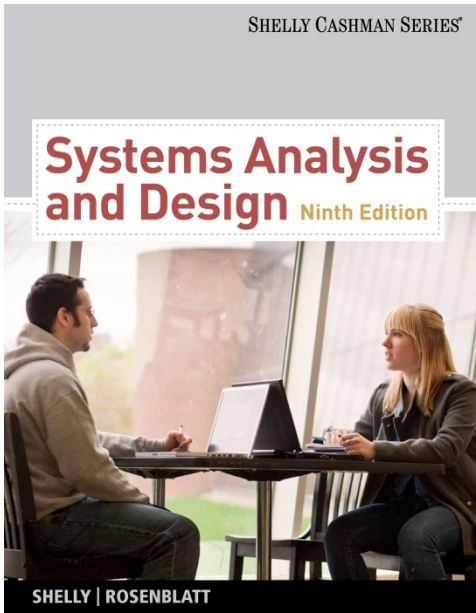
COURSE TECHNOLOGY
CENGAGE Learning

Systems Analysis and Design 9th 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
- Explain how to level and balance a set of data flow diagrams

Chapter Objectives

- Describe how a data dictionary 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

Introduction

- In Chapters 5 & 6, you will develop a logical model of the proposed system and document the system requirements
  - Logical model shows what the system must do
  - Physical model describes how the system will be constructed

Overview of Data and Process Modeling Tools

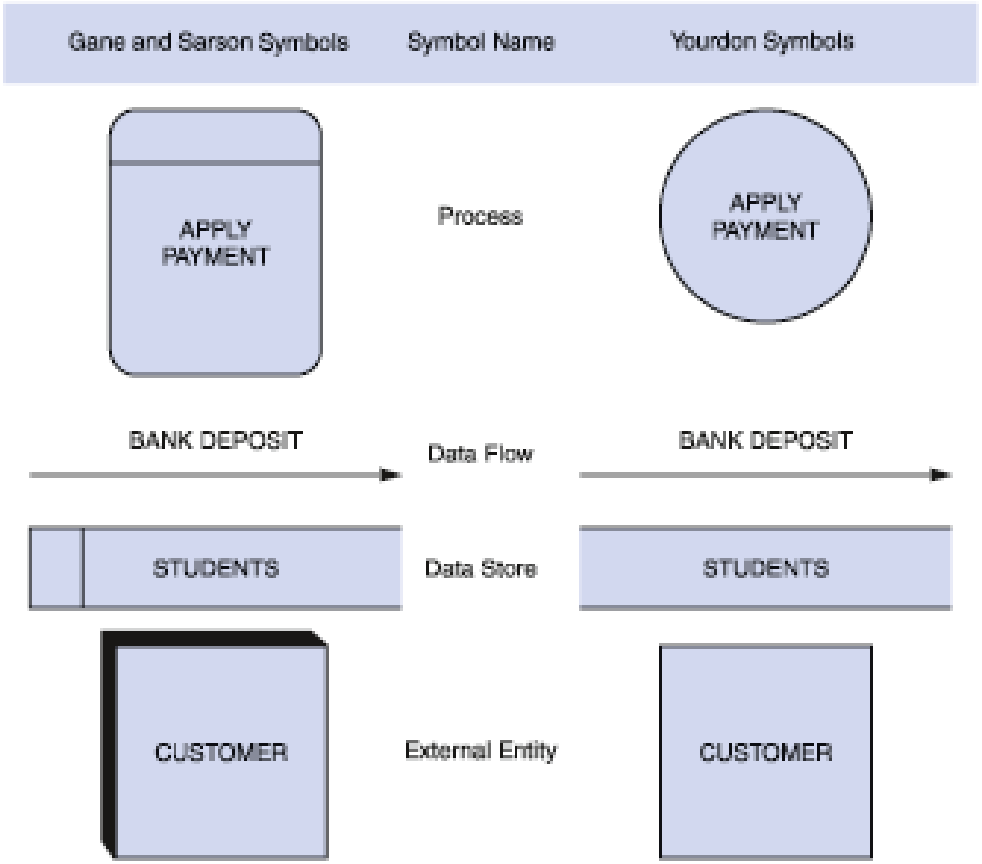
- Systems analysts use many graphical techniques to describe an information system
- A data flow diagram (DFD) uses various symbols to show how the system transforms input data into useful information

