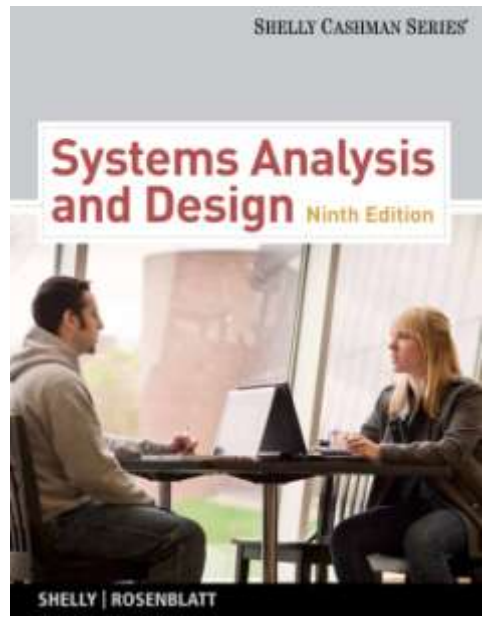
Systems Analysis and Design 9th Edition

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

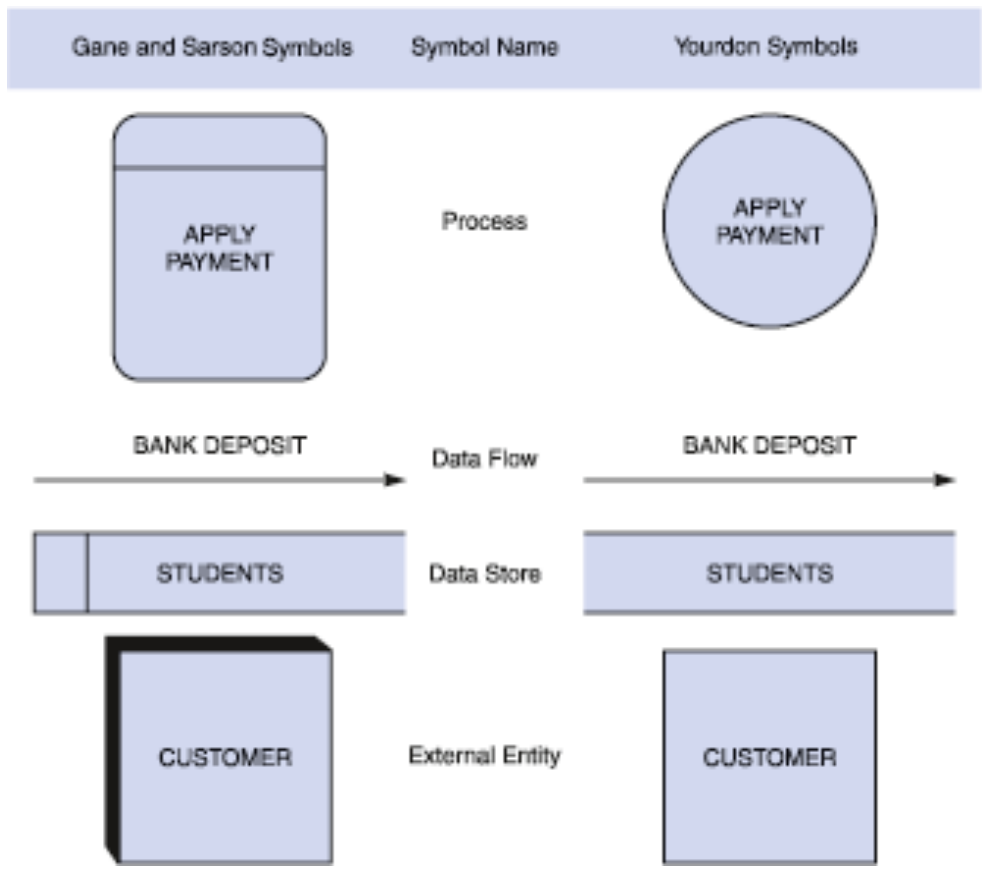
- Systems analysts use many graphical techniques to describe an information system
- A data flow diagram (DFD) uses various symbols to show how the system transforms input data into useful information

