INTRODUCTION

- In this lecture, we discuss two of the most common documentation tools:
  - **Data flow diagrams**

- **Graphical descriptions of the sources and destinations of data. They show:**
  - **Where data comes from**
  - **How it flows**
  - **The processes performed on it**
  - **Where it goes**

INTRODUCTION

- In this chapter, we discuss two of the most common documentation tools:
  - Data flow diagrams
  - **Flowcharts**

    - **Include three types:**
      - **Document flowcharts describe the flow of documents and information between departments or units.**
      - **System flowcharts describe the relationship between inputs, processing, and outputs for a system.**
      - **Program flowcharts describe the sequence of logical operations performed in a computer program.**

INTRODUCTION

- Documentation techniques are ***necessary*** tools for accountants:
  - **HKSA 315** requires the auditor to understand specified aspects of the entity and its environment, and components of its internal control, in order to identify and assess the risks of material misstatement

(HKSA: Hong Kong Standard of Auditing)

INTRODUCTION

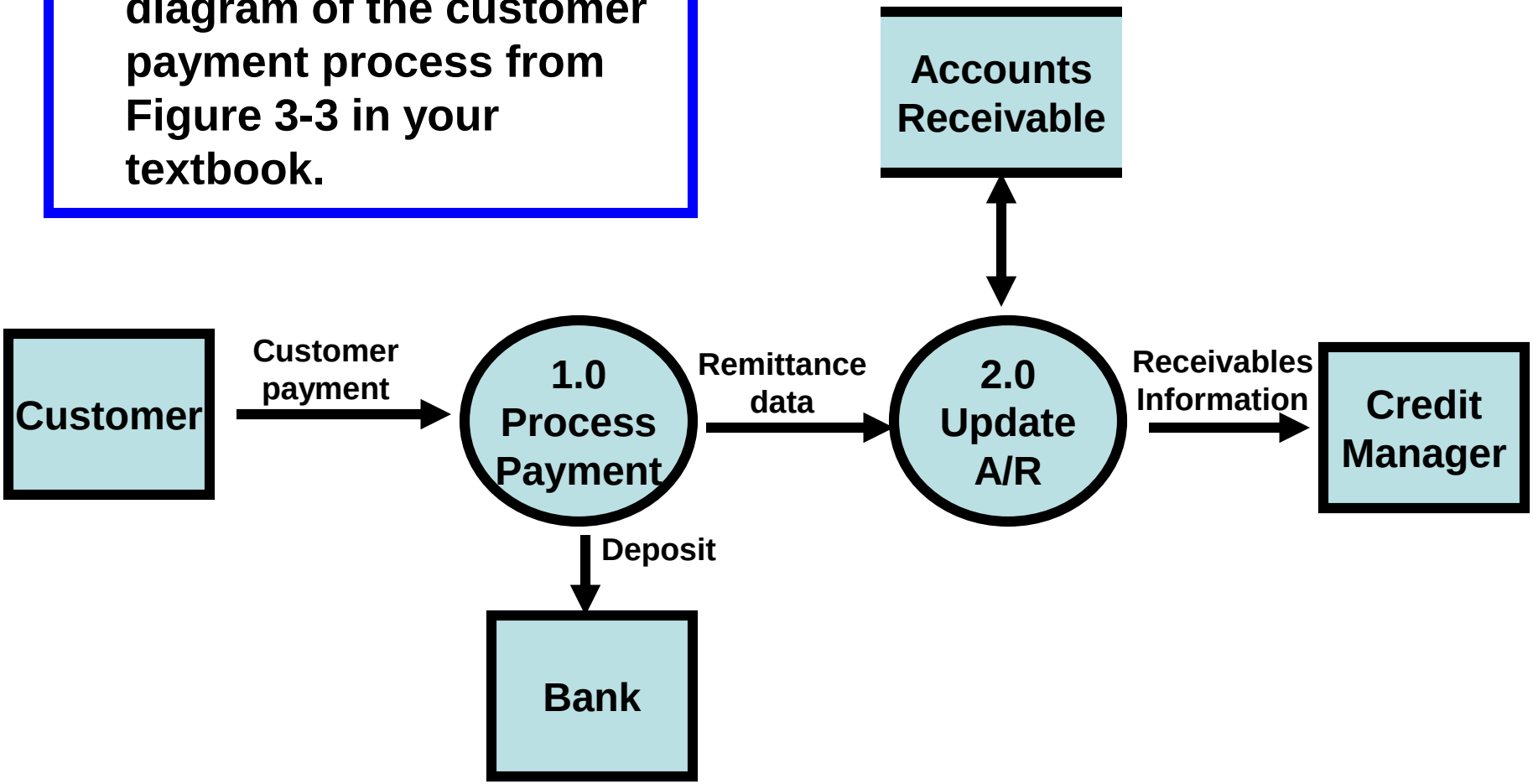
- Documentation tools help accountants by:
  - Organizing very complicated systems into a form that can be more readily understood.
  - Helping new team members understand a pre-existing system.