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

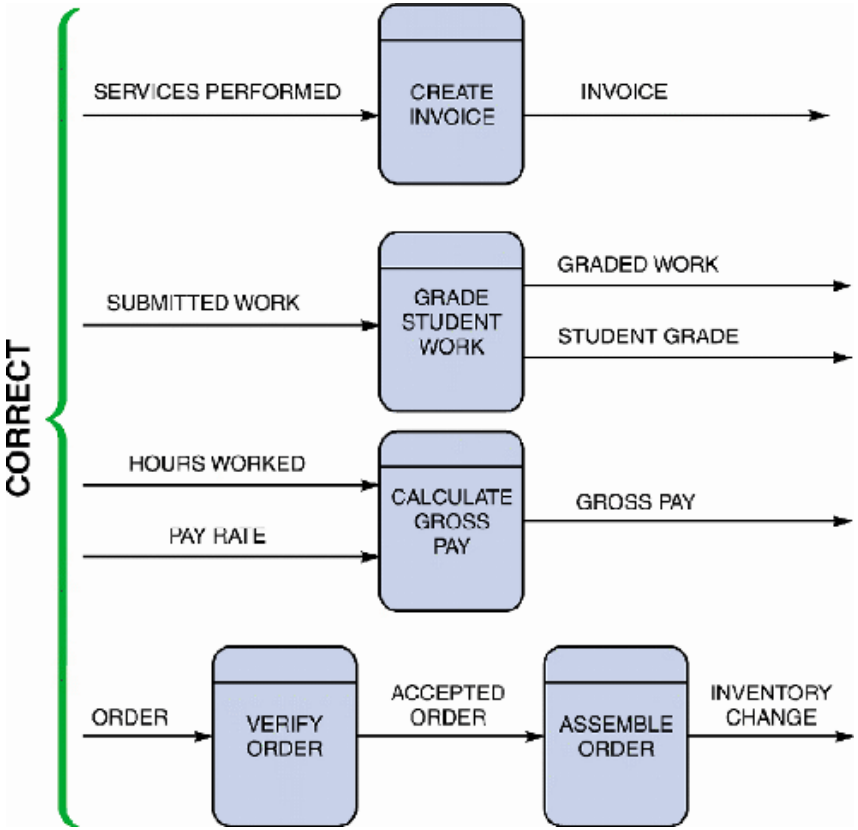
- DFD Symbols



Data Flow Diagrams

- DFD Symbols
  - Process symbol
    - Receives input data and produces output that has a different content, form, or both
    - Contain the business logic, also called business rules
    - Referred to as a black box

