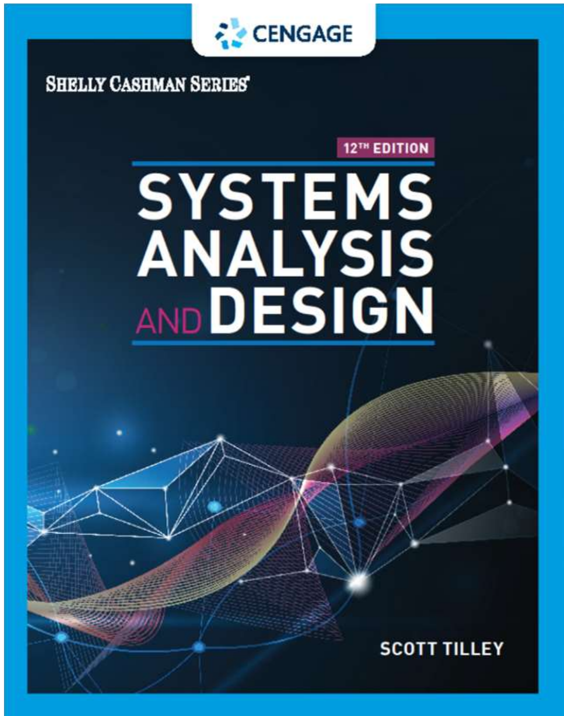


Chapter 5

Data and Process Modeling

Learning Objectives (1 of 2)

- After this chapter, you will be able to:
  - Describe the relationship between logical and physical models
  - Explain data flow diagrams
  - Draw the four basic data flow diagram symbols
  - Explain the six guidelines used when drawing data flow diagrams
  - Draw context diagrams
  - Draw diagram 0 data flow diagrams

Learning Objectives (2 of 2)

- Draw lower-level data flow diagrams
- Explain how to level and balance data flow diagrams
- Create a data dictionary
- Apply process description tools in modular design

Logical Versus Physical Models (1 of 2)

- 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

Logical Versus Physical Models (2 of 2)

- Many analysts follow a four-model approach
  - Physical model of the current system
  - Logical model of the current system
  - Logical model of the new system
  - Physical model of the new system

Data Flow Diagrams

- 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
    - Shows how data moves through an information system but does not show program logic or processing steps

Data Flow Diagram Symbols (1 of 9)

- Four basic symbols represent processes, data flows, data stores, and entities

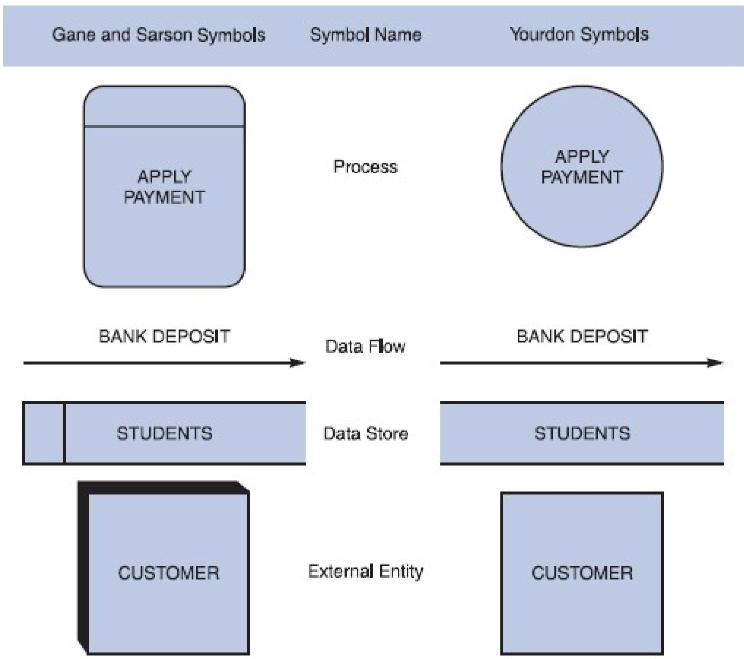


FIGURE 5-1 Data flow diagram symbols, symbol names, and examples of the Gane and Sarson and Yourdon symbol sets

Data Flow Diagram Symbols (2 of 9)

- Process symbols
  - Process receives input data and produces output
  - Contains business logic that transforms the data
  - Process name identifies a specific function
  - In DFDs, a process symbol can be referred to as a black box

Data Flow Diagram Symbols (3 of 9)