DATA FLOW DIAGRAMS

- A data flow diagram (DFD) graphically describes the flow of data within an organization. It is used to:
  - Document existing systems
  - Plan and design new systems

DATA FLOW DIAGRAMS

- Example of a data flow diagram of the customer payment process from Figure 3-3 in your textbook.



DATA FLOW DIAGRAMS

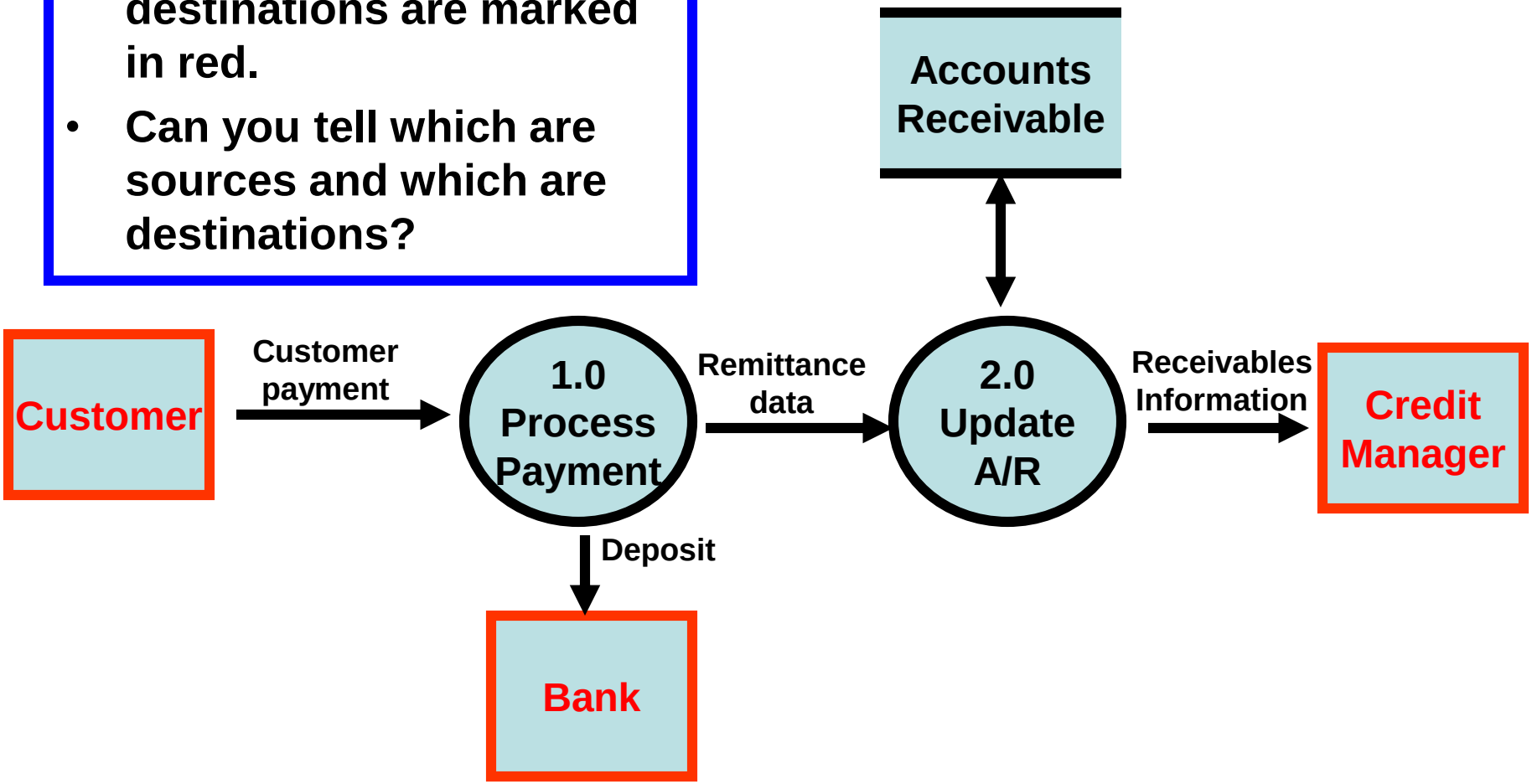
- A data flow diagram consists of four basic elements:
  - Data sources and destinations
  - Data flows
  - Transformation processes
  - Data stores

DATA FLOW DIAGRAMS

- Data sources and destinations
  - Appear as squares
  - Represent organizations or individuals that send or receive data used or produced by the system
- An item can be both a source and a destination

DATA FLOW DIAGRAMS

- Data sources and destinations are marked in red.
- Can you tell which are sources and which are destinations?

