Systems Analysis and Design 11th Edition

» Chapter 5
Data and Process Modeling

Chapter Objectives

- Describe data and process modeling concepts and tools, including data flow diagrams, 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

Chapter Objectives (Cont.)

▸ Explain how to level and balance a set of data flow diagrams

Introduction

- **Logical Model**: Shows what the system must do, regardless of how it will be implemented physically
- **Physical Model**: Describes how the system will be constructed

Overview of Data and Process Modeling Tools

- Systems analysts use graphical techniques to describe an information system
- Data flow diagram (DFD) – Uses various symbols to show how the system transforms input data into useful information

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
  ◦ Four basic symbols represent processes, data flows, data stores, and entities
  ◦ **Gane and Sarson**: Used in data flow diagrams
    • Processes, data flows, data stores, and external entities all have a unique symbol
  ◦ **Yourdon**: Used in data flow diagrams
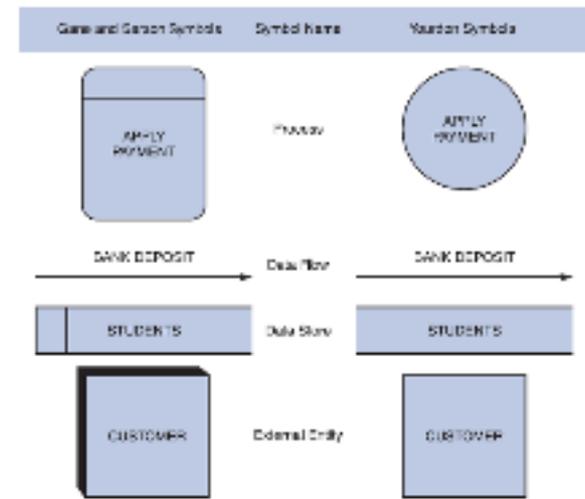   • Processes, data flows, data stores, and external entities each have a unique symbol

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

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 (Cont. 3)
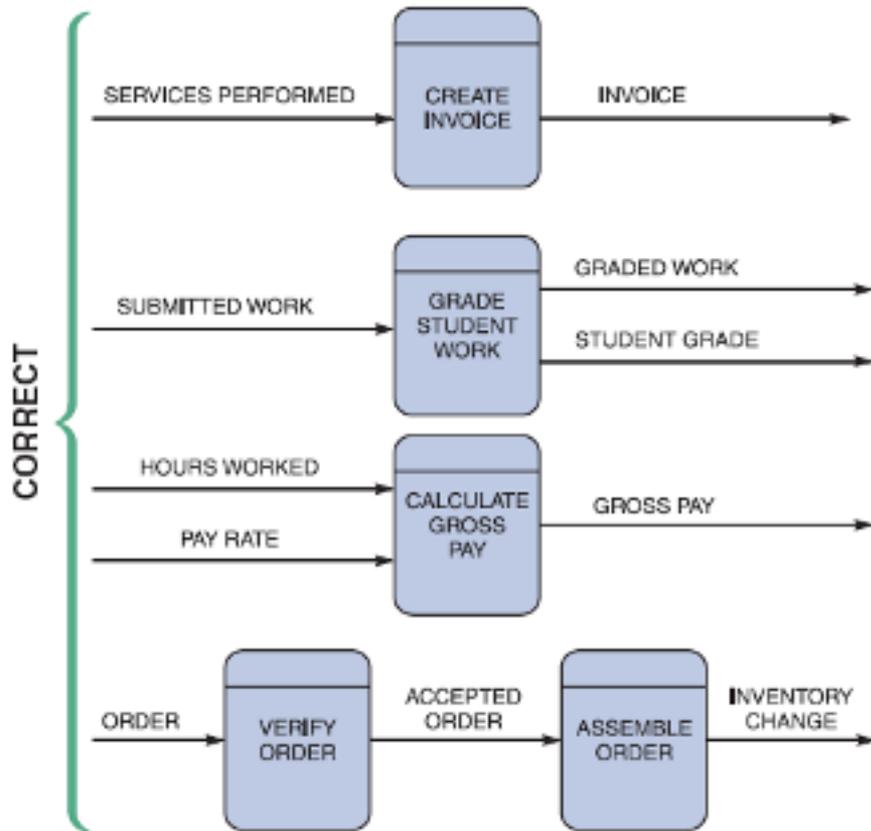
▸ **Data Flow Symbol**
  ◦ Represents one or more data items
  ◦ The symbol for a data flow is a line with a single or double arrowhead

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

Data Flow Diagrams (Cont. 4)