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

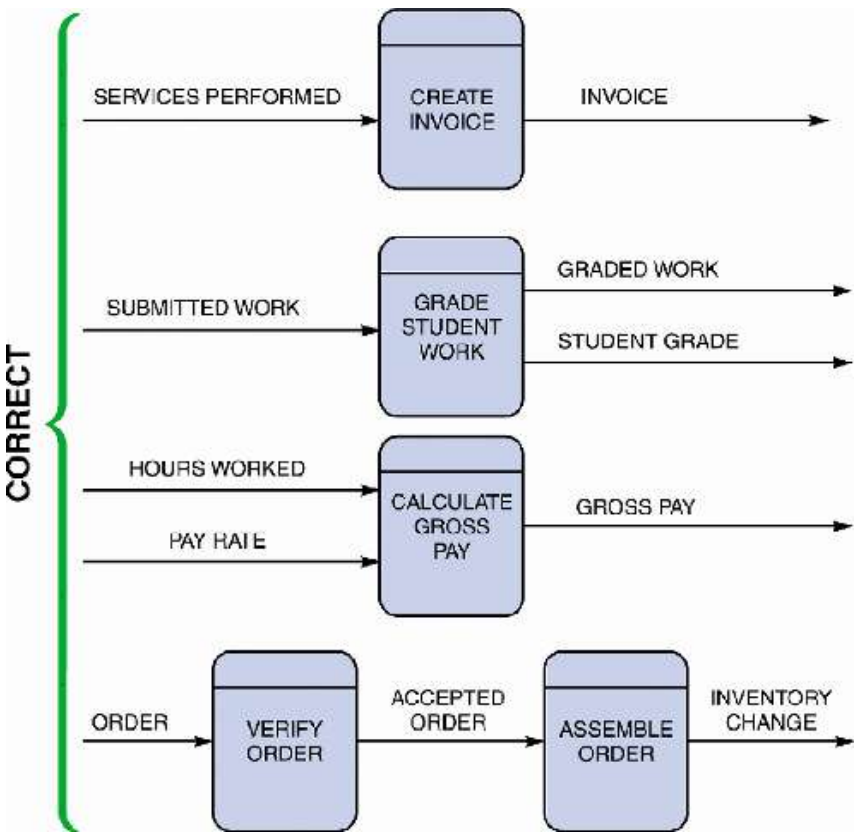
- DFD Symbols



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

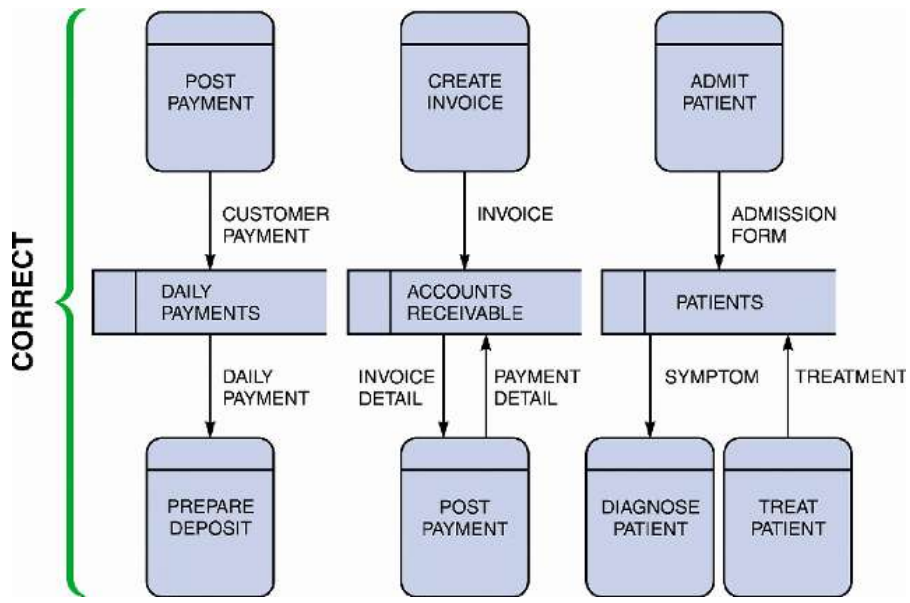
Data Flow Diagrams