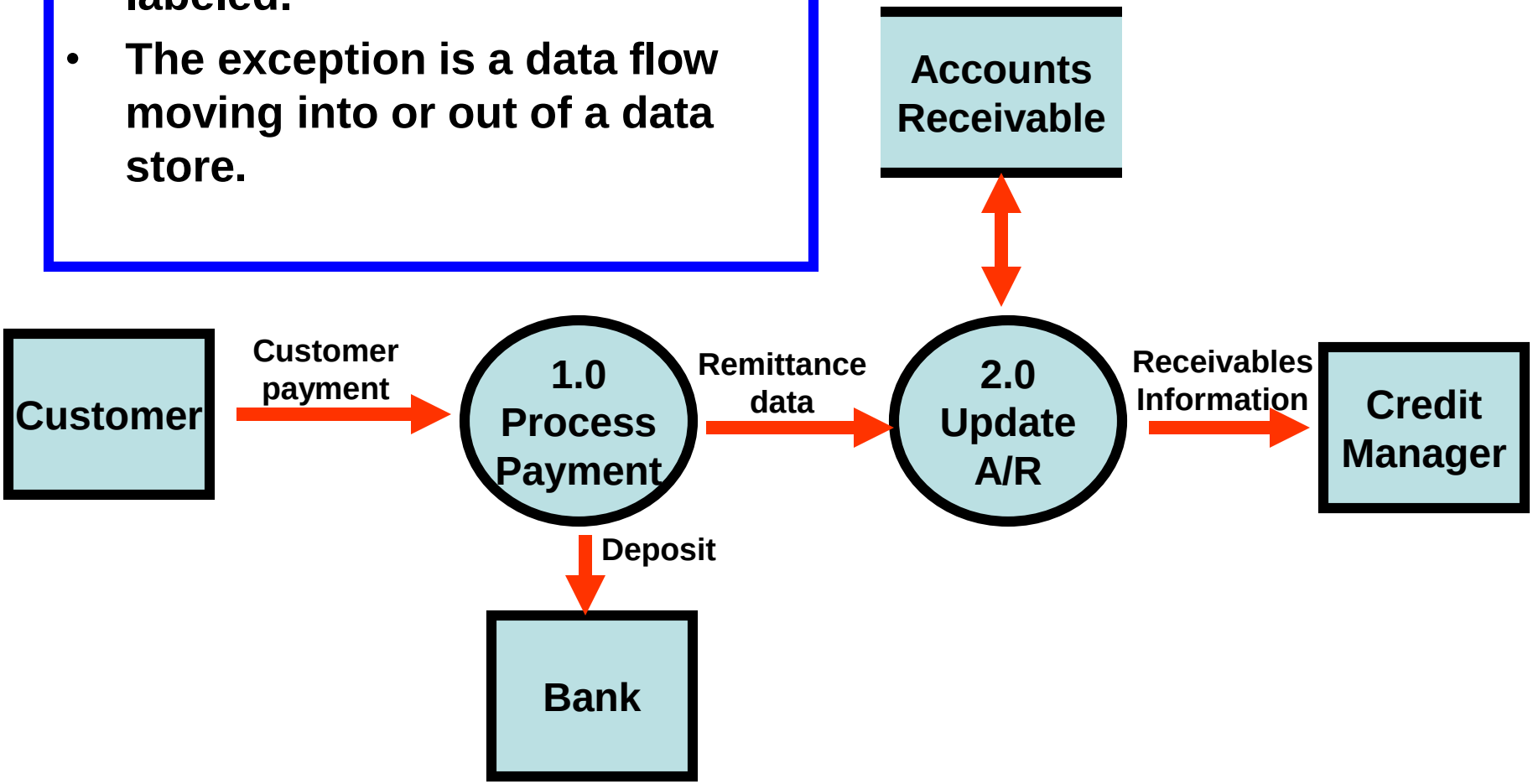


DATA FLOW DIAGRAMS

- Data flows
  - Appear as arrows
  - Represent the flow of data between sources and destinations, processes, and data stores