▸ **Data Flow Symbol**
  ◦ Following data flow and process combinations must be avoided
    ◦ **Spontaneous generation**
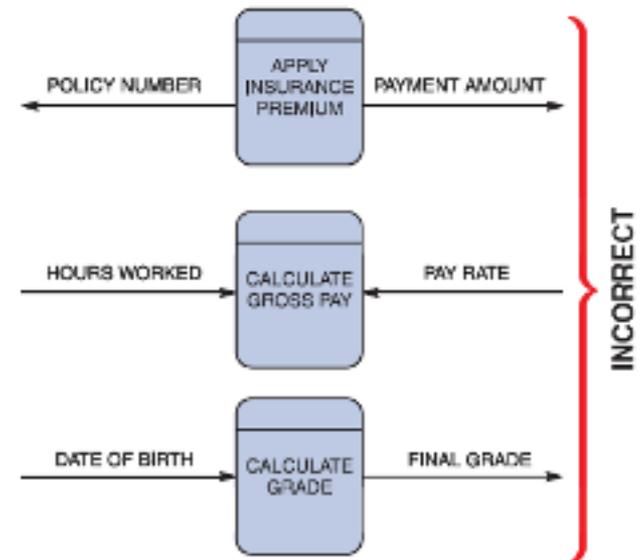   ◦ **Black holes**
    ◦ **Gray holes**

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
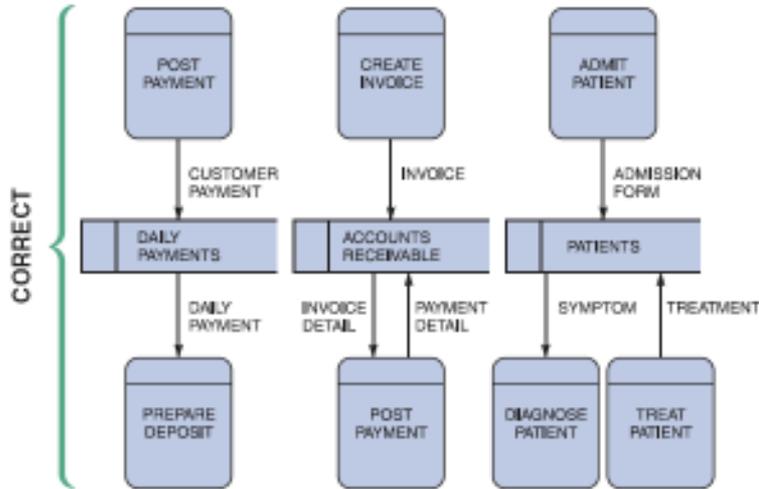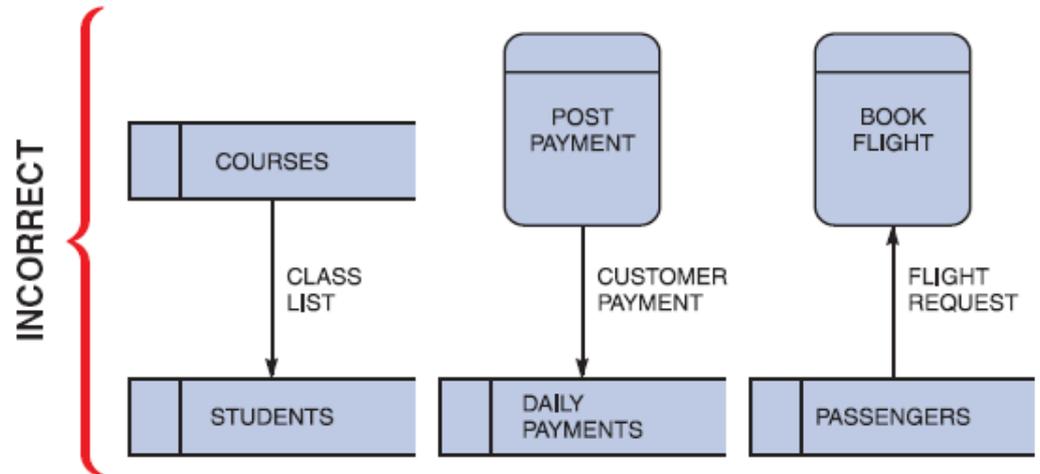
Data Flow Diagrams (Cont. 6)