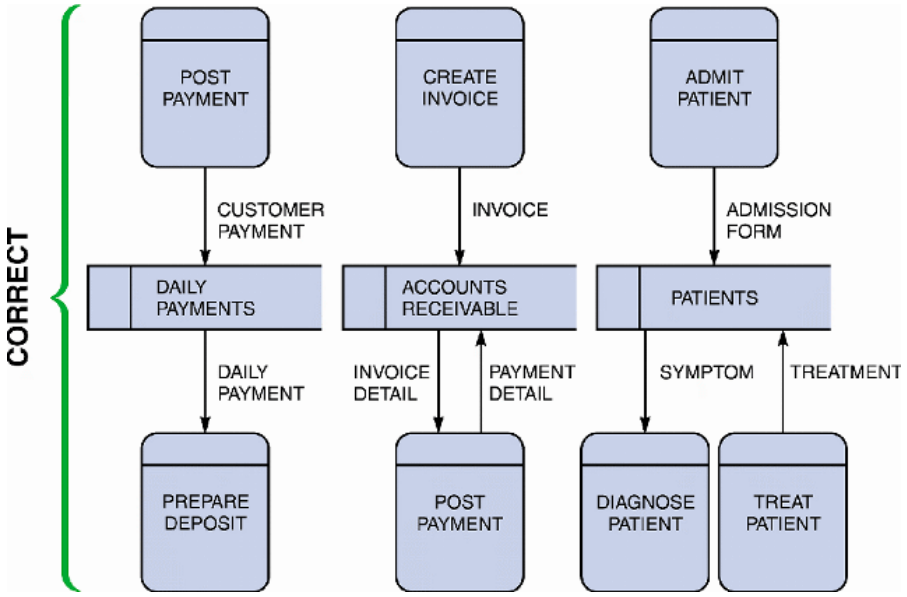
Data Flow Diagrams



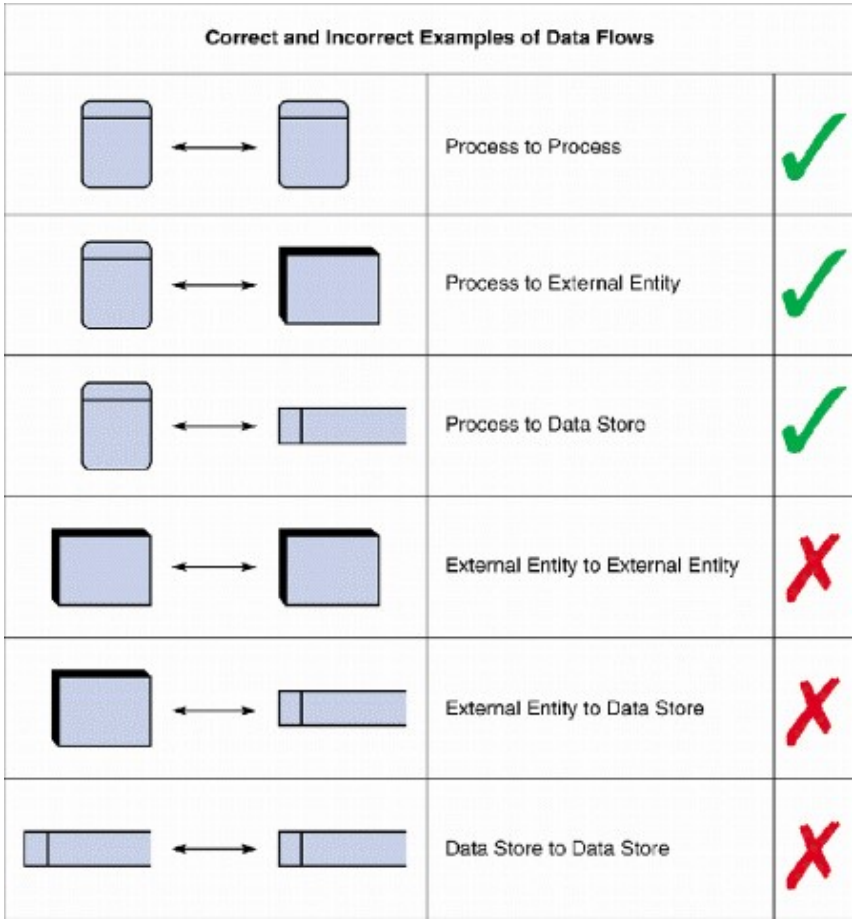
- DFD Symbols
  - Data flow symbol
    - Represents one or more data items
    - The symbol for a data flow is a line with a single or double arrowhead
    - Spontaneous generation
    - Black hole
    - Gray hole

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



- DFD Symbols
  - Entity Symbol
    - Name of the entity appears inside the symbol
    - Terminators
    - Source
    - Sink