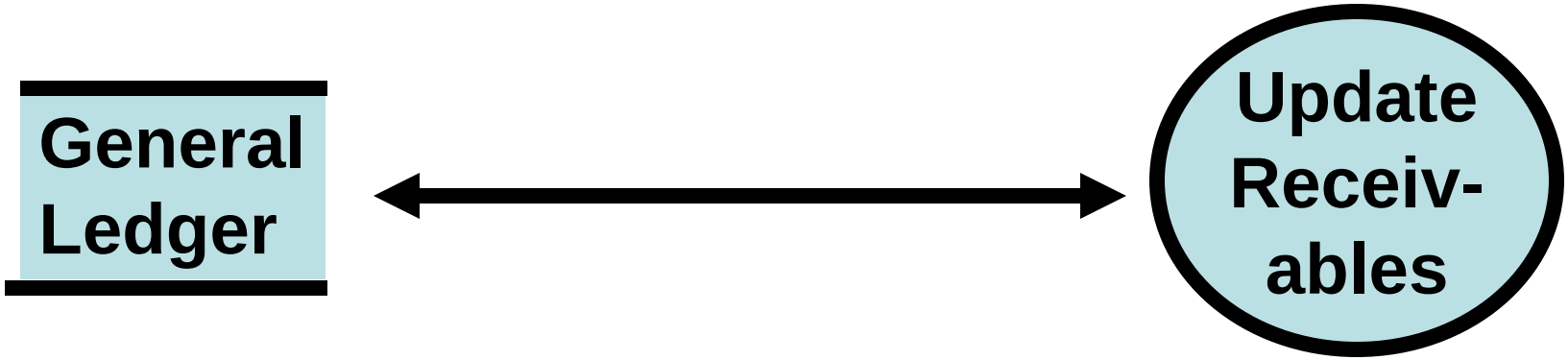
DATA FLOW DIAGRAMS

- Data flows should always be labeled.
- The exception is a data flow moving into or out of a data store.



DATA FLOW DIAGRAMS

- As you probably surmised from the previous slides, if a data flow is two-way, use a bi-directional arrow.

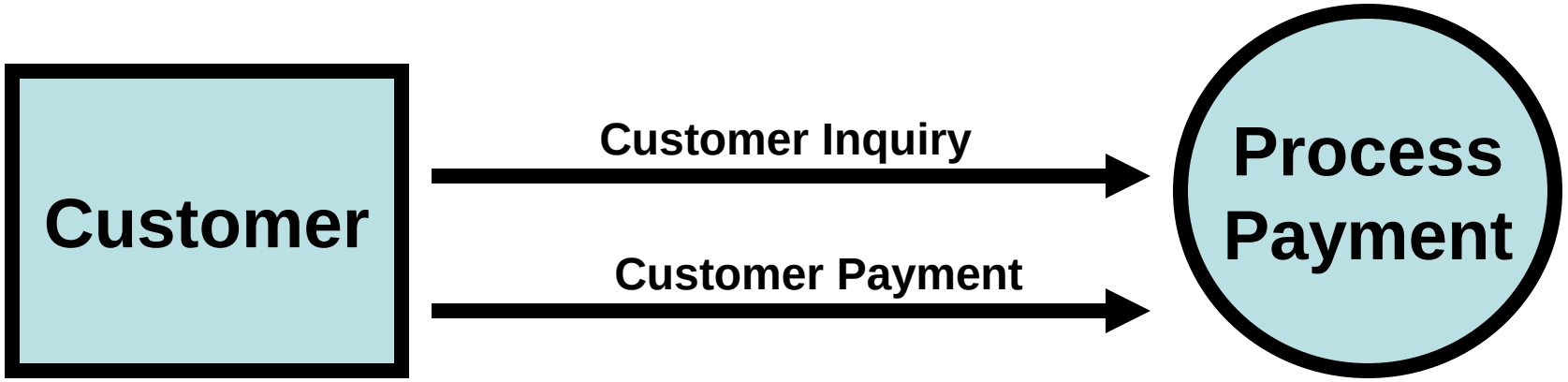


DATA FLOW DIAGRAMS

- If two data elements flow together, then the use of one data flow line is appropriate.