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

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

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
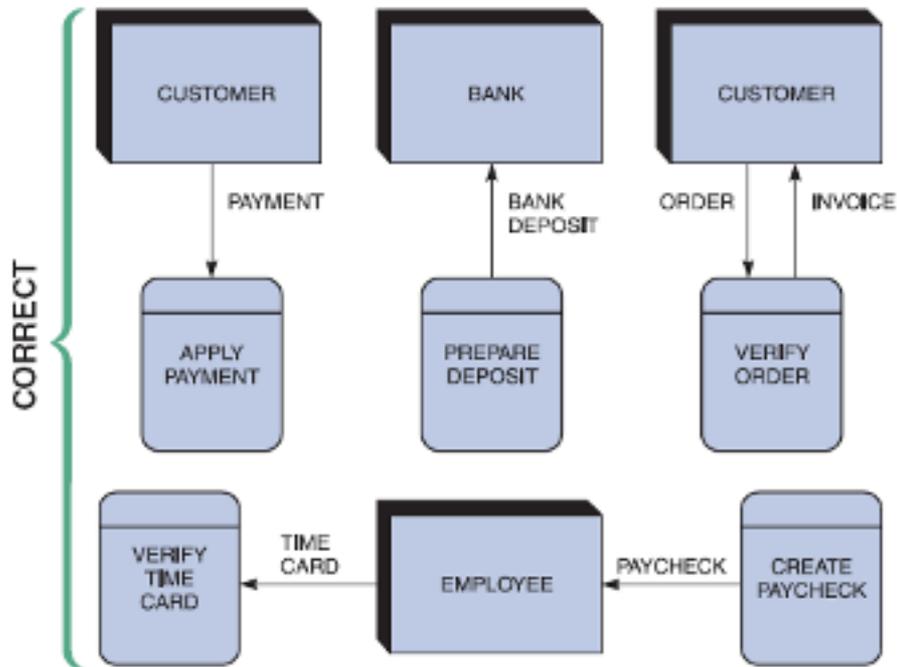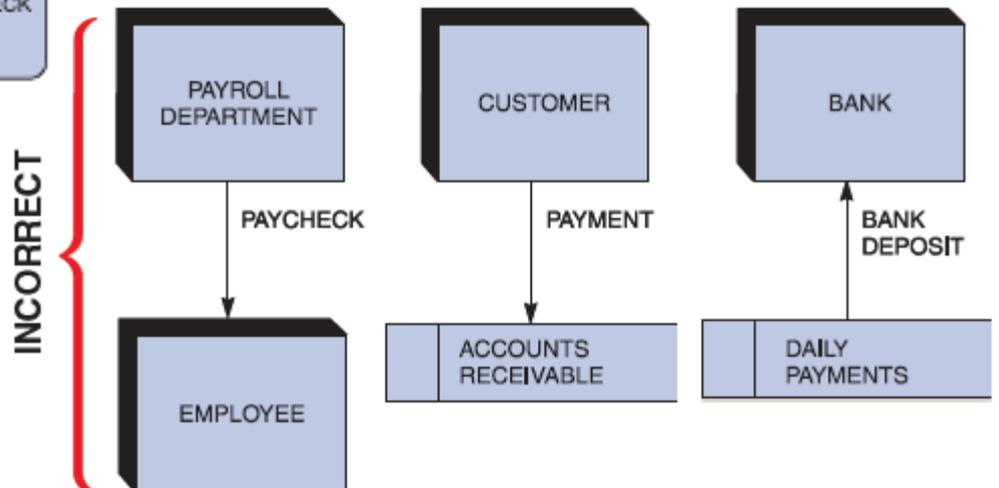
Data Flow Diagrams (Cont. 8)

FIGURE 5-8 Examples of incorrect uses of external entities. An external entity must be connected by a data flow to a process, and not directly to a data store or to another external entity

FIGURE 5-7 Examples of correct uses of external entities in a data flow diagram

Data Flow Diagrams (Cont. 9)

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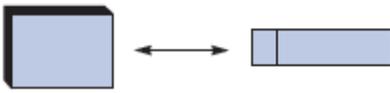 ◦ Large processes can be broken down into smaller components

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

Correct and Incorrect Examples of Data Flows		
	Process to Process	✔
	Process to External Entity	✔
	Process to Data Store	✔
	External Entity to External Entity	�’
	External Entity to Data Store	✗
	Data Store to Data Store	✗

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 (Cont. 1)