- Data flow symbols
  - Line with a single or double arrowhead

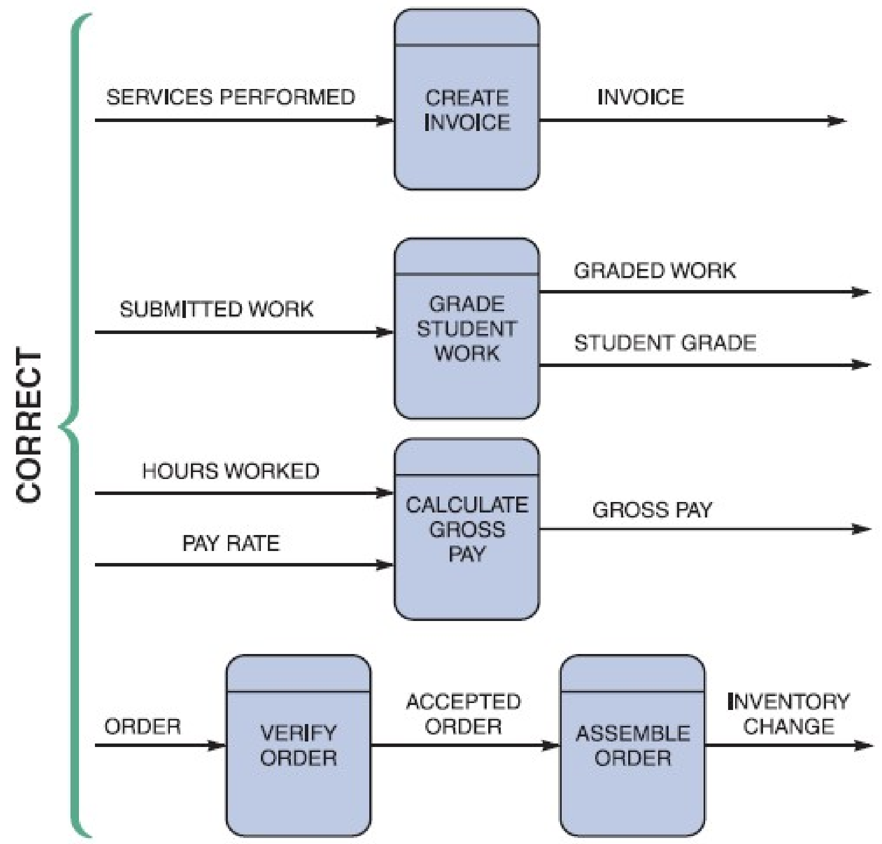


FIGURE 5-3 Examples of correct combinations of data flow and process symbols

Data Flow Diagram Symbols (4 of 9)

- Data flow and process combinations that must be avoided
  - Spontaneous generation
  - Black holes
  - Gray holes

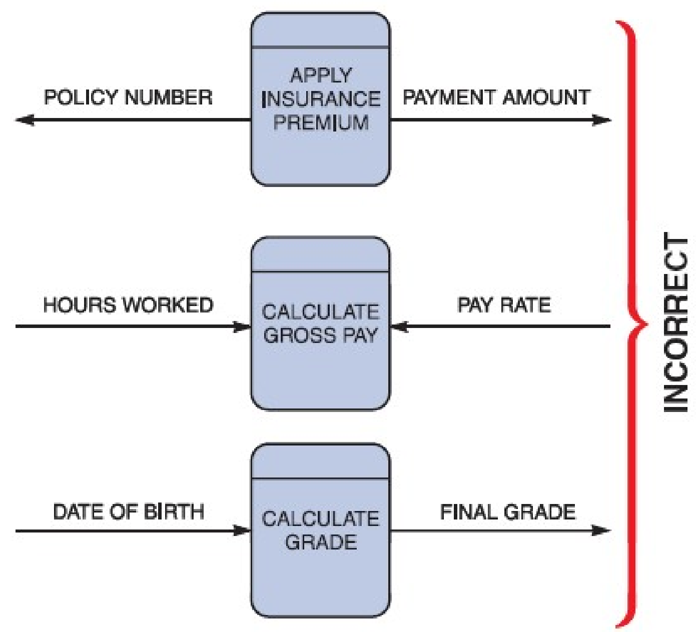


FIGURE 5-4 Examples of incorrect combinations of data flow and process symbols. APPLY INSURANCE PREMIUM has no input and is called a spontaneous generation process. CALCULATE GROSS PAY has no outputs and is called a black hole process. CALCULATE GRADE has an input that is obviously unable to produce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

Data Flow Diagram Symbols (5 of 9)

- Data store symbol
  - Represent data that the system stores
  - DFD does not show the detailed contents of a data store
    - 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 Diagram Symbols (6 of 9)

- Entity symbol
  - Shows how the system interfaces with the outside world
  - DFD shows only external entities that provide data to the system or receive output
    - DFD entities also are called terminators because they are data origins or final destinations
    - Source and sink entities

Data Flow Diagram Symbols (7 of 9)