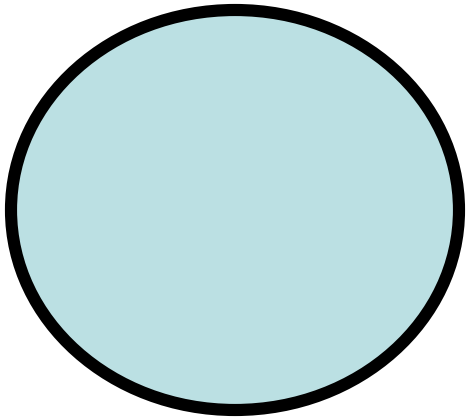
DATA FLOW DIAGRAMS

- If the data elements do not always flow together, then multiple lines will be needed.



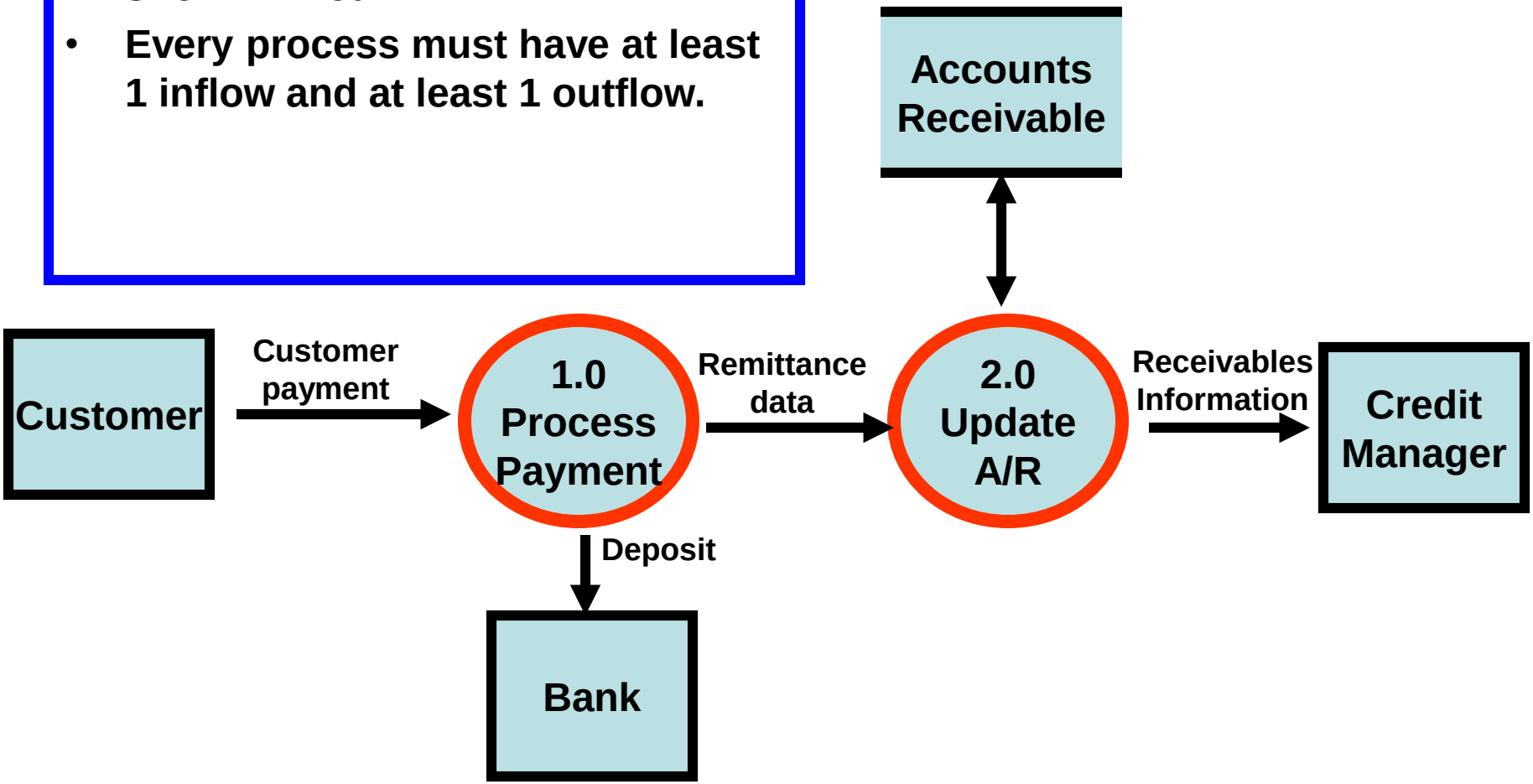
DATA FLOW DIAGRAMS

- Transformation Processes
  - Appear as circles
  - Represent the transformation of data



DATA FLOW DIAGRAMS

- The transformation processes are shown in red.
- Every process must have at least 1 inflow and at least 1 outflow.

