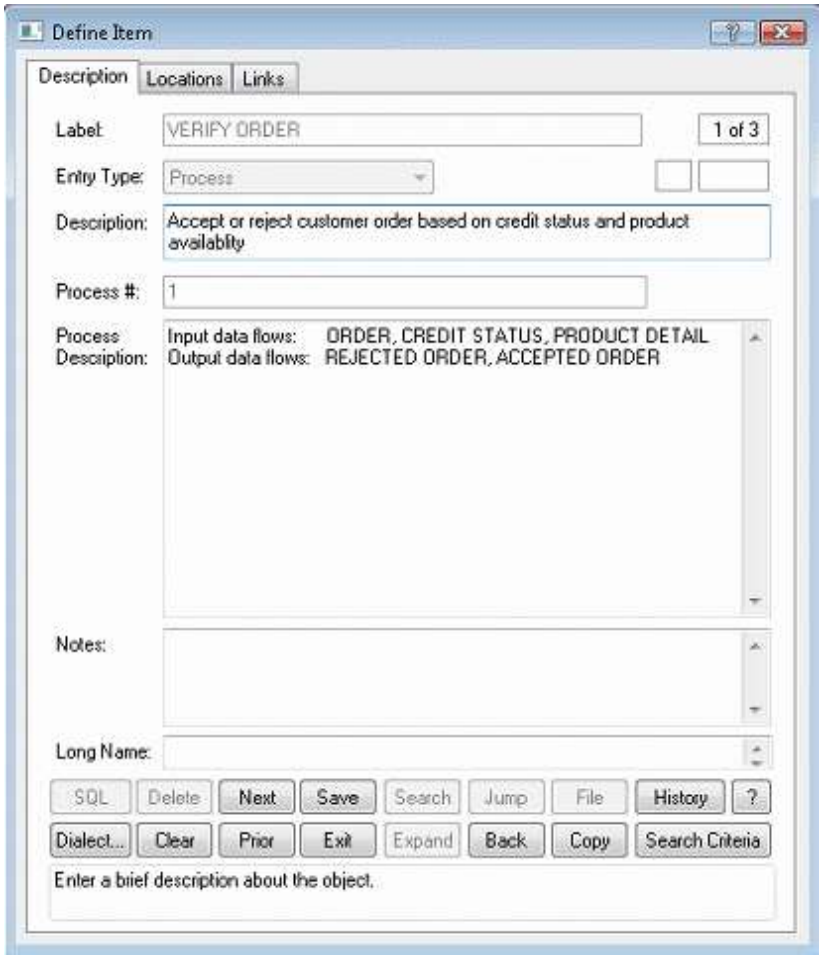
Data Dictionary

- Documenting the **Data Stores**
  - Typical characteristics of a data store are
    - Data store name or label
    - Description
    - Alternate name(s)
    - Attributes
    - Volume and frequency



p.220 FIGURE5-26

Data Dictionary

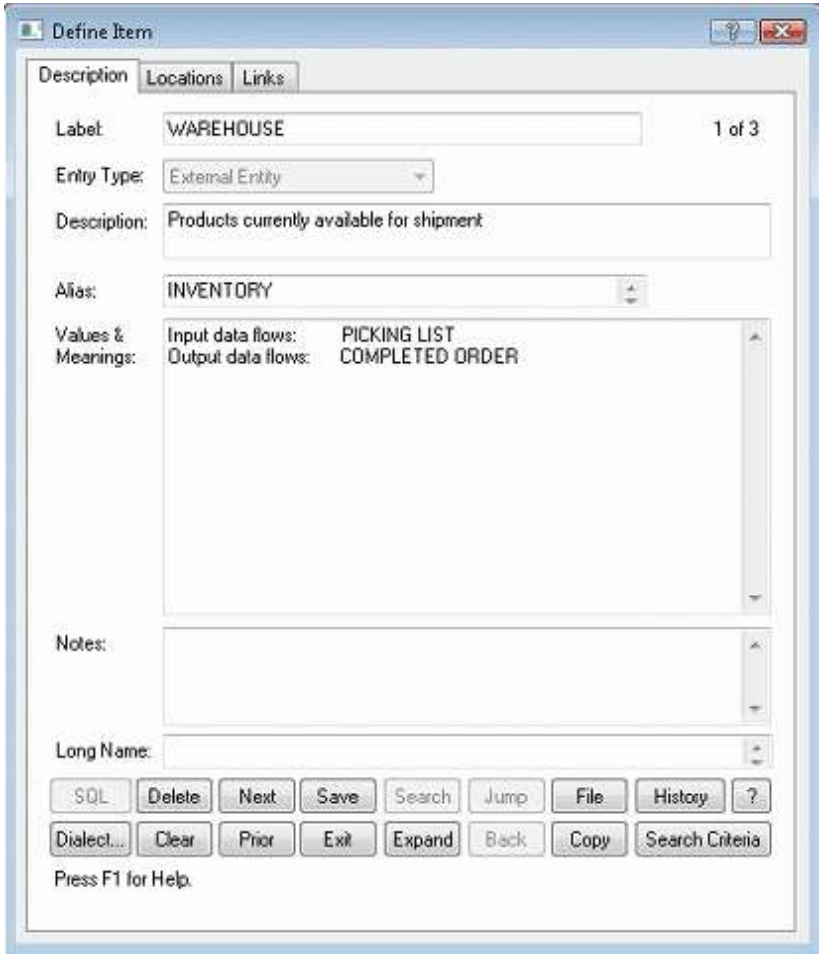


- Documenting the **Processes**
  - Typical characteristics of a process
    - Process name or label
    - Description
    - Process number
    - Process description