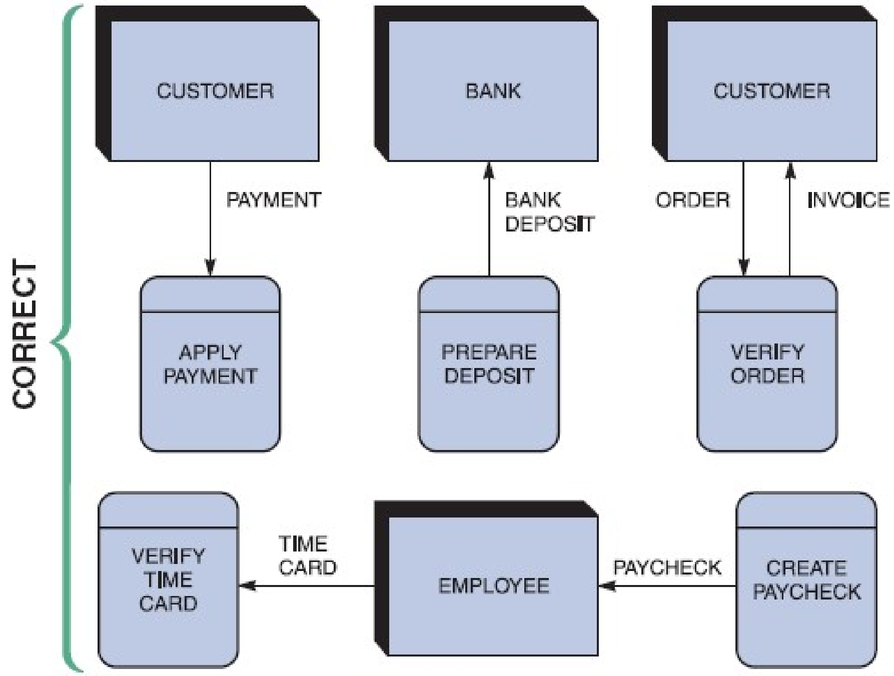


FIGURE 5-7 Examples of correct uses of external entities in a data flow diagram.

Data Flow Diagram Symbols (8 of 9)

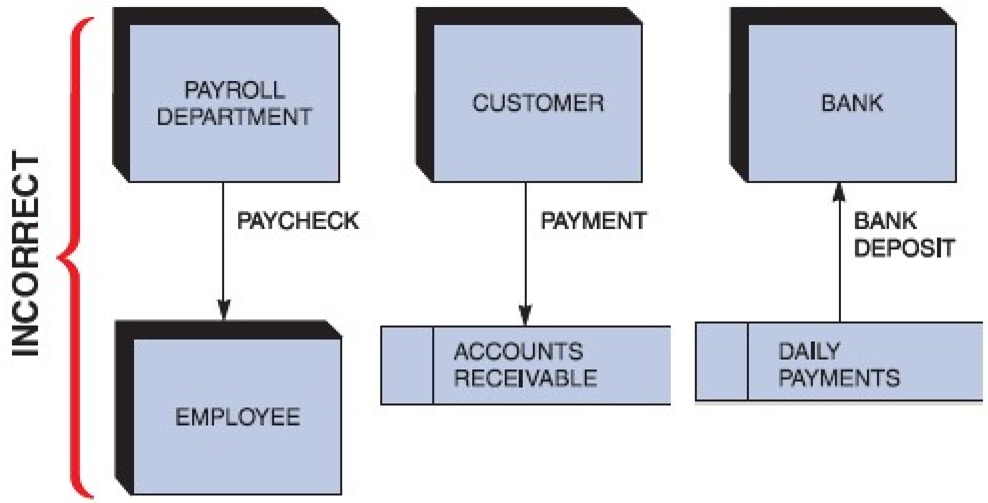


FIGURE 5-8 Examples of incorrect uses of external entities. An external entity must be connected by a data flow to a process, and not directly to a data store or to another external entity.

Data Flow Diagram Symbols (9 of 9)