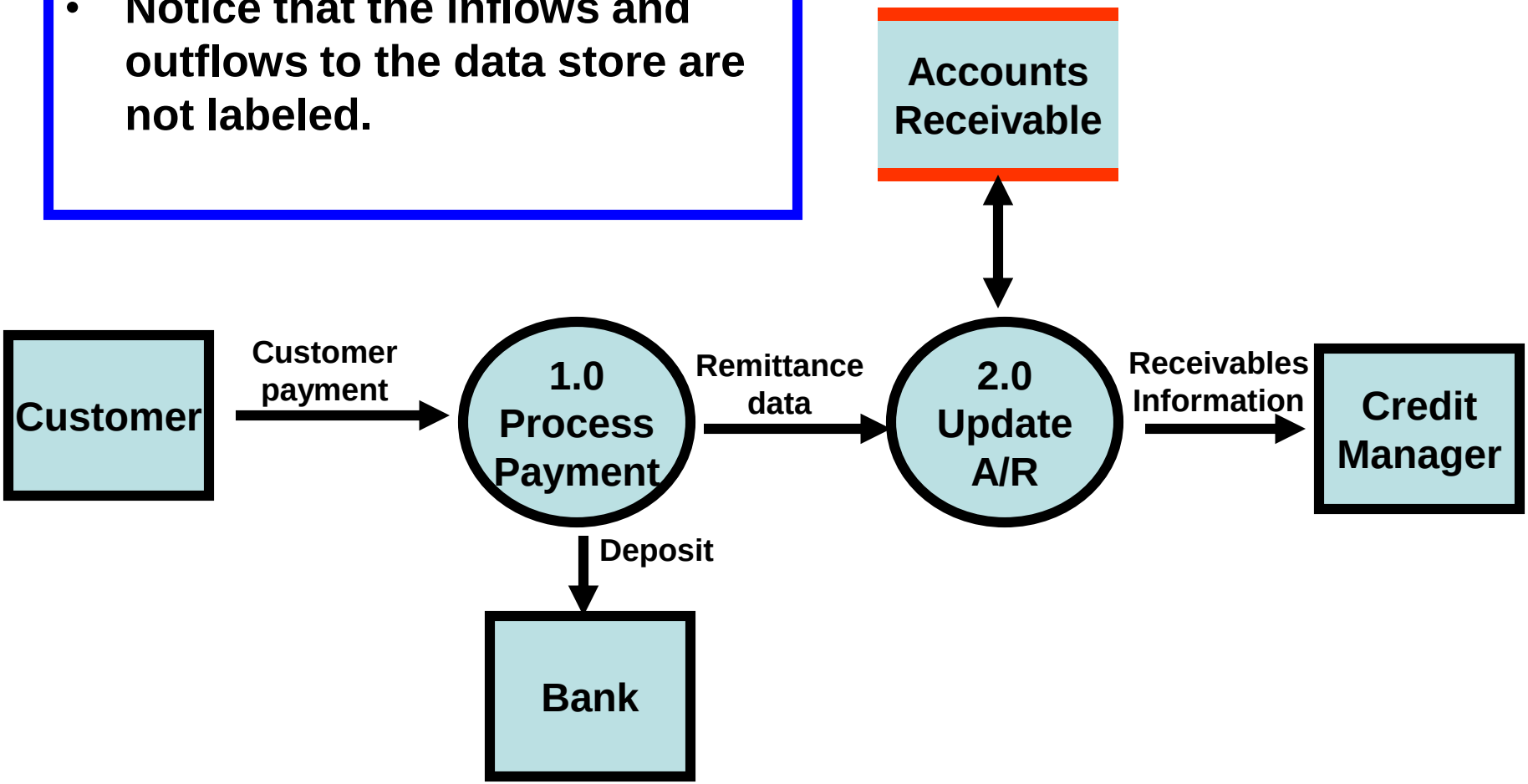


DATA FLOW DIAGRAMS

- Data stores
  - Appear as two horizontal lines
  - Represent a temporary or permanent repository of data