▸ Guidelines for Drawing DFDs
  ◦ Draw the context diagram 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 symbols
  ◦ Do not cross lines
  ◦ Provide a unique name and reference number for each process
  ◦ Ensure that the model is accurate, easy to understand, and meets the needs of its users
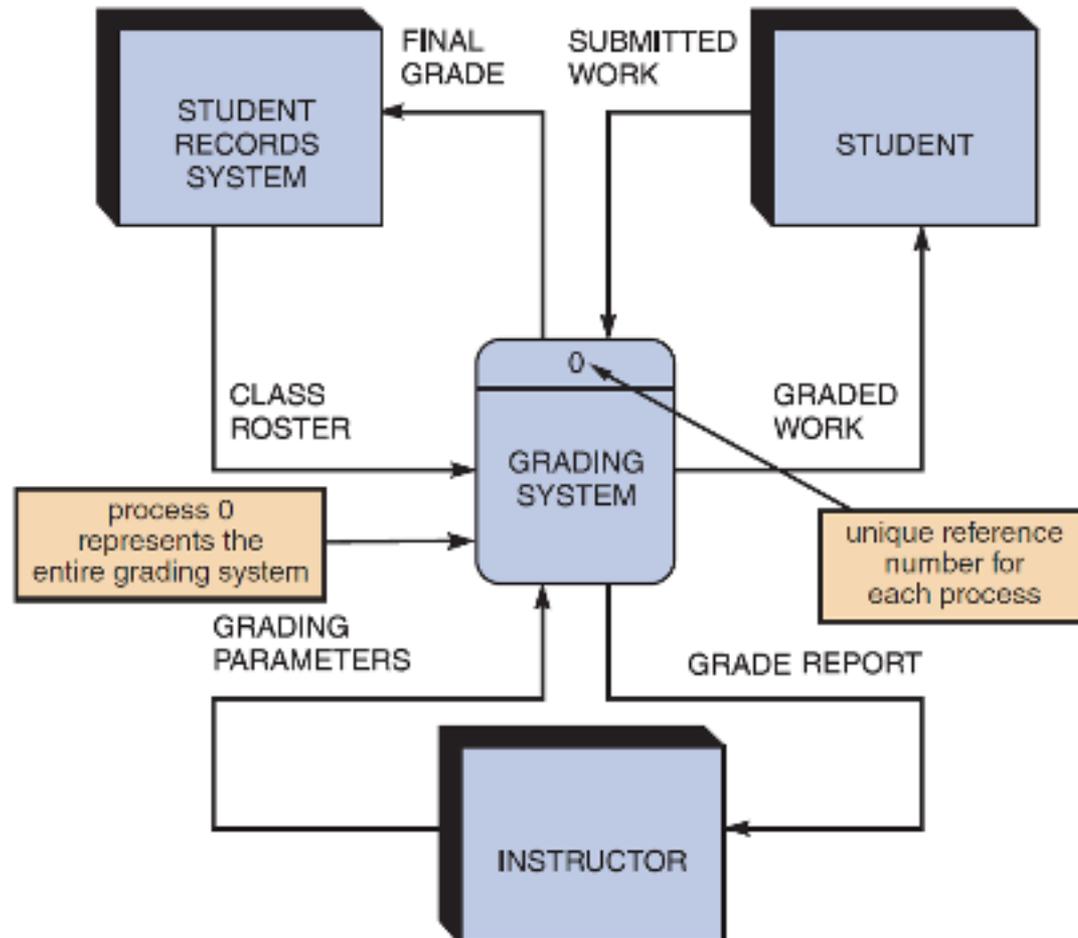
Creating a Set of DFDs (Cont.2)