- Using DFD symbols

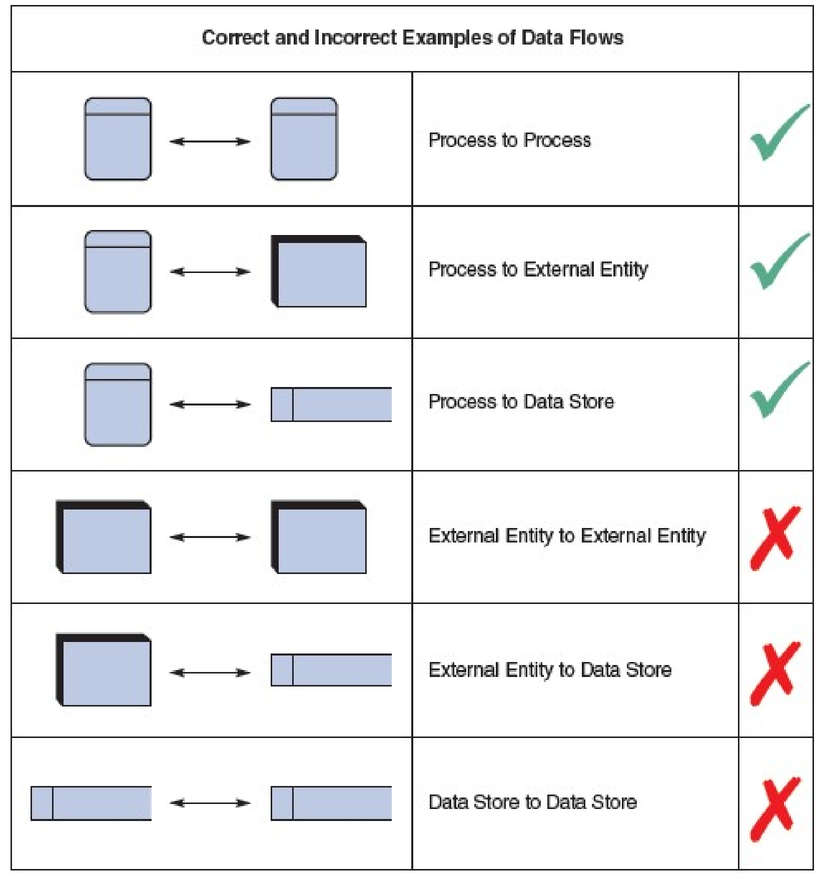


FIGURE 5-9 Examples of correct and incorrect uses of data flows.

Drawing Data Flow Diagrams (1 of 2)

- Graphical model is created based on fact-finding results
  - Review guidelines for drawing DFDs
  - Apply guidelines and create a set of DFDs

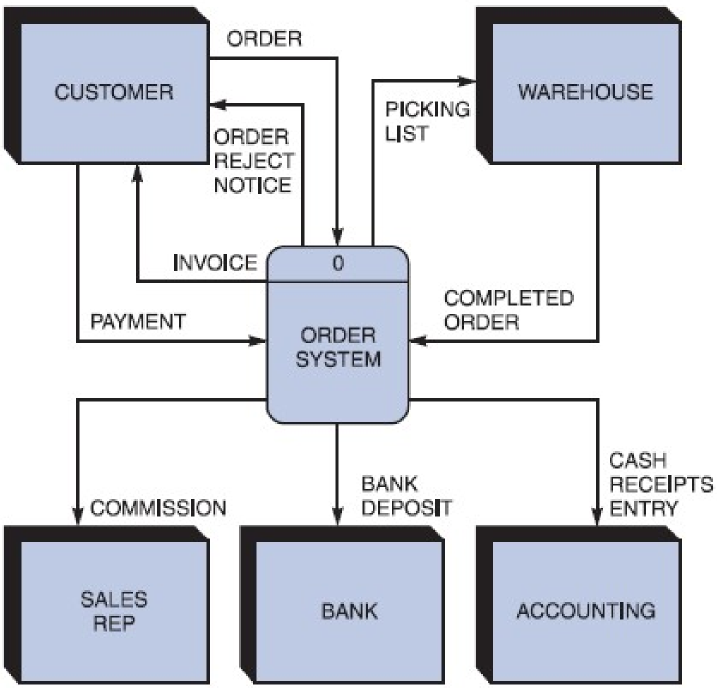
Drawing Data Flow Diagrams (2 of 2)

- Guidelines
  - 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

Drawing a Context Diagram

- First step in constructing a set of DFDs

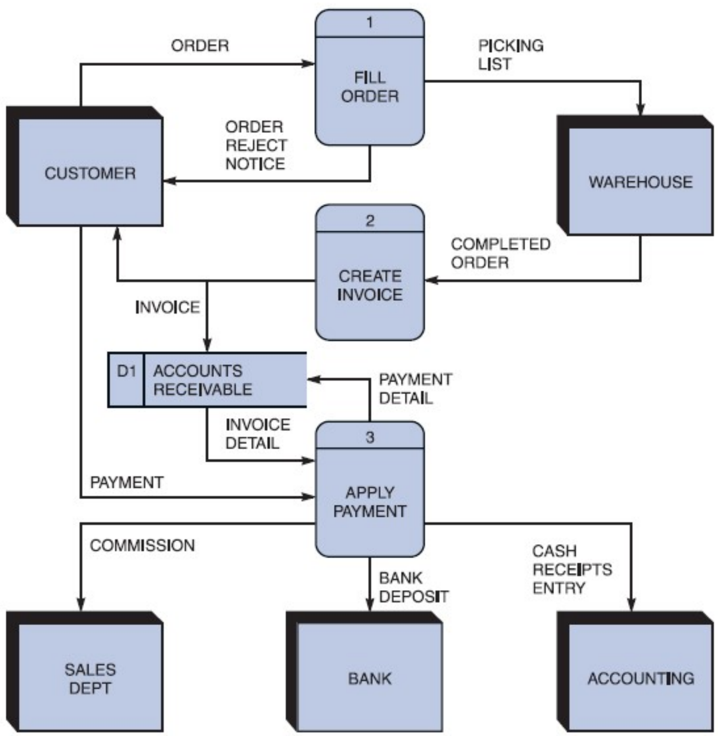
FIGURE 5-11 Context diagram DFD for an order system.