DATA FLOW DIAGRAMS

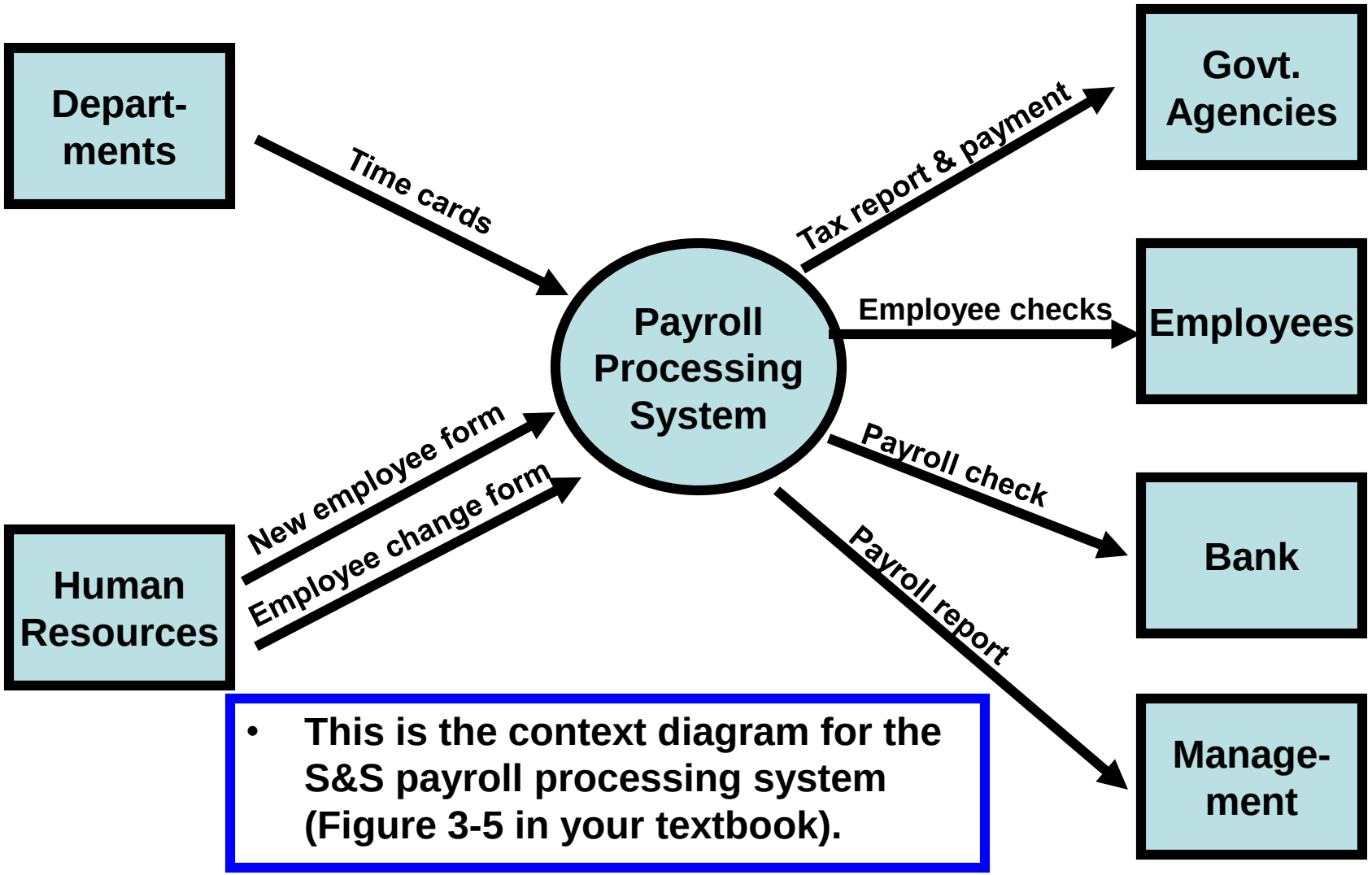
- The data store is shown in red.
- Notice that the inflows and outflows to the data store are not labeled.