220 FIGURE5-27

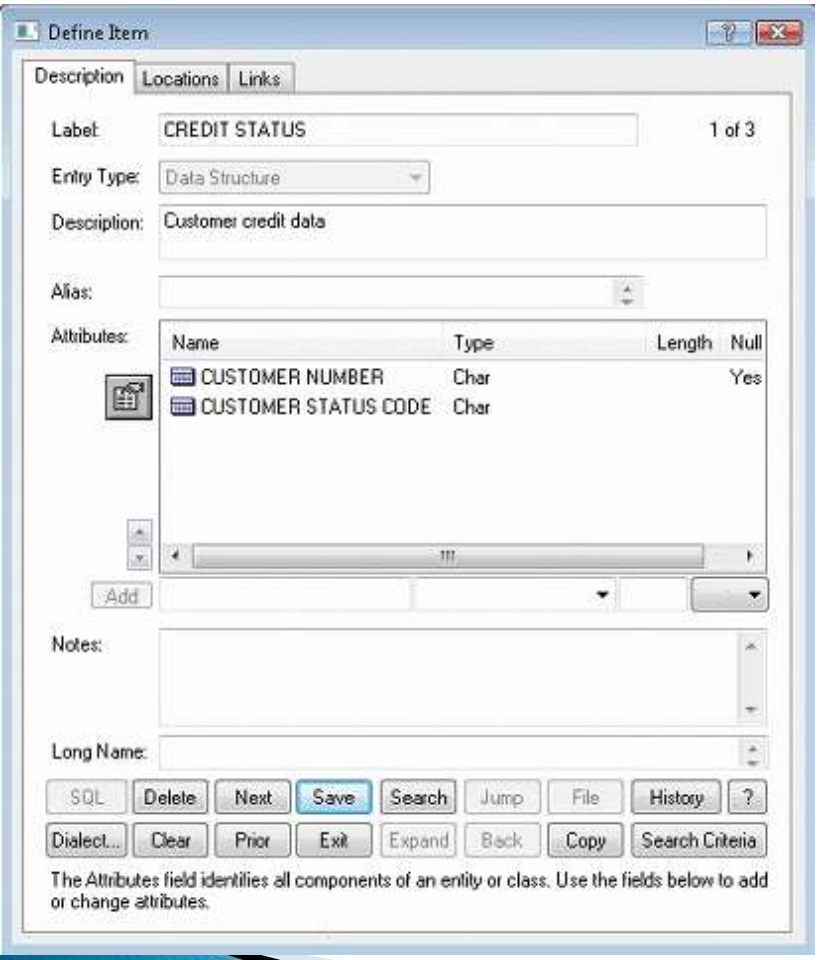
Data Dictionary

- Documenting the **Entities**
  - Typical characteristics of an entity include
    - Entity name
    - Description
    - Alternate name(s)
    - Input data flows
    - Output data flows



p.221 FIGURE5-28

Data Dictionary



- Documenting the **Records**
  - Typical characteristics of a record include
    - Record or data structure name
    - Definition or description
    - Alternate name(s)
    - Attributes

p.221 FIGURE5-29

Data Dictionary

- Documenting the **Data Flows**
  - The typical attributes are as follows
    - Data flow name or label
    - Description
    - Alternate name(s)
    - Origin
    - Destination
    - Record
    - Volume and frequency

Data Dictionary

- Documenting the **Data Stores**
  - Typical characteristics of a data store are
    - Data store name or label
    - Description
    - Alternate name(s)
    - Attributes
    - Volume and frequency

Data Dictionary

- Documenting the **Processes**
  - Typical characteristics of a process
    - Process name or label
    - Description
    - Process number
    - Process description

Data Dictionary

- Documenting the **Entities**
  - Typical characteristics of an entity include
    - Entity name
    - Description
    - Alternate name(s)
    - Input data flows
    - Output data flows

Data Dictionary

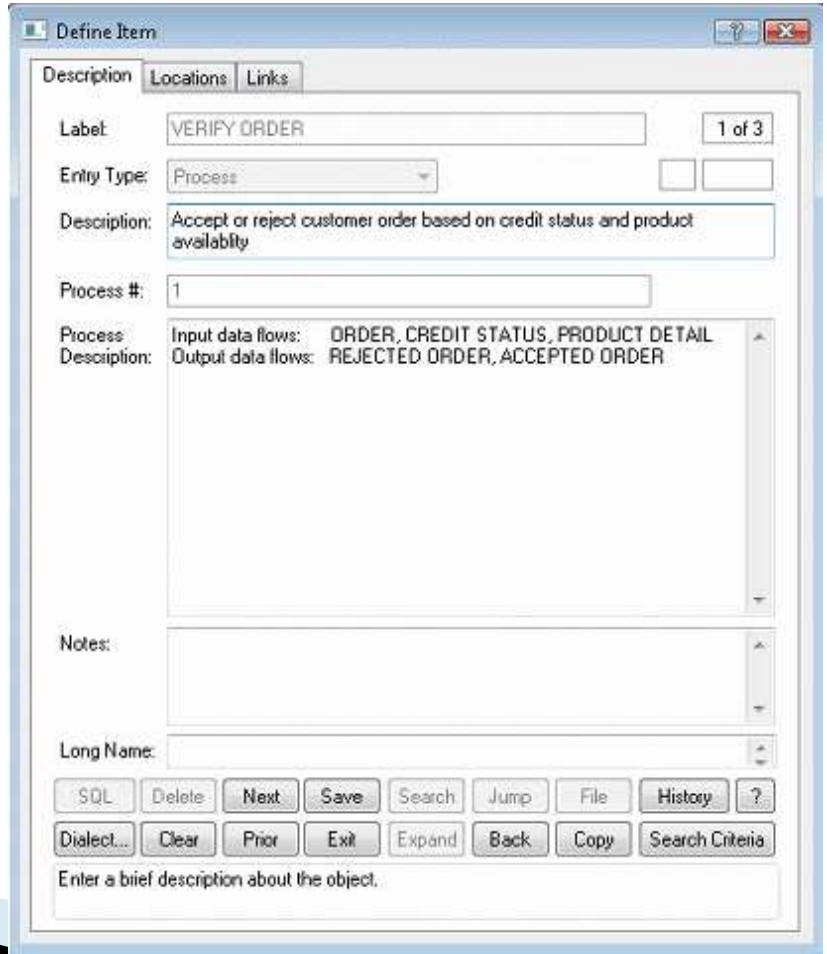
- Documenting the **Records**
  - Typical characteristics of a record include
    - Record or data structure name
    - Definition or description
    - Alternate name(s)
    - Attributes

Data Dictionary

- Data Dictionary **Reports**
  - Many valuable reports
    - An alphabetized list of all data elements by name
    - A report describing each data element and indicating the user or department that is responsible for data entry, updating, or deletion
    - A report of all data flows and data stores that use a particular data element
    - Detailed reports showing all characteristics of data elements, records, data flows, processes, or any other selected item stored in the data dictionary

分組練習

請寫出專案資訊系統的Context Diagram中的Processes的Data Dictionary



Process Description Tools

Process Description Tools

- **Process description**: Documents the details of a functional primitive and represents a specific set of processing steps and business logic
- Tools – structured English, decision tables, and decision trees
- Used in object-oriented development
  - O-O analysis – combines data and the processes that act on the data into things called objects, and similar objects can be grouped together into classes
  - O-O processes are called methods