Drawing a Diagram 0 DFD

- Shows the detail inside the black box

FIGURE 5-13 Diagram 0 DFD for the order system.



Drawing Lower-Level DFDs (1 of 5)

- Leveling and balancing techniques are used

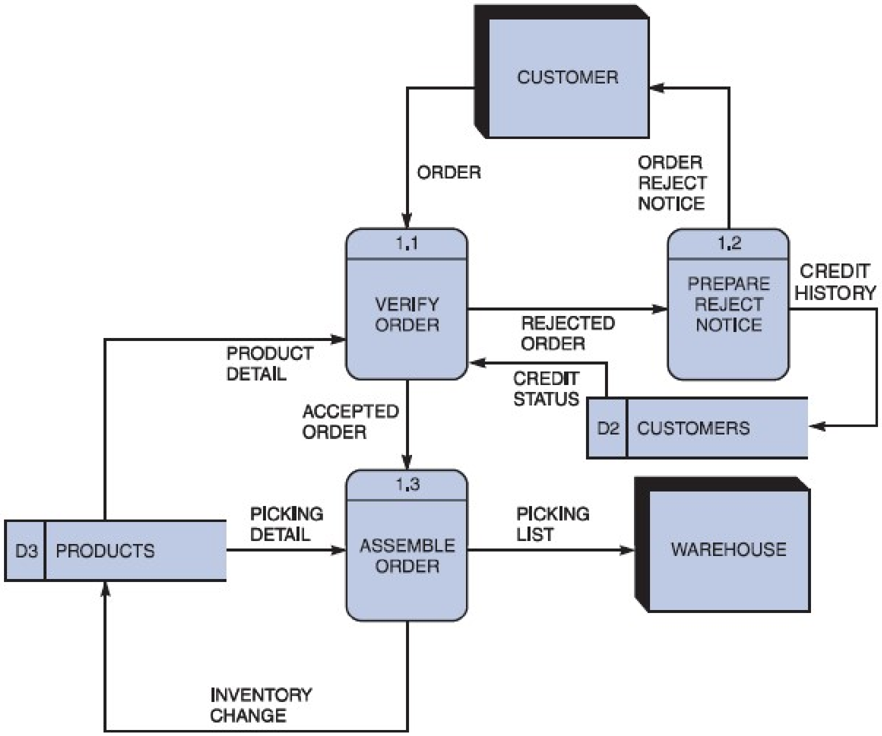
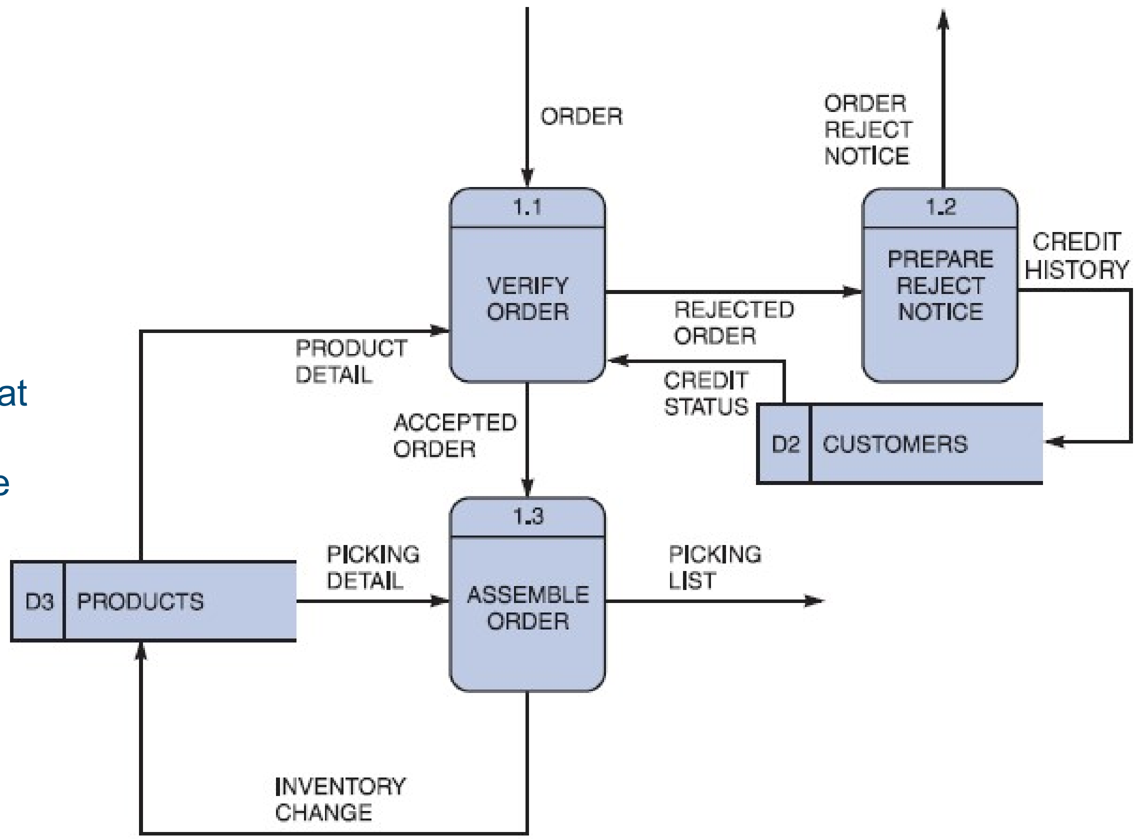