FIGURE 5-10 Context diagram DFD for grading system

Creating a Set of DFDs (Cont. 3)
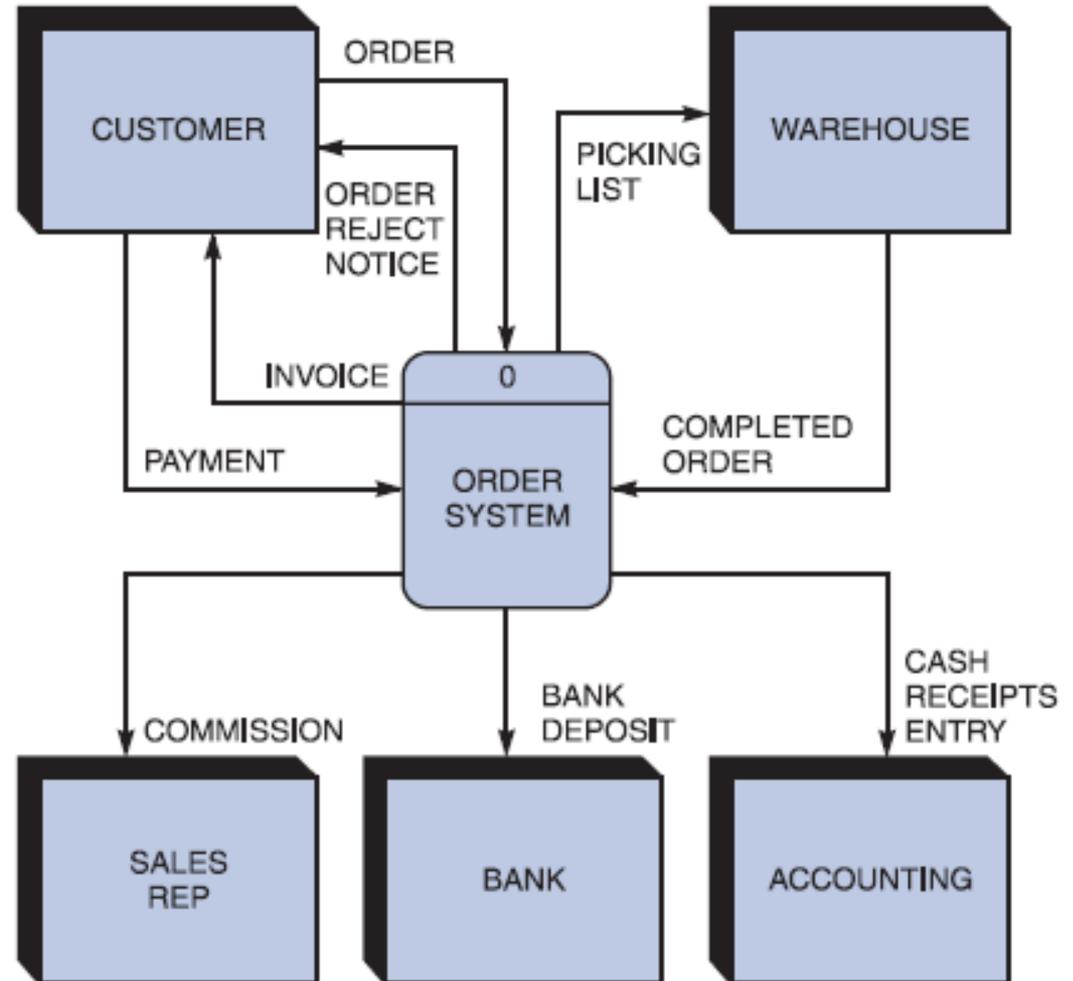
▸ **Step 1: Draw a Context Diagram**