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

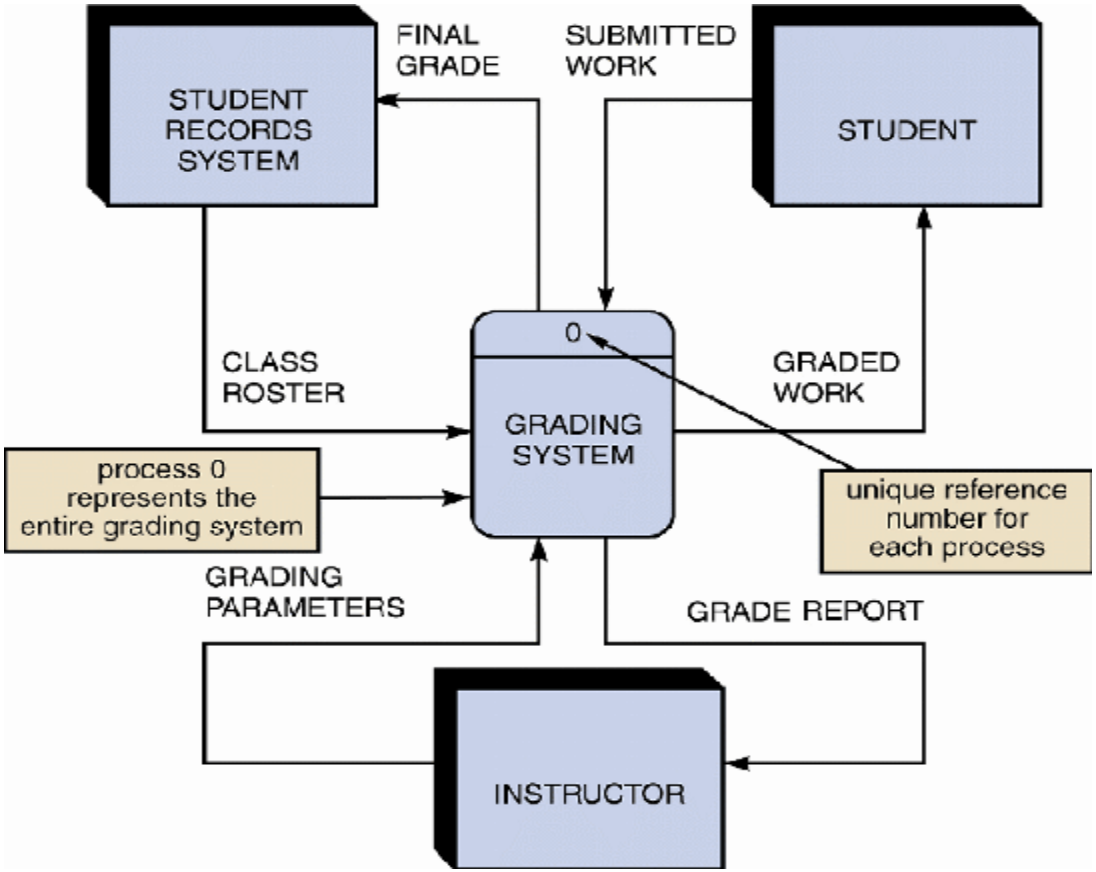
- Guidelines for Drawing DFDs
  - Draw the context diagram so that it fits on one page
  - Use the name of the information system as the process name in the context diagram
  - Use unique names within each set of symbols