FIGURE 5-14 Diagram 1 DFD shows details of the FILLORDER process in the order system

Drawing Lower-Level DFDs (2 of 5)

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



Drawing Lower-Level DFDs (3 of 5)

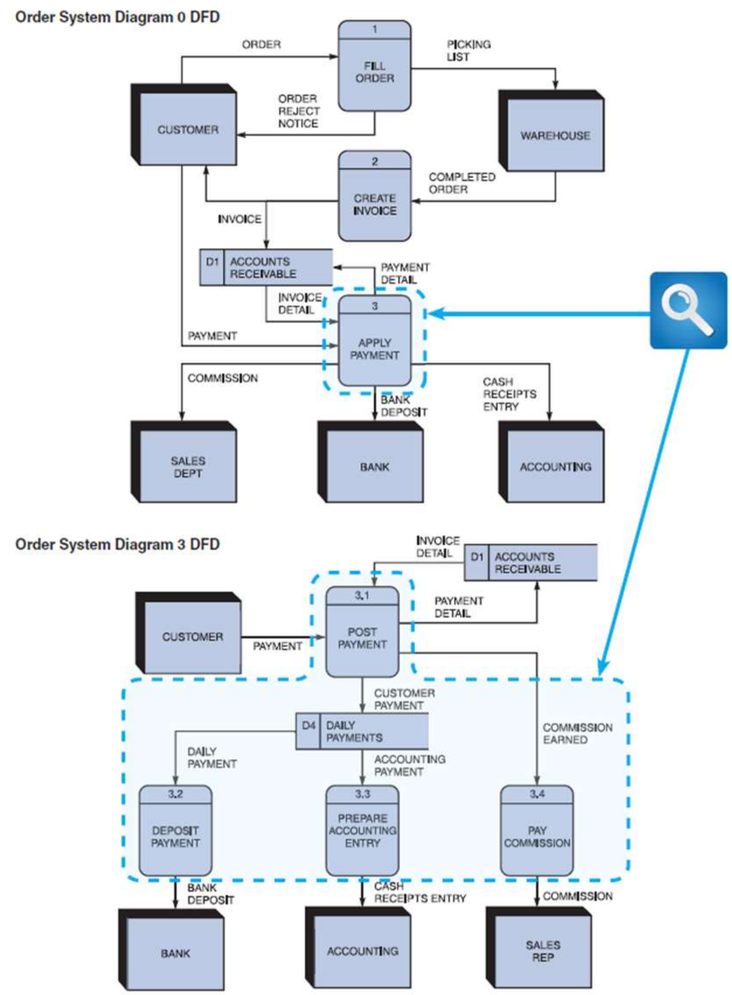


FIGURE 5-16 The order system diagram 0 is shown at the top of the figure, and exploded diagram 3 DFD (for the APPLY PAYMENT process) is shown at the bottom. The two DFDs are balanced because the child diagram at the bottom has the same input and output flows as the parent process 3 shown at the top.

Drawing Lower-Level DFDs (4 of 5)