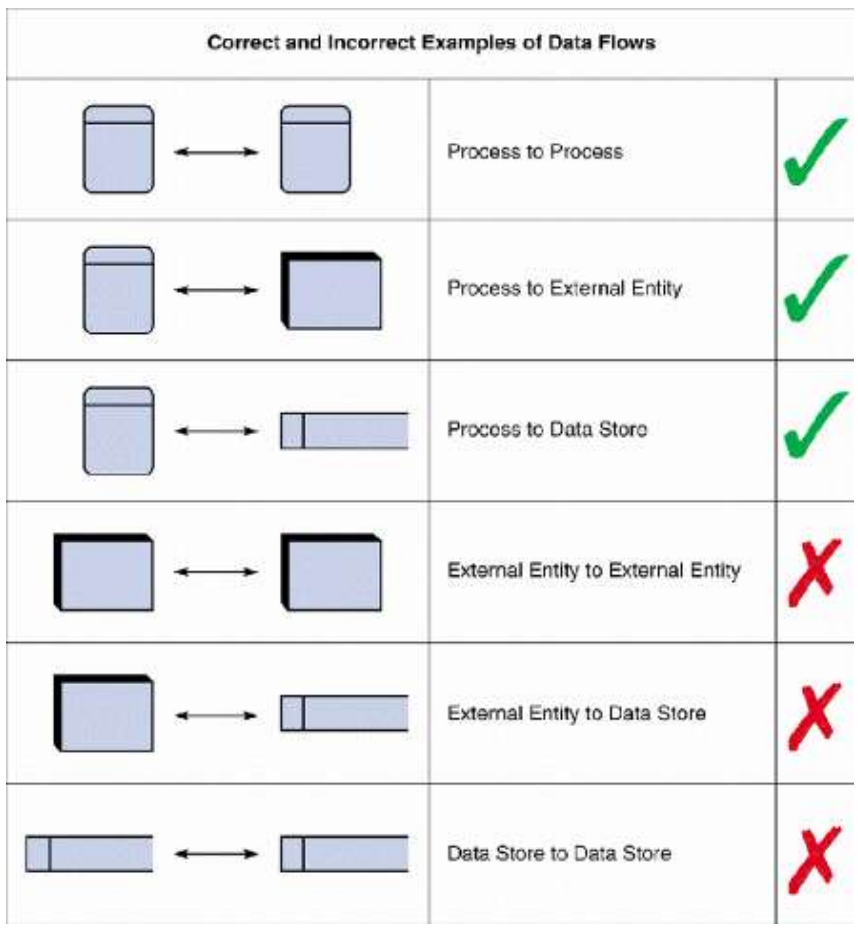
- DFD Symbols
  - Data flow symbol
    - Represents one or more data items
    - The symbol for a data flow is a line with a single or double arrowhead
  - Spontaneous generation
  - Black hole
  - Gray hole