Process Description Tools (Cont. 3)

- **Decision Tables**
  - Show a logical structure, with all possible combinations of conditions and resulting actions
    - Every possible outcome should be considered to ensure that nothing has been overlooked
  - Number of rules doubles each time a condition is added
  - Can have more than two possible outcomes
  - Are the best way to describe a complex set of conditions

Process Description Tools

- A process description documents the details of a functional primitive, which represents a specific set of processing steps and business logic
- It should be noted that this chapter deals with structured analysis, but the process description tools also can be used in object-oriented development, which is described in Chapter 6

Process Description Tools

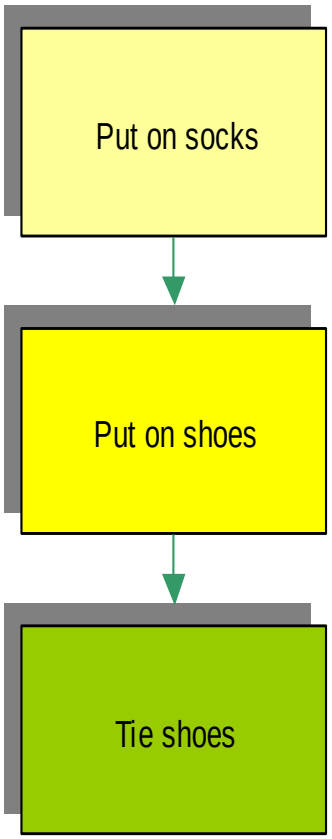
- Modular Design
  - Based on combinations of three logical structures, sometimes called control structures, which serve as building blocks for the process
    - Sequence
    - Selection
    - Iteration – looping

Sequence structure

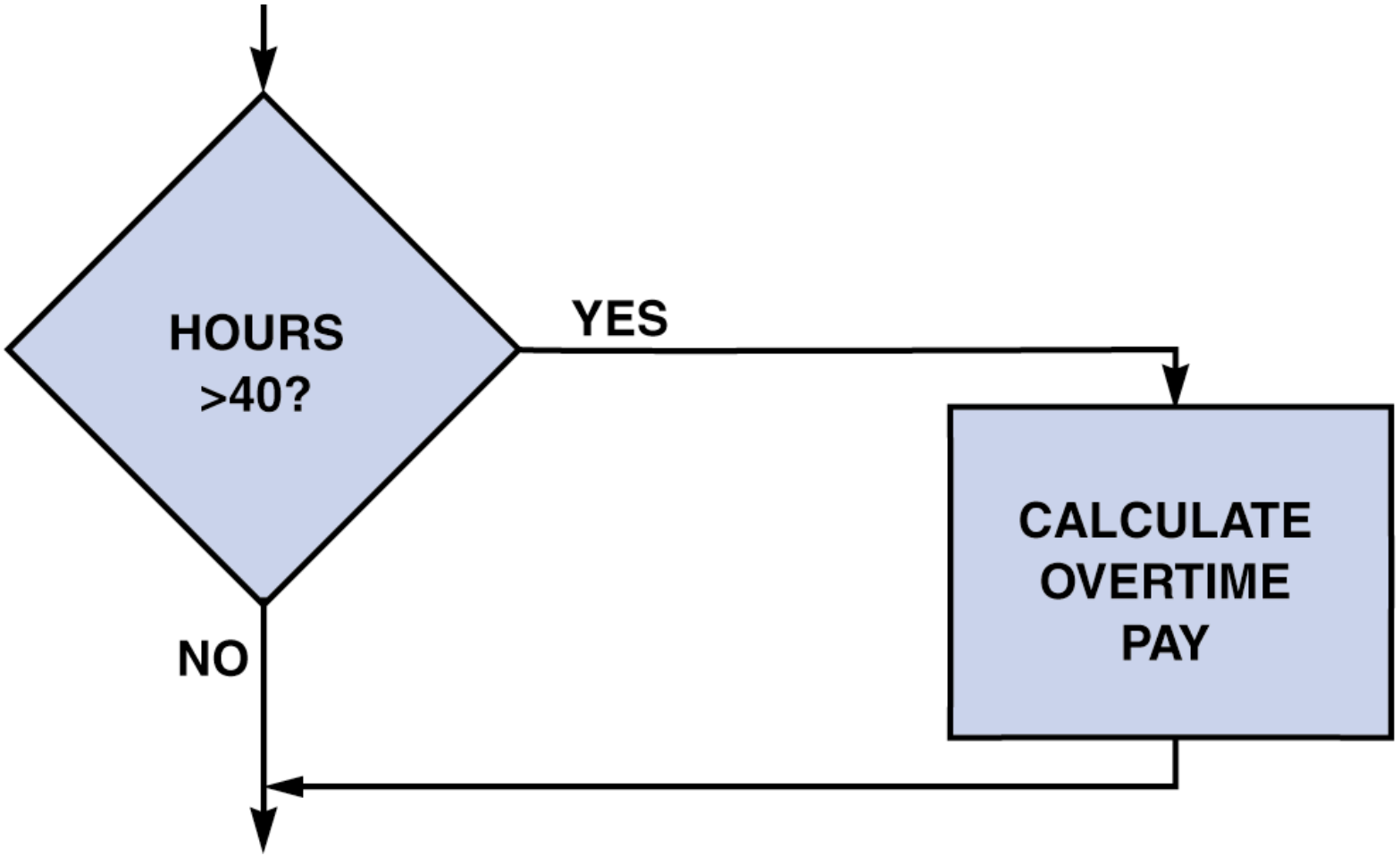
p.166 FIGURE 5-24

After CLASS ACTIVITIES

- Encourage students to draw a diagram similar to Figure 5-30 to show how the sequence structure might be applied to an everyday task. For example:



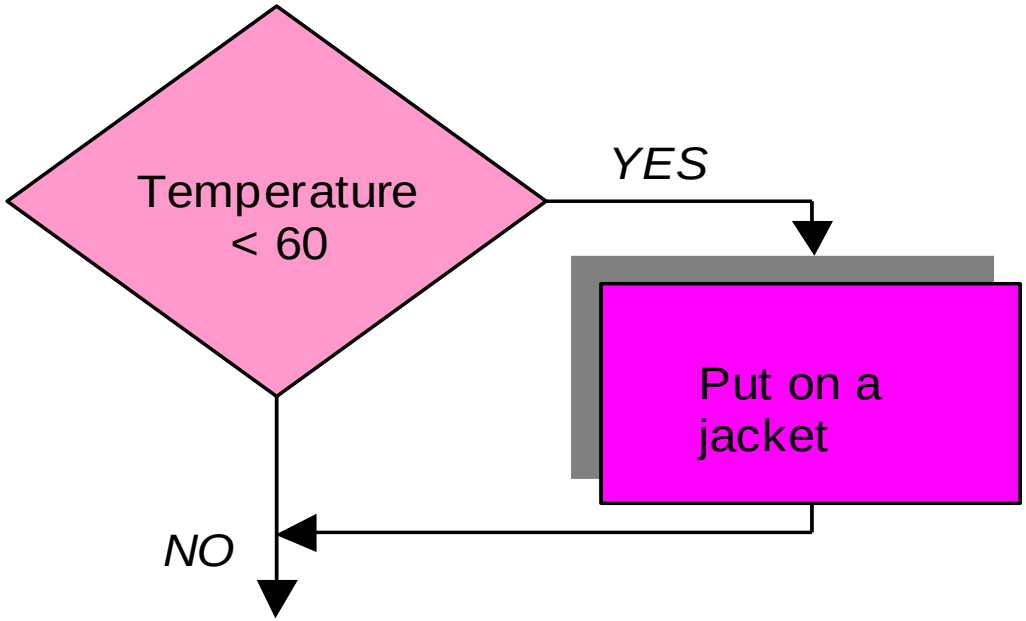
Selection structure



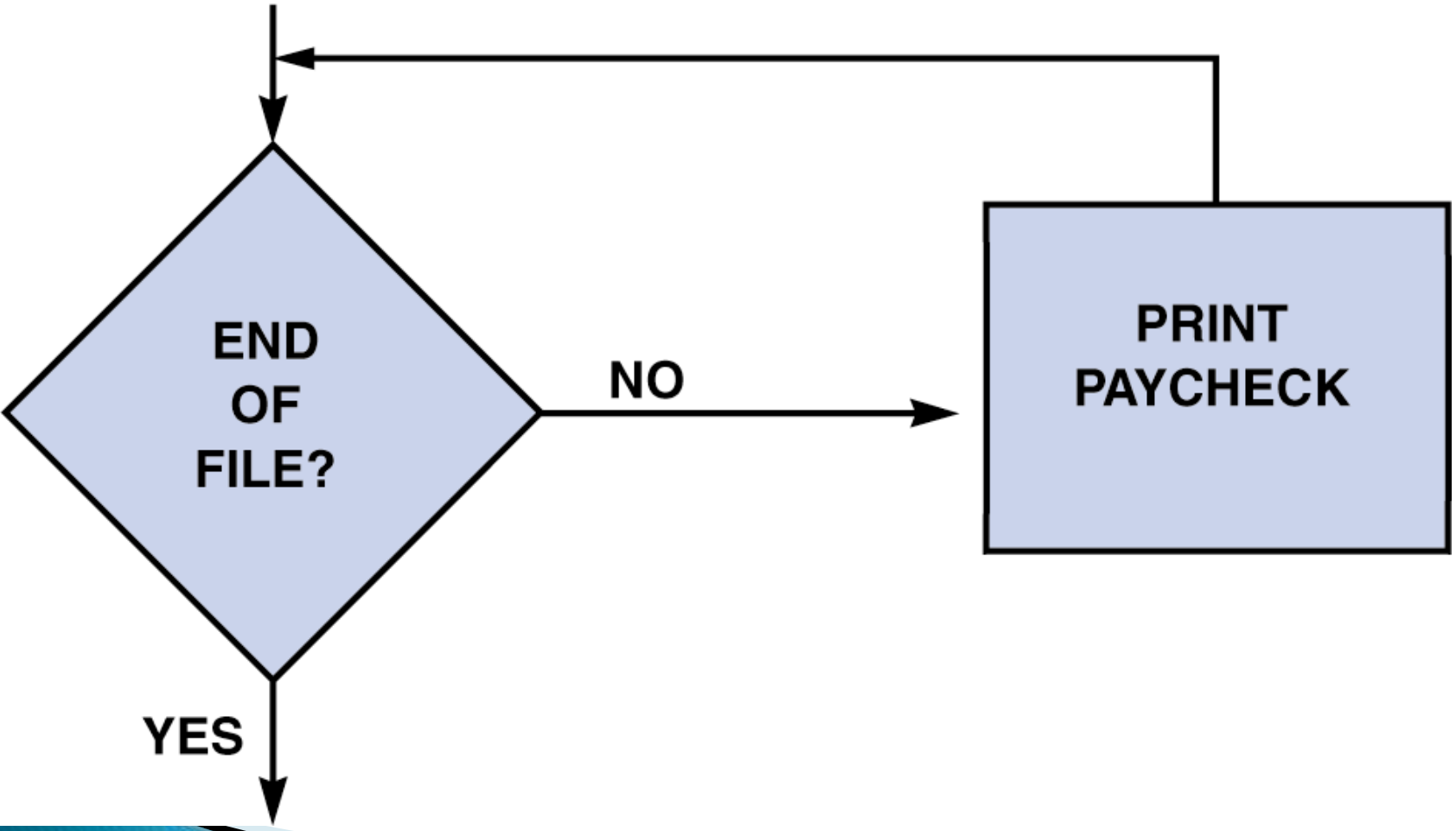
p.166 FIGURE 5-25

For example

- Have students draw a diagram similar to Figure 4-31 to show how the selection structure might be applied to an everyday task. For example:



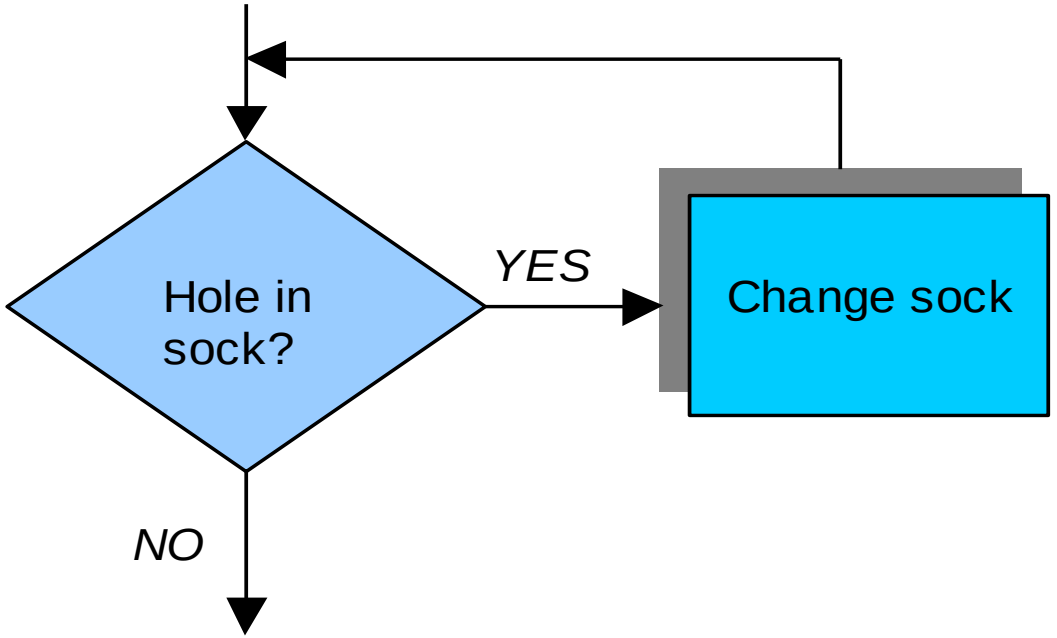
Iteration structure



p.166 FIGURE 5-26

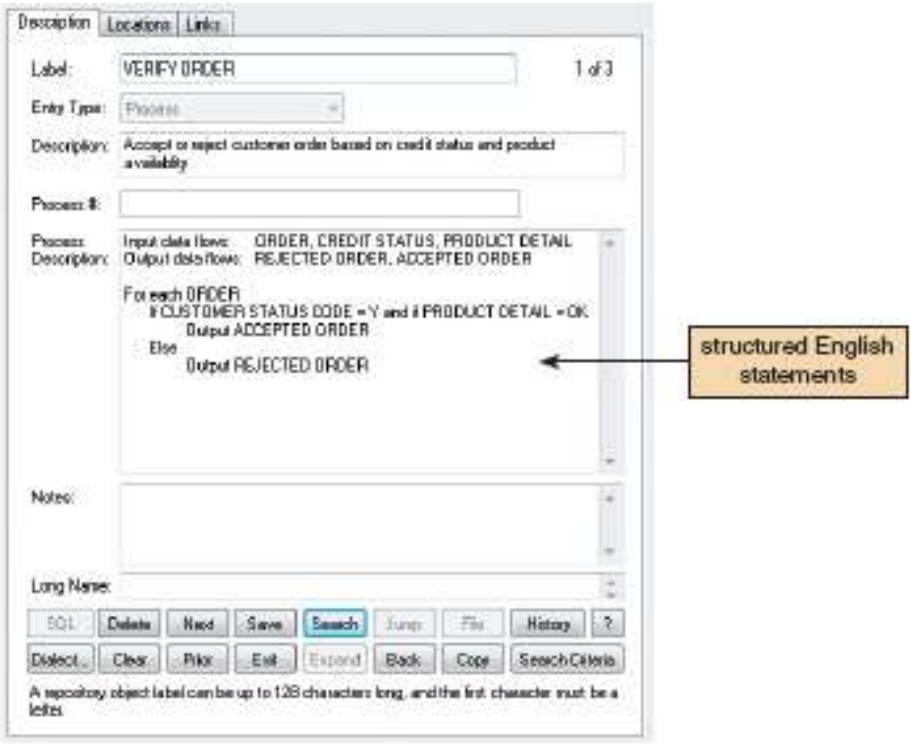
For Example

- Have students draw a diagram similar to Figure 5-26 to show how the iteration structure might be applied to an everyday task. For example:



Process Description Tools (Cont. 2)

- Structured English
  - Rules
    - Use only the three building blocks of sequence, selection, and iteration
    - Use indentation for readability
    - Use a limited vocabulary
      - standard terms used in the data dictionary
      - Specific words that describe the processing rules



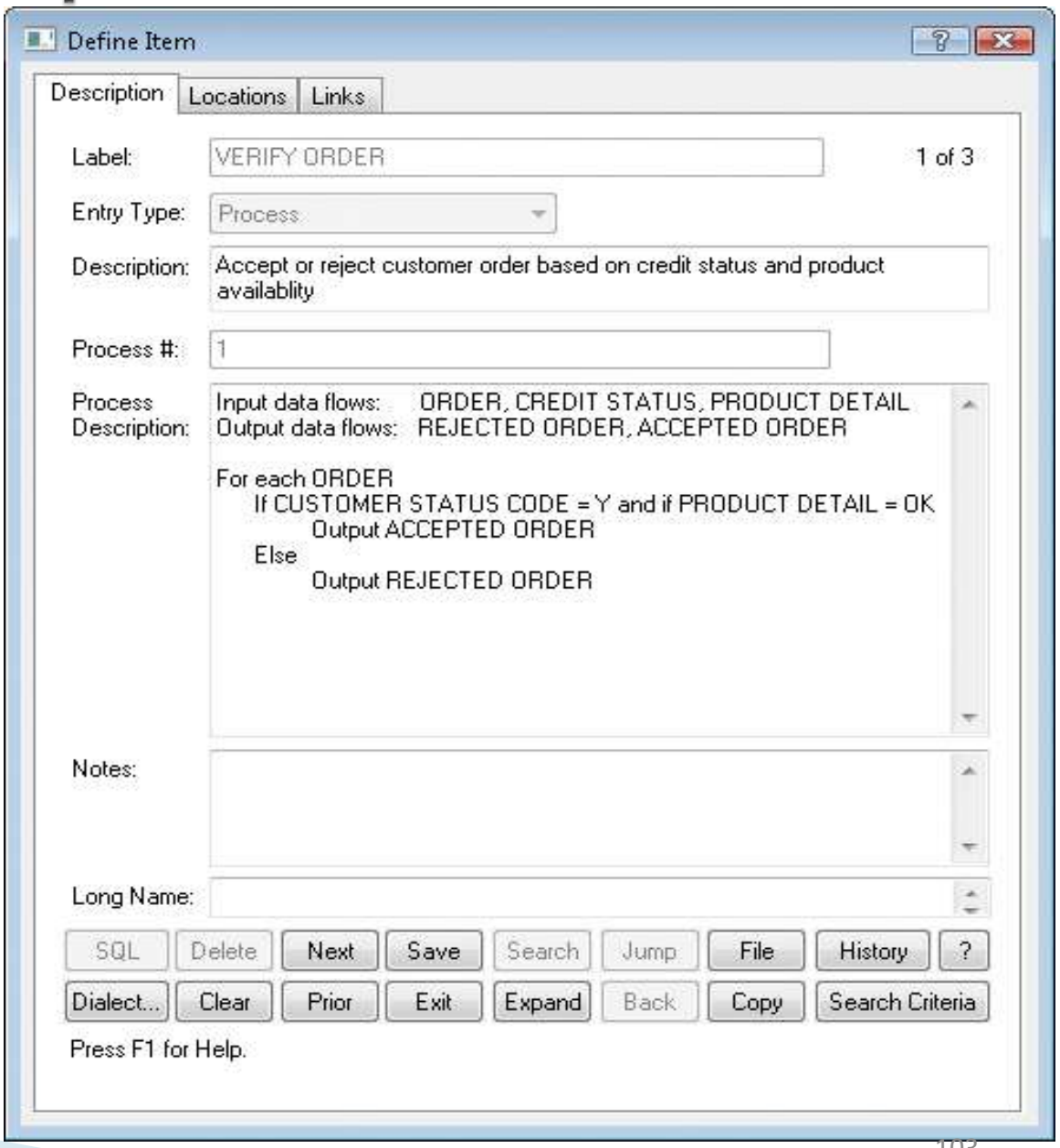
Source: Visible Systems Corporation.