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
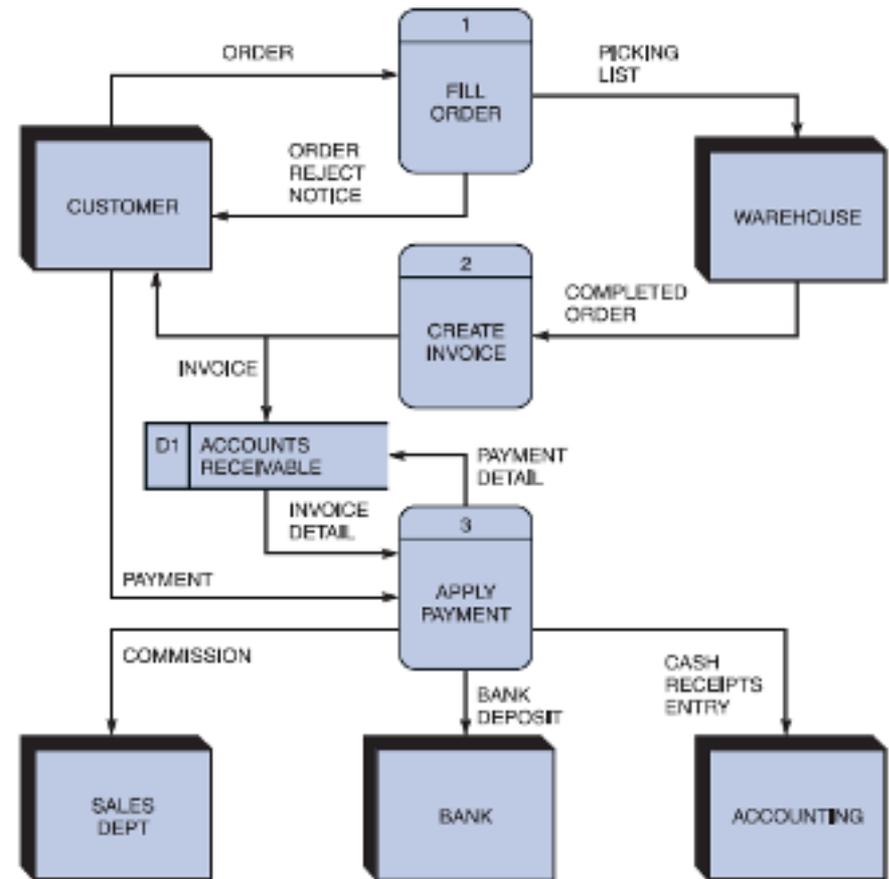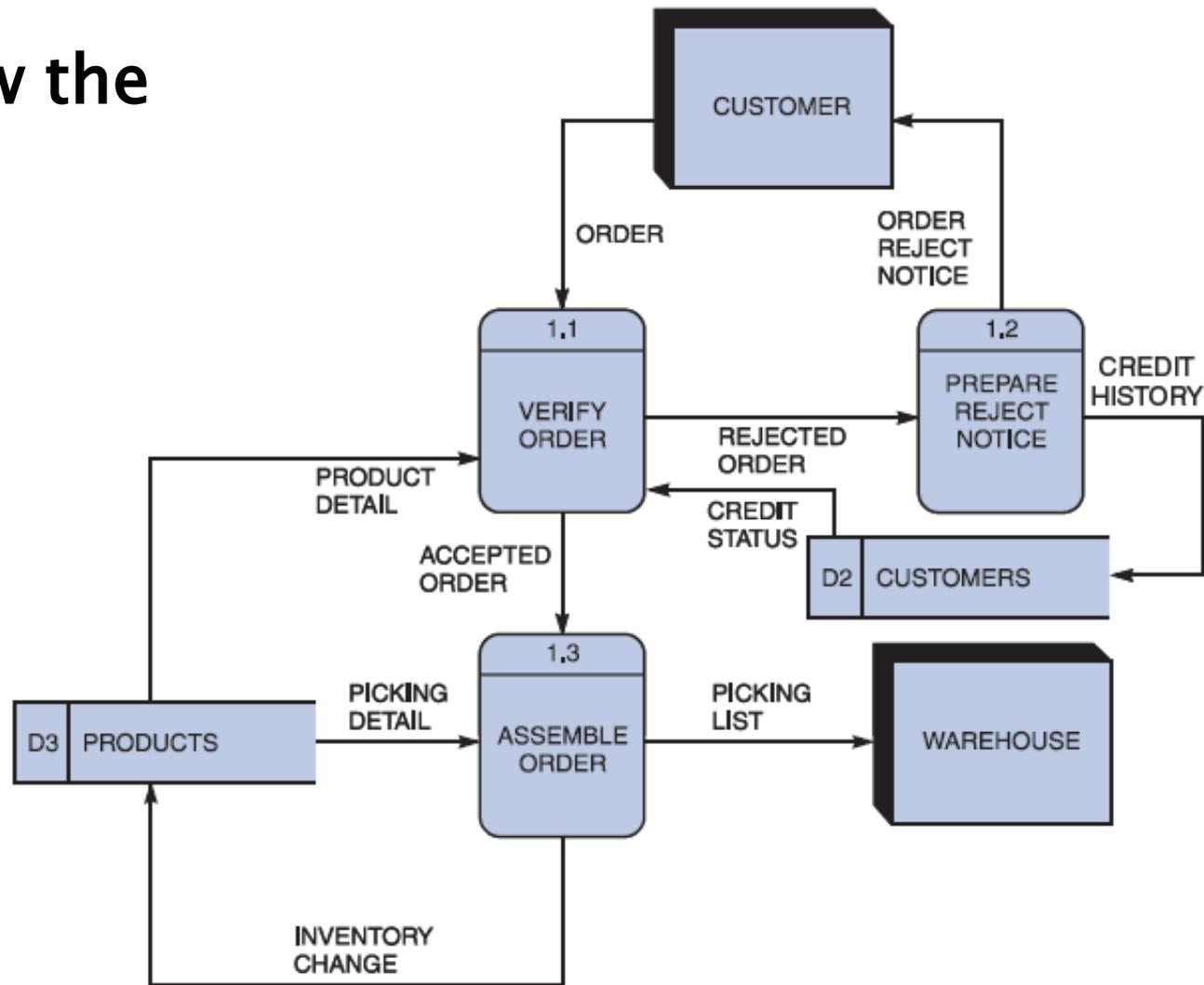 - ◦ Child diagram
  - ◦ Functional primitive