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

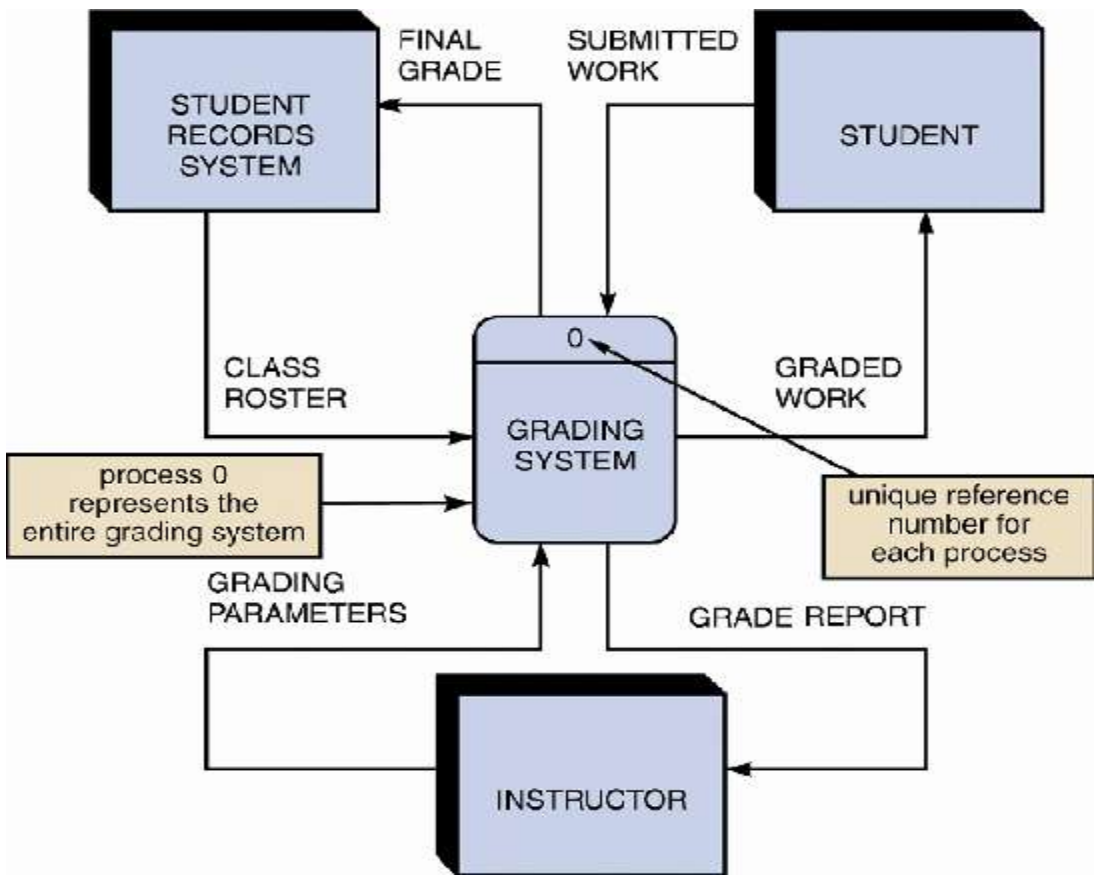
- Guidelines for Drawing DFDs
  - Draw the context diagram so that it fits on one page
  - Use the name of the information system as the process name in the context diagram
  - Use unique names within each set of symbols