FIGURE 5-27 The VERIFY ORDER process description includes logical rules and a structured English version of the policy. Notice the alignment and indentation of the logic statements

Process Description Tools

- Structured English
  - Must conform to the following rules
    - Use only the three building blocks of sequence, selection, and iteration
    - Use indentation for readability
    - Use a limited vocabulary, including standard terms used in the data dictionary and specific words that describe the processing rules

Process Description Tools



p.167 FIGURE5-27

Process Description Tools

- Structured English
  - Must conform to the following rules
    - Use only the three building blocks of sequence, selection, and iteration
    - Use indentation for readability
    - Use a limited vocabulary, including standard terms used in the data dictionary and specific words that describe the processing rules

Process Description Tools

- Structured English
  - Might look familiar to programming students because it resembles pseudocode
  - The primary purpose of structured English is to describe the underlying business logic

Keroro

變裝 Keroro

Pseudo Keroro

Process Description Tools

- Decision Tables
  - Shows a logical structure, with all possible combinations of conditions and resulting actions
  - It is important to consider every possible outcome to ensure that you have overlooked nothing

VERIFY ORDER Business Process

VERIFY ORDER Business Process with Two Conditions

- An order will be accepted only if the product is in stock and the customer's credit status is OK.
- All other orders will be rejected.

- Two Conditions
  - Product is in stock
  - Customer's credit status is OK
- Two Actions
  - Accept order
  - Reject order

VERIFY ORDER Process

	1	2	3	4
Credit status is OK	Y	Y	N	N
Product is in stock	Y	N	Y	N
Accept order	X			
Reject order		X	X	X

VERIFY ORDER Business Process

VERIFY ORDER Business Process with Three Conditions

- An order will be accepted only if the product is in stock and the customer's credit status is OK.
- The credit manager can waive the credit status requirement.
- All other orders will be rejected.

- Three Conditions:
  - Customer's credit status is OK
  - Product is in stock
  - The credit manager can waive the credit status requirement
- Two Actions
  - Accept order
  - Reject order

VERIFY ORDER Process with Credit Waiver

An accepted order requires that credit status is OK and the product is in stock. Otherwise, the order is rejected. This example is more complex, because the credit manager can waive the credit status requirement in certain cases.

	1	2	3	4	5	6	7	8
Credit status OK	Y	Y	Y	Y	N	N	N	N
Product is in stock	Y	Y	N	N	Y	Y	N	N
Waiver from credit manager	Y	N	Y	N	Y	N	Y	N
Accept order								
Reject order								

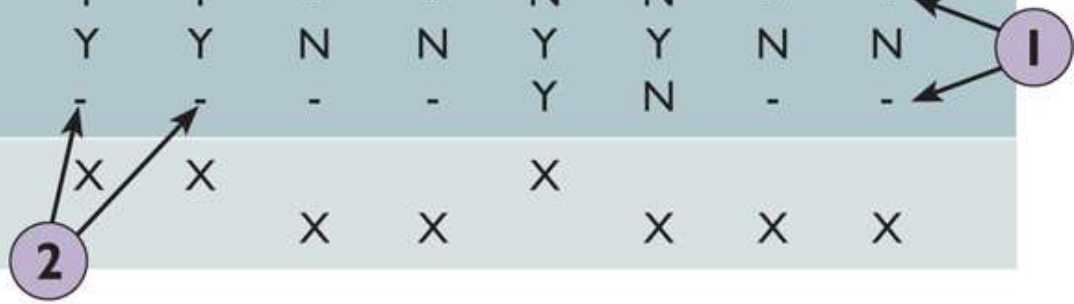
VERIFY ORDER Process

VERIFY ORDER Process with Credit Waiver (initial version)

	1	2	3	4	5	6	7	8
Credit status is OK	Y	Y	Y	Y	N	N	N	N
Product is in stock	Y	Y	N	N	Y	Y	N	N
Waiver from credit manager	Y	N	Y	N	Y	N	Y	N
Accept order	X	X			X			
Reject order			X	X		X	X	X

Rule combination and simplification

	1	2	3	4	5	6	7	8
Credit status is OK	Y	Y	-	-	N	N	-	-
Product is in stock	Y	Y	N	N	Y	Y	N	N
Waiver from credit manager	-	-	-	-	Y	N	-	-
Accept order	X	X			X			
Reject order			X	X		X	X	X



VERIFY ORDER Process with Credit Waiver (after rule combination and simplification)

	1 (COMBINES PREVIOUS 1,2)	2 (PREVIOUS 5)	3 (PREVIOUS 6)	4 (COMBINES PREVIOUS 3,4,7,8)
Credit status is OK	Y	N	N	-
Product is in stock	Y	Y	Y	N
Waiver from credit manager	-	Y	N	-
Accept order	X	X		
Reject order			X	X

Process Description Tools

VERIFY ORDER Process with Credit Waiver (Initial version)

	1	2	3	4	5	6	7	8
Credit status is OK	Y	Y	Y	Y	N	N	N	N
Product is in stock	Y	Y	N	N	Y	Y	N	N
Waiver from credit manager	Y	N	Y	N	Y	N	Y	N
Accept order	X	X			X			
Reject order			X	X		X	X	X

VERIFY ORDER Process with Credit Waiver (With rules marked for combination)