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
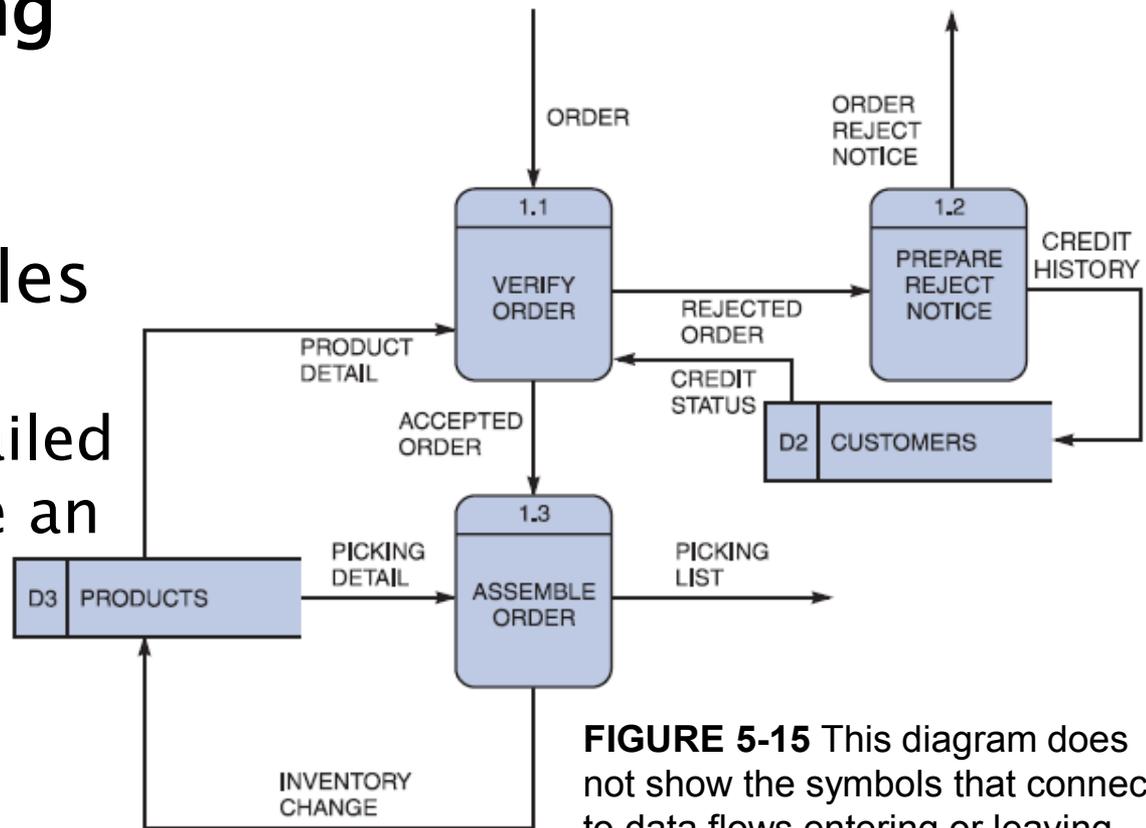 - Exploding, partitioning, or decomposing

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

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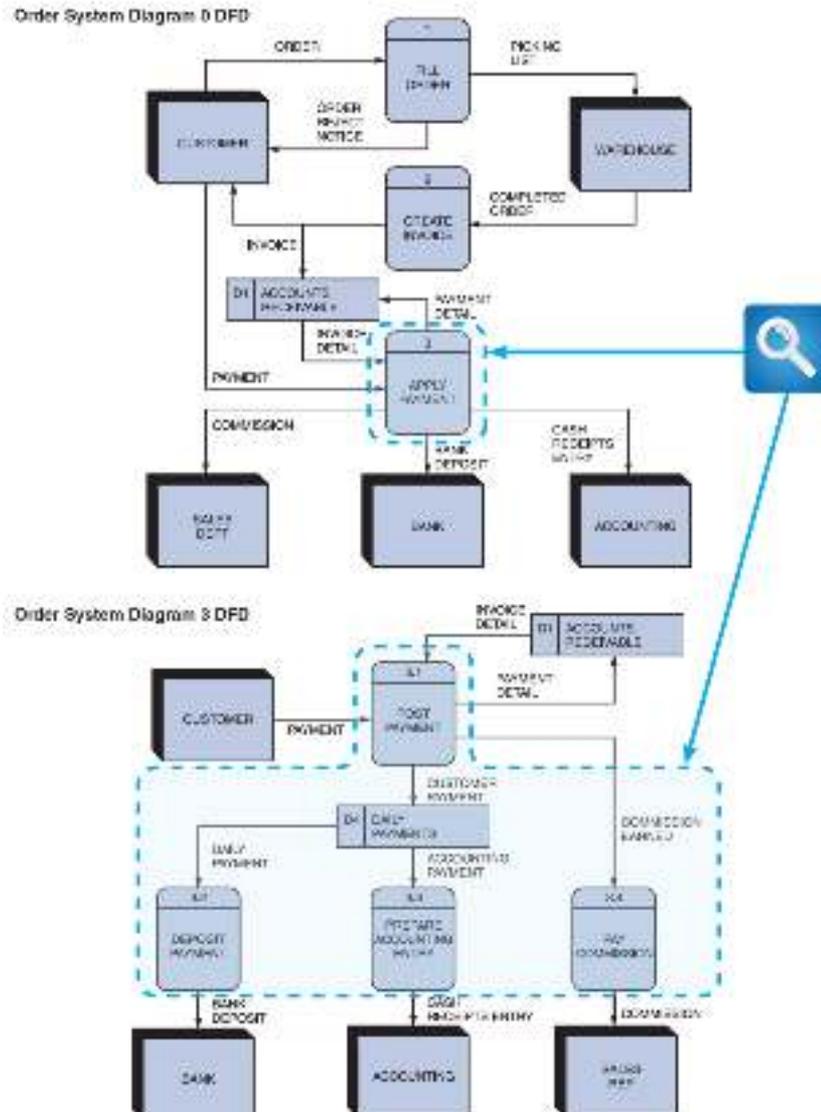# Creating a Set of DFDs (Cont. 7)