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

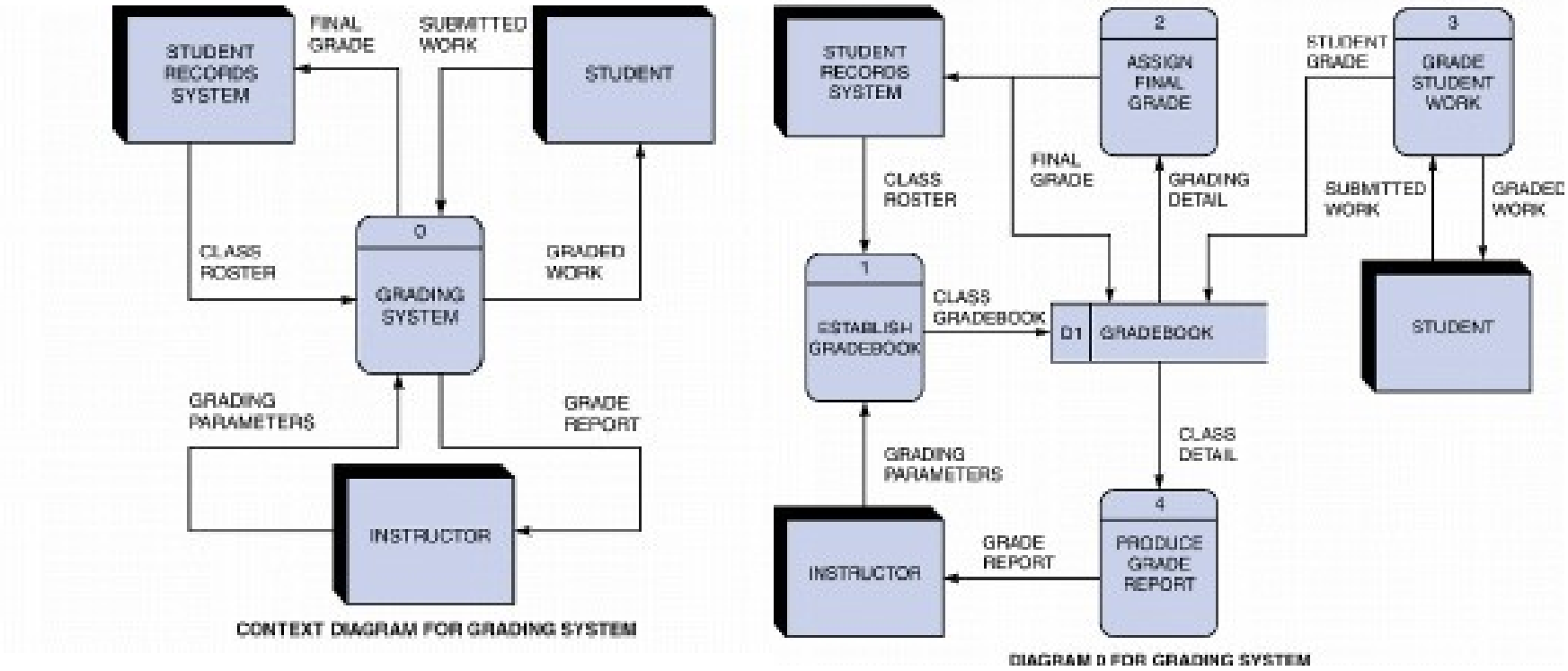
Creating a Set of DFDs

- Step 1: Draw a Context Diagram



Creating a Set of DFDs

- Step 2: Draw a Diagram 0 DFD

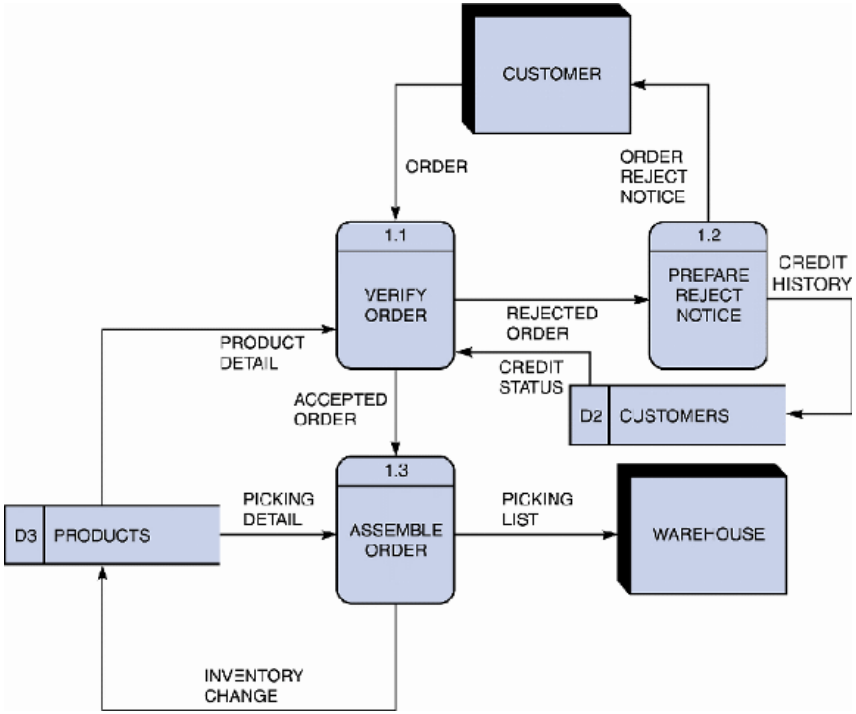


Creating a Set of DFDs

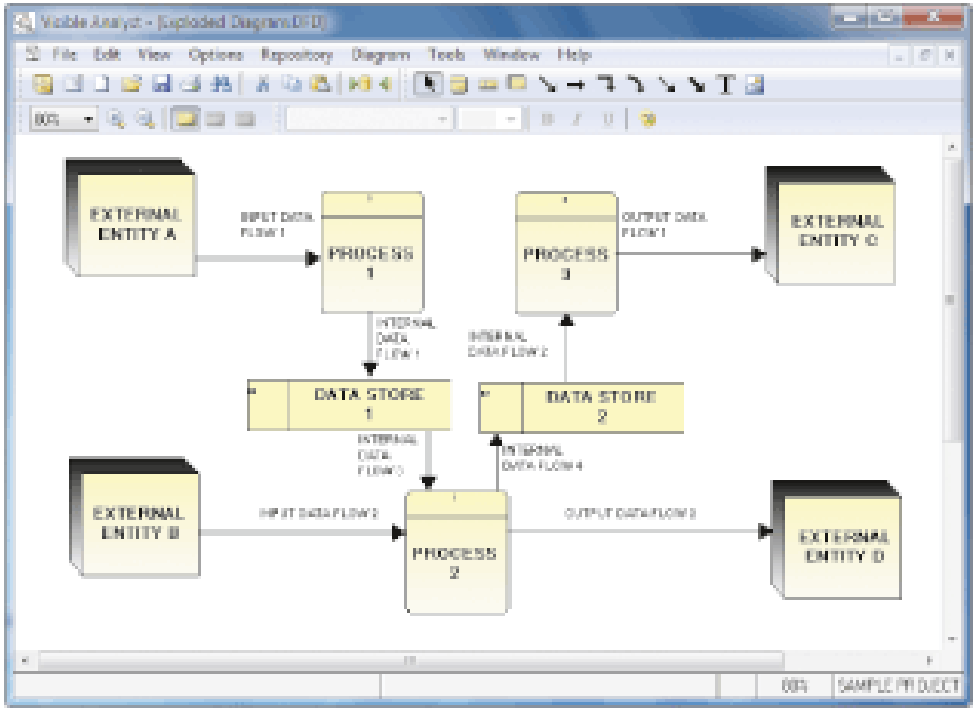
- Step 2: Draw a Diagram 0 DFD
  - If same data flows in both directions, you can use a double-headed arrow
  - Diagram 0 is an exploded view of process 0
  - Parent diagram
  - Child diagram
  - Functional primitive

Creating a Set of DFDs

- Step 3: Draw the Lower-Level Diagrams
  - Must use leveling and balancing techniques
  - Leveling examples
    - Uses a series of increasingly detailed DFDs to describe an information system
    - Exploding, partitioning, or decomposing



Creating a Set of DFDs



- Step 3: Draw the Lower-Level Diagrams
  - Balancing Examples
    - Ensures that the input and output data flows of the parent DFD are maintained on the child DFD

Data Dictionary Overview

- A **data dictionary** is essentially a repository for all relevant data within a system.
- It's a comprehensive catalog used to document and organize system data.
- Analysts refer to it to **keep track of data specifications**, ensuring clarity and consistency across the system

- **Example**:

In a library management system, the data dictionary would include entries for data elements like "Book ID," "Author Name," and "Due Date."

Data Dictionary - Data Elements

- **Data elements** (also known as data items or fields) are the smallest units of data with specific meanings.
- **Records** (or data structures) combine multiple data elements, creating meaningful units stored in data flows or data stores

- **Example**:

For a university's course management system, a data element might be "Student ID," while a record could be a student profile combining "Student ID," "Name," and "Enrollment Date."

Data Dictionary - Documenting Data Elements

- Every data element needs thorough documentation to provide clear and comprehensive information. Typical attributes include:
- Name and label
- Alias (if applicable)
- Type and length (e.g., integer, string)
- Default value, acceptable values, and domain rules
- Source, security level, and responsible user(s)
- Description and comments

- **Example**:

A data element in a hospital system, like "Patient ID," might have an alias "Patient Number," a length limit, domain rules restricting it to unique identifiers, and security settings.

Data Dictionary - Documenting **Data Flows**

- **Data flows** describe the movement of data within the system.
- Key attributes include:
  - **Name/Label**
  - **Description**, **origin**, and **destination**
  - **Record volume** and **frequency**

- **Example**:

In an e-commerce system, a "Purchase Order" data flow might move from the "Cart" process to the "Order Processing" system

Data Dictionary - **Documenting Data Stores**

- **Data stores** hold data for later retrieval and are documented with attributes such as:
  - **Name/Label** and **description**
  - **Attributes**, **volume**, and **frequency**

- **Example**:

In a banking system, a data store like "Account Balances" would contain records of customer balances, updated frequently

Data Dictionary - **Documenting Processes**

- **Processes** represent actions within the system and are documented by:
  - **Name/Label**, **description**, and **process number**
  - Details about the process functionality

- **Example**: An ATM withdrawal process includes:
  - "Input: Account Information" and
  - "Output: Withdrawal Confirmation."