	1	2	3	4	5	6	7	8
Credit status is OK	Y	Y	-	-	N	N	-	-
Product is in stock	Y	Y	N	N	Y	Y	N	N
Waiver from credit manager	-	-	-	-	Y	N	-	-
Accept order	X	X			X			
Reject order			X	X		X	X	X

VERIFY ORDER Process with Credit Waiver (After rule combination and simplification)

	1 (COMBINES PREVIOUS 1, 2)	2 (PREVIOUS 5)	3 (PREVIOUS 6)	4 (COMBINES PREVIOUS 3, 4, 7, 8)
Credit status is OK	Y	N	N	-
Product is in stock	Y	Y	Y	N
Waiver from credit manager	-	Y	N	-
Accept order	X	X		
Reject order			X	X

Sale Promotion Policy

SAMPLE OF A SALES PROMOTION POLICY

- Preferred customers who order more than $1,000 are entitled to a 5% discount, and an additional 5% discount if they used our charge card.
- Preferred customers who do not order more than $1,000 receive a $25 bonus coupon.
- All other customers receive a $5 bonus coupon.

STRUCTURED ENGLISH VERSION OF THE SALES PROMOTION POLICY

```
IF customer is a preferred customer, and
        IF customer orders more than $1,000 then
                Apply a 5% discount, and
                IF customer uses our charge card, then
                        Apply an additional 5% discount
        ELSE
                        Award a $25 bonus coupon
ELSE
        Award a $5 bonus coupon
```

Three conditions

- Preferred customers
- Order $1000 or more
- Use charge card

? conditions

- 5% discount
- Additional 5% discount
- $25 bonus coupon
- $5 bonus coupon

Process Description Tools

Sales Promotion Policy (initial version)

	1	2	3	4	5	6	7	8
Preferred customer	Y	Y	Y	Y	N	N	N	N
Ordered $1,000 or more	Y	Y	N	N	Y	Y	N	N
Used our charge card	Y	N	Y	N	Y	N	Y	N
5% discount	X	X						
Additional 5% discount	X							
$25 bonus coupon			X	X				
$5 bonus coupon					X	X	X	X

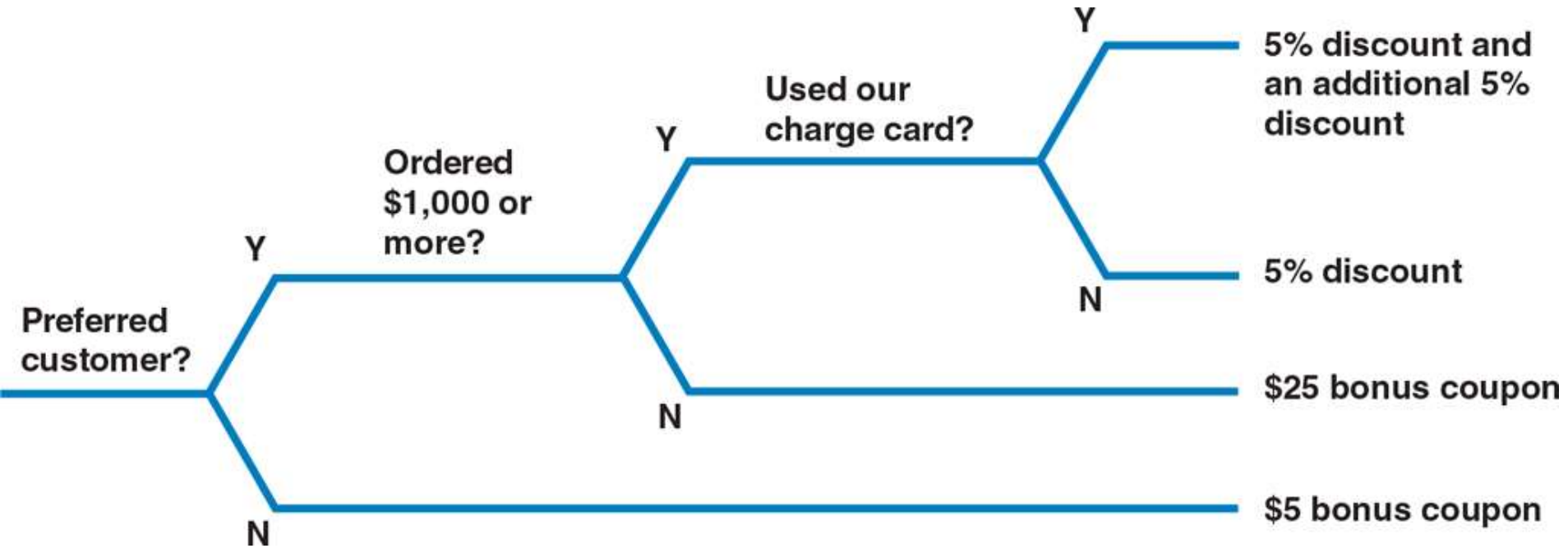
p.170 FIGURE5-33

Sales Promotion Policy (final version)

	1	2	3	4	5	6	7	8
Preferred customer	Y	Y	Y	Y	N	N	N	N
Ordered $1,000 or more	Y	Y	N	N	-	-	-	-
Used our charge card	Y	N	-	-	-	-	-	-
5% discount	X	X						
Additional 5% discount	X							
$25 bonus coupon			X	X				
$5 bonus coupon					X	X	X	X