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

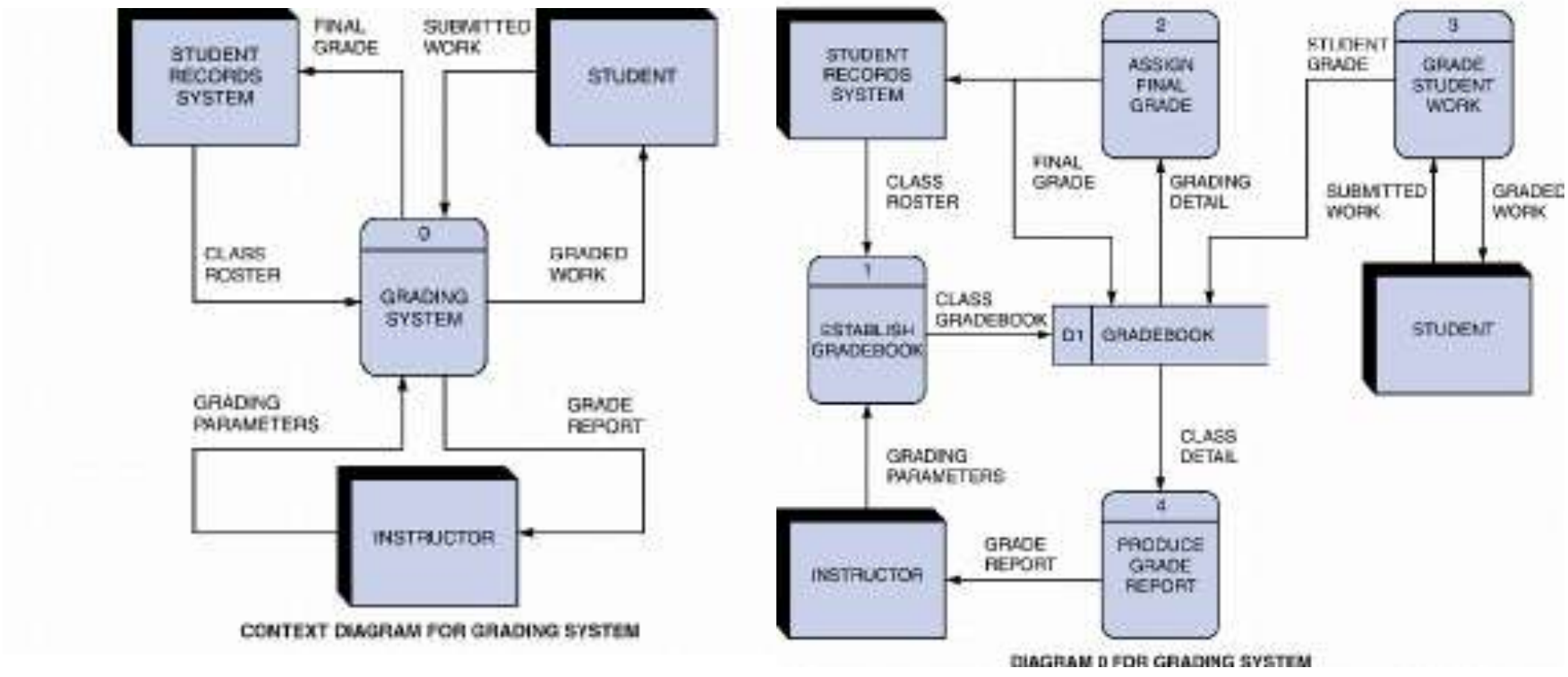
Creating a Set of DFDs

- Step 1: Draw a Context Diagram



Creating a Set of DFDs

- Step 2: Draw a Diagram 0 DFD

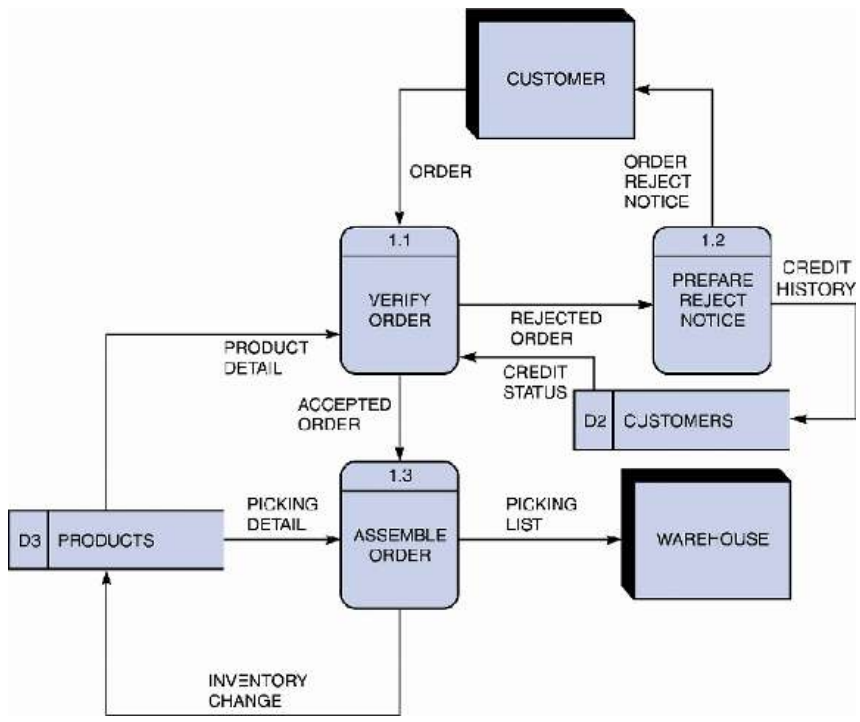


Creating a Set of DFDs

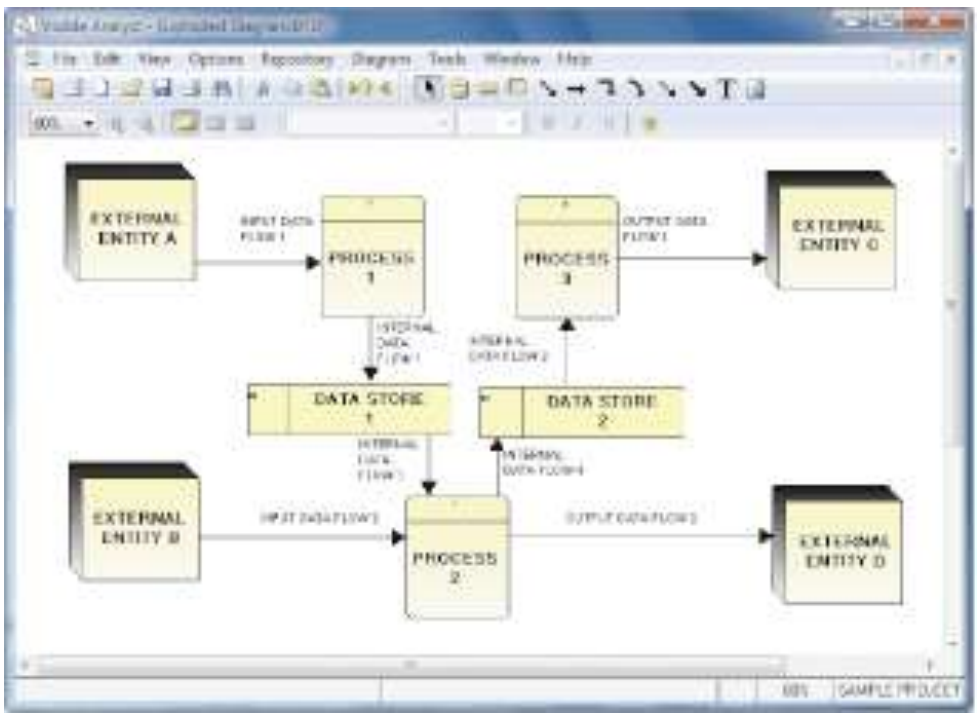
- Step 2: Draw a Diagram 0 DFD
  - If same data flows in both directions, you can use a double-headed arrow
  - Diagram 0 is an exploded view of process 0
  - Parent diagram
  - Child diagram
  - Functional primitive

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

- 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

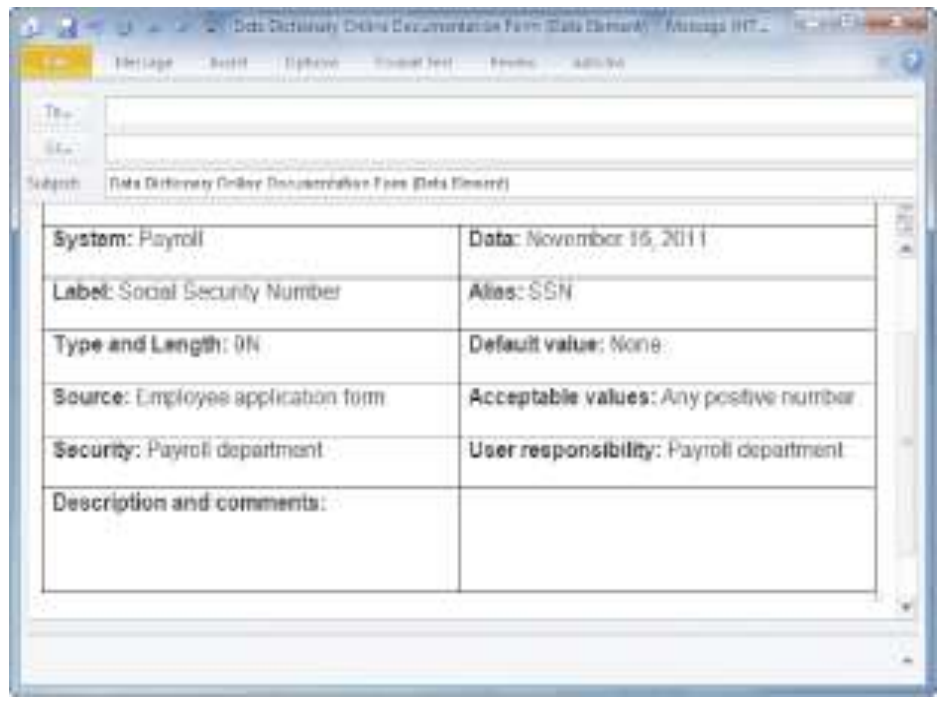
- A data element, also called a data item or field, is the smallest piece of data that has meaning
- Data elements are combined into records, also called data structures
- A record is a meaningful combination of related data elements that is included in a data flow or retained in a data store

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



System: Payroll	**Data:** November 16, 2011
Label: Social Security Number	**Alias:** SSN
Type and Length: 9N	**Default value:** None
Source: Employee application form	**Acceptable values:** Any positive number
Security: Payroll department	**User responsibility:** Payroll department
Description and comments:	