Data Dictionary - **Documenting Entities**

- **Entities** represent key objects within the system, documented by:
- **Entity name**, **description**, **alternate names**
- **Input and output data flows**

- **Example**:
- In a payroll system, an entity like "Employee" might include data flows for "Payroll Processing" and "Employee Benefits."

Data Dictionary - **Data Dictionary Reports**

- Reports generated from a data dictionary can provide valuable insights, such as:
  - A list of all data elements alphabetically
  - Reports of data elements by department or user responsible
  - Detailed reports of data flows, stores, and records

- **Example**:

A report listing all elements used in the "Order Processing" system of an online store helps identify **responsibilities** and **improve data management**.

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

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

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
```

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

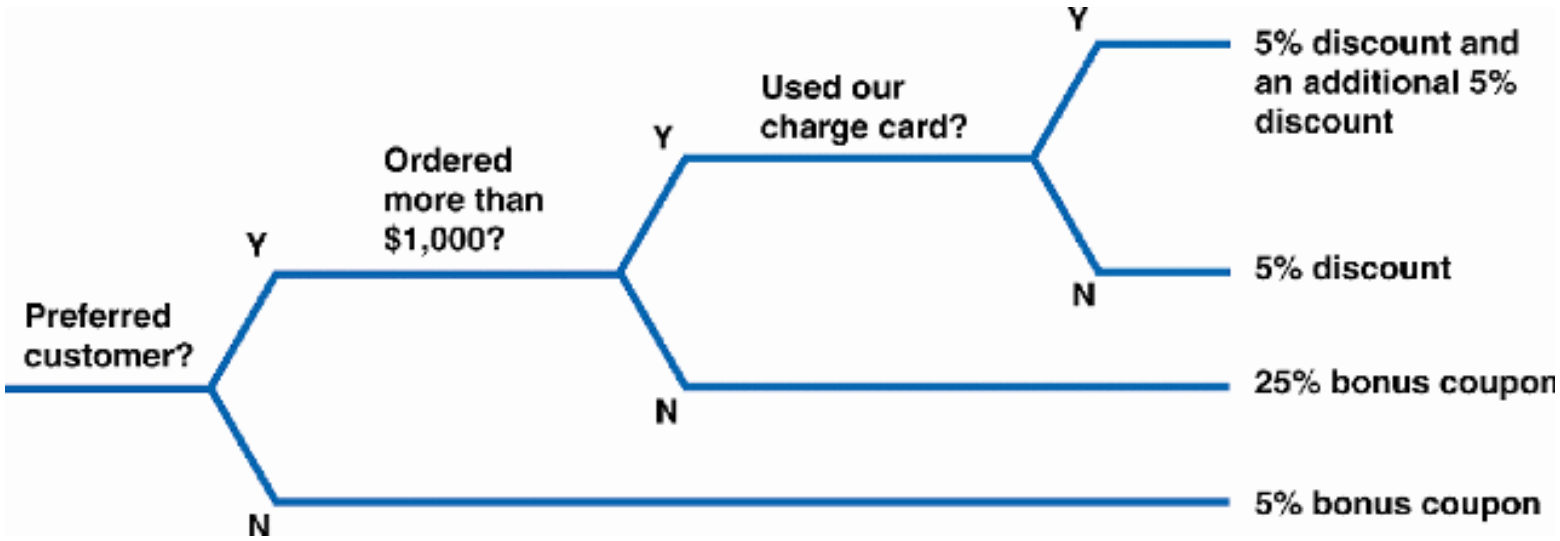
	1	2	3	4
Credit status is OK	Y	Y	N	N
Product is in stock	Y	N	Y	N
Accept order	X			
Reject order		X	X	X

Process Description Tools

- Decision Tables
  - The number of rules doubles each time you add a condition
  - Can have more than two possible outcomes
  - Often are the best way to describe a complex set of conditions

Process Description Tools

- Decision Trees



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

- 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

Chapter Summary

- The data dictionary is the central documentation tool for structured analysis
- 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

Chapter Summary

- Chapter 5 complete