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
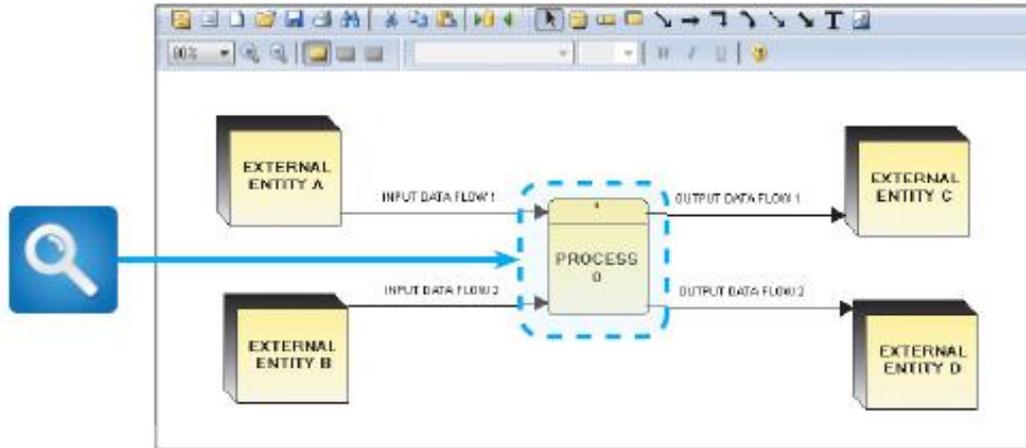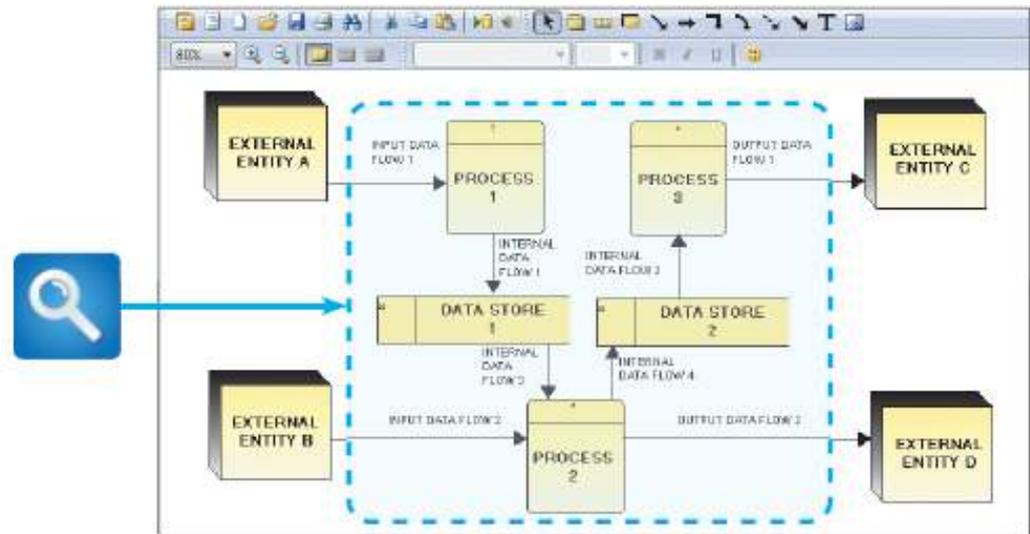
Creating a Set of DFDs (Cont. 8)

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

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