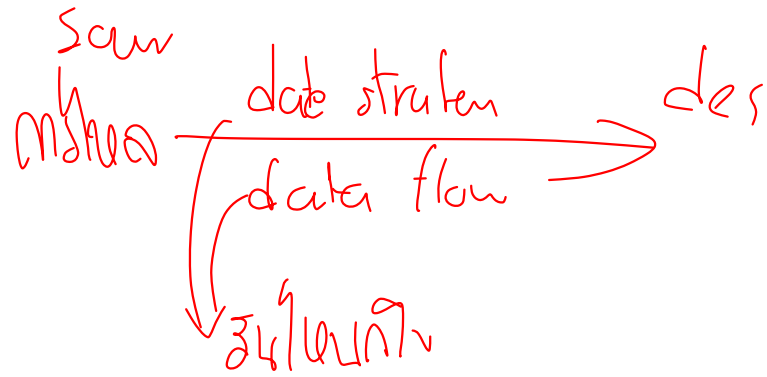
Data Dictionary

- 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

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

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

sudocode → อธิบาย level สุดท้ายเท่านั้น

context diagram ?

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

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

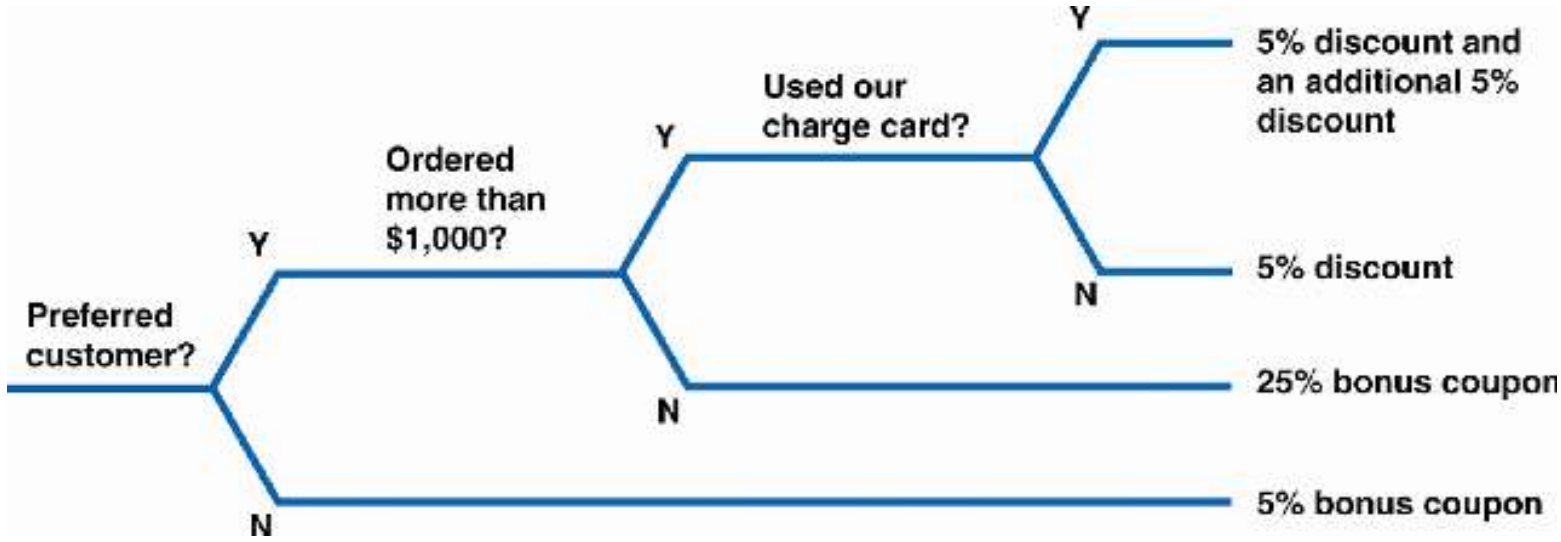
	1	2	3	4
Credit status is OK	Y	Y	N	N
Product is in stock	Y	N	Y	N
Accept order	X			
Reject order		X	X	X

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



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

- Sequence of Models
  - Many 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 that extra step allows them to understand the current system better

Logical Versus Physical Models

- 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, and a physical model of the new system
  - The only disadvantage of the four-model approach is the added 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

- 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