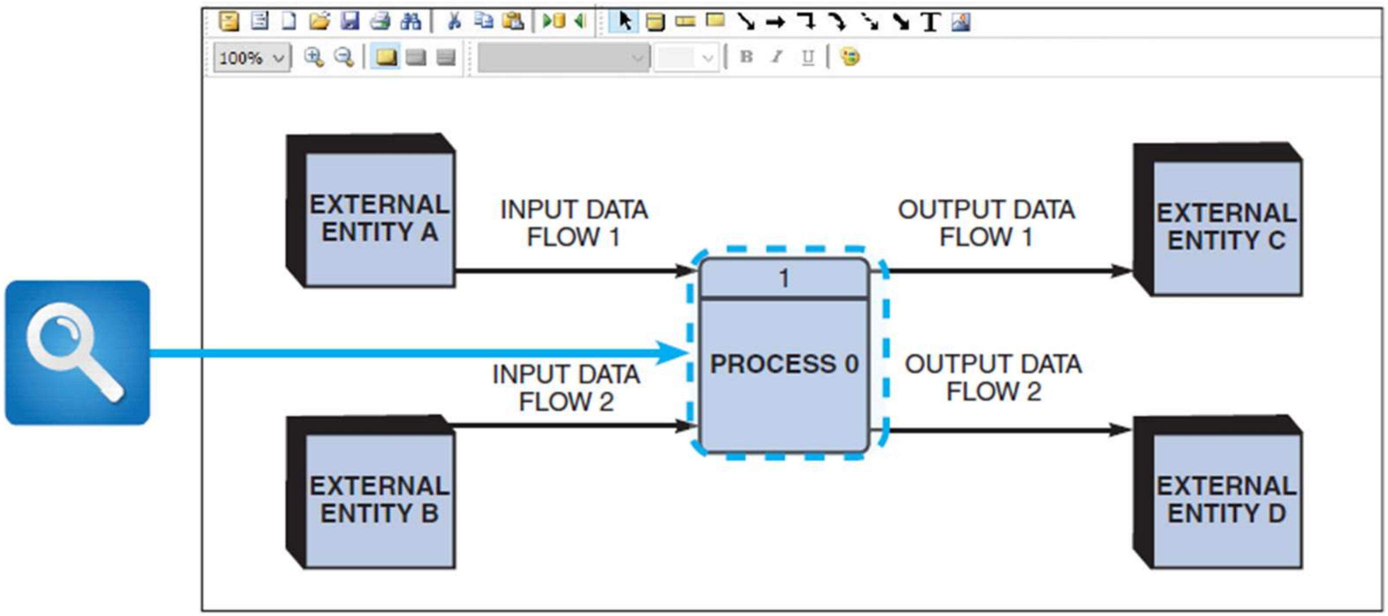


FIGURE 5-17 Example of a parent DFD diagram, showing process 0 as a black box.

Drawing Lower-Level DFDs (5 of 5)

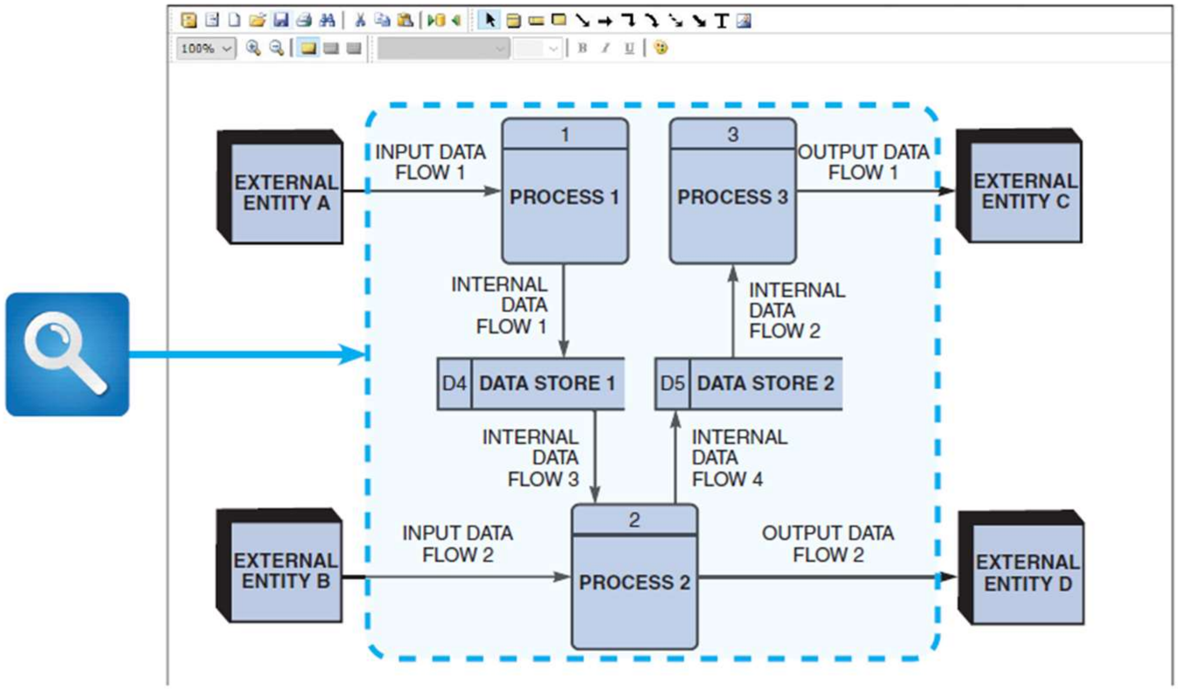


FIGURE 5-18 In the next level of detail, the process 0 black box reveals three processes, two data stores, and four internal data flows — all of which are shown inside the dashed line.