Process Description Tools

- Decision Trees



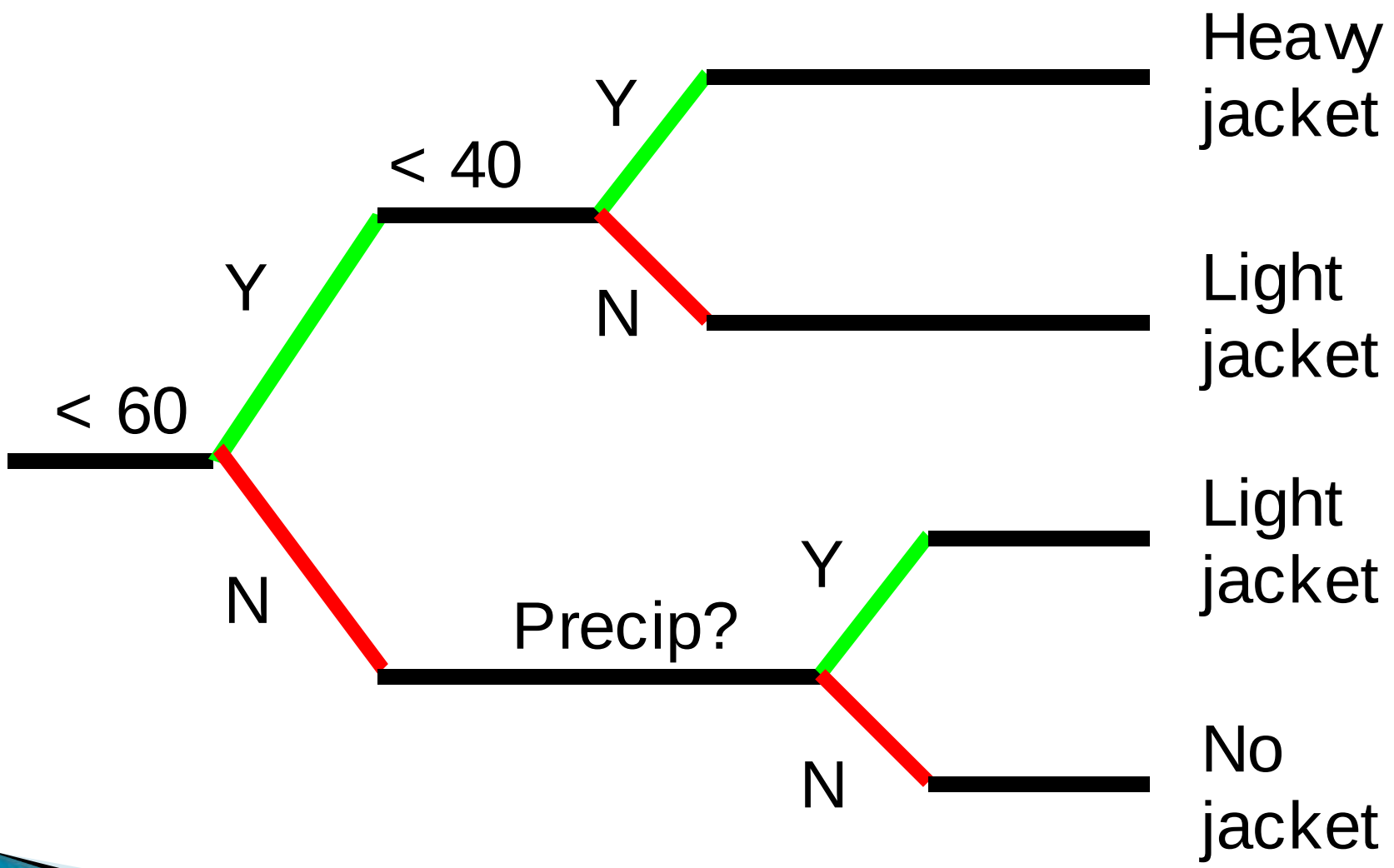
CLASSROOM ACTIVITIES 1

- generate a decision table that can be used for a simple decision, such as determining whether to wear a heavy/light jacket, or no jacket depending on outside temperature (less than 60° or less than 40°) and precipitation.

	Rules					
	1	**2**	**3**	**4**	**5**	**6**
Conditions:						
Temp < 60°?	N	N	Y	Y	Y	Y
Temp < 40°?	N	N	N	N	Y	Y
Precipitation?	N	Y	N	Y	N	Y
Actions:						
No jacket	X					
Light jacket		X	X	X		
Heavy jacket					X	X

CLASSROOM ACTIVITIES 2

- generate a decision tree that can be used for a simple decision, such as determining whether to wear a heavy/light jacket, or no jacket depending on outside temperature (less than 60° or less than 40°) and precipitation.


< 60
Y
< 40
Y
Heavy jacket
N
Light jacket
N
Precip?
Y
Light jacket
N
No jacket

- Leah Jones is the IT manager at Rock Solid Outfitters, a medium-sized supplier of outdoor climbing and camping gear. Steve Allen, the marketing director, has asked Leah to develop a special Web-based promotion.

- As Steve described it to Leah, Rock Solid will provide free shipping for any customer who either completes an online survey form or signs up for the Rock Solid online newsletter.
- Additionally, if a customer completes the survey and signs up for the newsletter, Rock Solid will provide a $10 merchandise credit for orders over $100 or more.

- Leah has asked you to develop a decision table that will reflect the promotional rules that a programmer will use. She wants you to show all possibilities, then to simplify the results to eliminate any combinations that would be unrealistic or redundant.

- Step 1: Design the table with three possible conditions and two possible outcomes.

RULES	1	2	3	4	5	6	7	8
Completed survey form?								
Signed up for newsletter?								
Order > $100?								
Free shipping								
$10 merchandise credit								

- Step 2: Now the rules can be simplified

RULES	1	2	3	4	5	6	7	8
Completed survey form?	y	y	y	y	n	y	n	n
Signed up for newsletter?	y	y	n	n	y	y	n	n
Order > $100?	y	n	y	n	y	n	y	n
Free shipping	y	y	y	y	y	y	n	n
$10 merchandise credit								

- Step 3: Finally, based on the analysis described in Step 2, the original eight rules can be combined into just five rules,

RULES	1	2	3	4	5	6	7	8
Completed survey form?								
Signed up for newsletter?								
Order > $100?								
Free shipping								
$10 merchandise credit								

Logical versus Physical Models

- While structured analysis tools are used to develop a logical model for a new information system, such tools also can be used to develop physical models of an information system
- A physical model shows how the system's requirements are implemented

Logical versus Physical Models

(Cont. 1)

- **Sequence of Models**
  - Systems analysts create a physical model of the current system and then develop a logical model of the current system before tackling a logical model of the new system
    - Performing extra step allows to understand the current system better

Logical versus Physical Models

(Cont. 2)

- **Four-Model Approach**
  - Develop:
    - A physical model of the current system
    - A logical model of the current system
    - A logical model of the new system
    - A physical model of the new system
  - Disadvantage – Additional time and cost

Chapter Summary

- During data and process modeling, a systems analyst develops graphical models to show how the system transforms data into useful information
- The end product of data and process modeling is a logical model that will support business operations and meet user needs
- Data and process modeling involves three main tools: data flow diagrams, a data dictionary, and process descriptions

Chapter Summary (Cont. 1)

- Data flow diagrams (DFDs) graphically show the movement and transformation of data in the information system
- DFDs use four symbols
- A set of DFDs is like a pyramid with the context diagram at the top
- The data dictionary is the central documentation tool for structured analysis

Chapter Summary (Cont. 2)

- Each functional primitive process is documented using structured English, decision tables, and decision trees
- Structured analysis tools can be used to develop a logical model during one systems analysis phase, and a physical model during the systems design phase