Data Dictionary (1 of 11)

- Central storehouse of information about a system's data
  - An analyst uses the data dictionary to collect, document, and organize specific facts about a system
  - Defines and describes all data elements and meaningful combinations of data elements

Data Dictionary (2 of 11)

- Data element (i.e., data item or field)
  - Smallest piece of data that has meaning within an information system
  - Combined into records (i.e., data structures)
    - Record: meaningful combination of related data elements that is included in a data flow or retained in a data store

Data Dictionary (3 of 11)

- Using CASE tools for documentation
  - More complex the system, more difficult it is to maintain full and accurate documentation
  - Modern CASE tools simplify the task
  - A CASE repository ensures data consistency

Data Dictionary (4 of 11)

- Documenting the data elements
  - Every data element in the data dictionary should be documented
  - Objective: provide clear, comprehensive information about the data and processes that make up a system

Data Dictionary (5 of 11)

- Recorded and described attributes
  - Data element name and label
  - Alias
  - Type and length
  - Default value
  - Acceptable values
  - Source
  - Security
  - Responsible user(s)
  - Description and comments

Data Dictionary (6 of 11)

- Documenting the data flows
  - Data flow name or label
  - Description
  - Alternate name(s)
  - Origin
  - Destination
  - Record
  - Volume and frequency

Data Dictionary (7 of 11)

- Documenting the data stores
  - Data store name or label
  - Description
  - Alternate name(s)
  - Attributes
  - Volume and frequency

Data Dictionary (8 of 11)

- Documenting the processes
  - Process name or label
  - Description
  - Process number
  - Process description

Data Dictionary (9 of 11)

- Documenting the entities
  - Entity name
  - Description
  - Alternate name(s)
  - Input data flows
  - Output data flows

Data Dictionary (10 of 11)

- Documenting the records
  - Record or data structure name
  - Definition or description
  - Alternate name(s)
  - Attributes

Data Dictionary (11 of 11)

- Data dictionary reports
  - Alphabetized list of all data elements
  - Report describing each data element and indicating the user or department
  - 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

Process Description Tools in Modular Design (1 of 6)

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

Process Description Tools in Modular Design (2 of 6)

- Modular design
  - Based on combinations of logical structures (i.e., control structures), which serve as building blocks for the process
    - Sequence
    - Selection
    - Iteration

Process Description Tools in Modular Design (3 of 6)

- Structured English
  - Subset of standard English that describes logical processes clearly and accurately
    - Use only the three building blocks of sequence, selection, and iteration
    - Use indentation for readability
    - Use a limited vocabulary

Process Description Tools in Modular Design (4 of 6)

- Decision tables
  - Logical structure that shows every combination of conditions and outcomes
  - Number of rules doubles each time a condition is added
  - Best way to describe a complex set of conditions

Process Description Tools in Modular Design (5 of 6)

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

FIGURE 5-35 In this version, dashes have been added to indicate that a condition is not relevant. At this point, it appears that several rules can be combined.

Process Description Tools in Modular Design (6 of 6)

- Decision trees
  - Graphical representation of conditions, actions, and rules found in a decision table

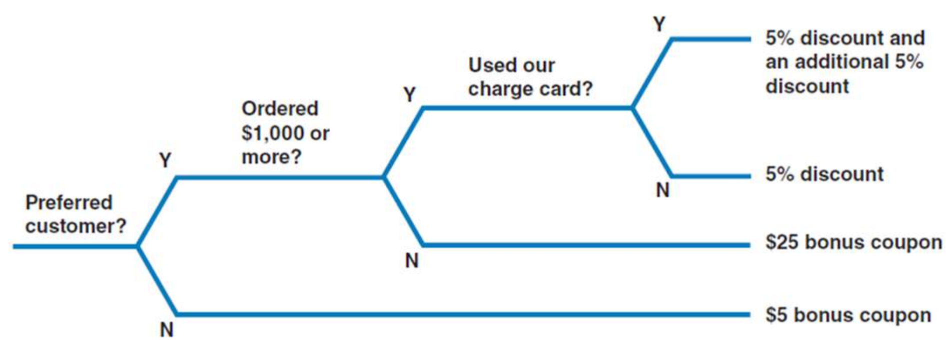


FIGURE 5-36 This example is based on the same Sales Promotion Policy shown in the decision tables in Figures 5-34 and 5-35 on the previous page. Like a decision table, a decision tree shows all combinations of conditions and outcomes. The main difference is the graphical format, which many viewers find easier to interpret

Summary

- Structured analysis tools
  - Used to develop a logical model during one systems analysis phase and a physical model during the systems design phase
- Data and process modeling
  - Main tools: DFDs, data dictionary, and process description
- Each functional primitive process is documented
  - Structured English, decision tables, and decision trees