DATA FLOW DIAGRAMS

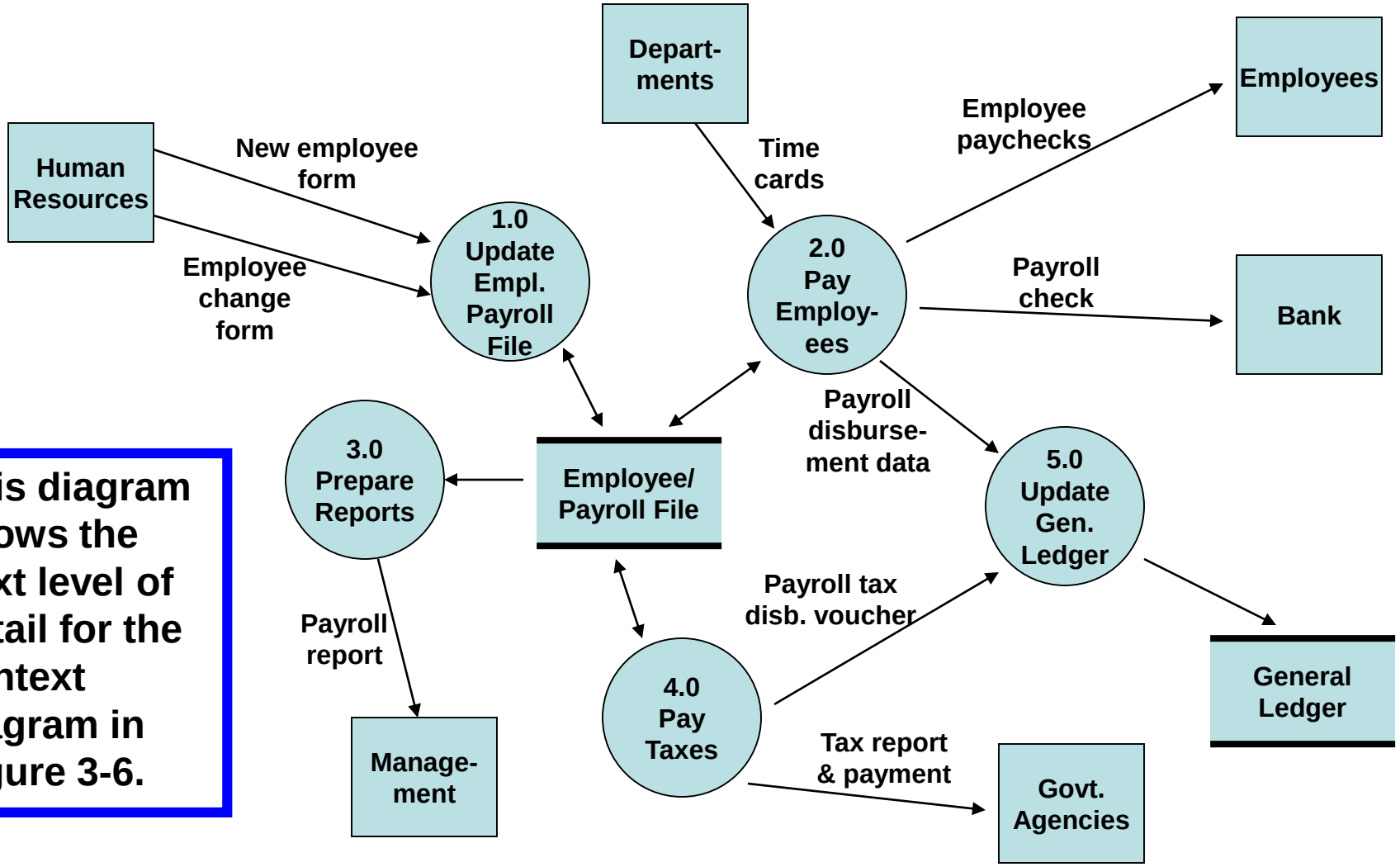
- The highest level of DFD is called a **context diagram**.
  - It provides a summary-level view of the system.
  - It depicts a data processing system and the external entities that are:
    - Sources of its input
    - Destinations of its output

CONTEXT DIAGRAM



- This is the context diagram for the S&S payroll processing system (Figure 3-5 in your textbook).

LEVEL 0 DFD



This diagram shows the next level of detail for the context diagram in Figure 3-6.

DATA FLOW DIAGRAMS

- RULE 1: Understand the system. Observe the flow of information and interview people involved to gain that understanding.
- RULE 2: Ignore control processes and control actions (e.g., error corrections). Only very critical error paths should be included.
- RULE 3: Determine the system boundaries—where it starts and stops. If you're not sure about a process, include it.

DATA FLOW DIAGRAMS

- RULE 4: Draw the context diagram first, and then draw successively greater levels of detail.
- RULE 5: Identify and label all data flows. The only ones that do not have to be labeled are those that go into or come out of data stores.
- RULE 6: Data flows that always flow together should be grouped together. Those that do not flow together should be shown on separate lines.

DATA FLOW DIAGRAMS

- RULE 7: Show a process (circle) wherever a data flow is converted from one form to another. Likewise, every process should have at least one incoming data flow and at least one outgoing data flow.
- RULE 8: Transformation processes that are logically related or occur simultaneously can be grouped in one bubble.
- RULE 9: Number each process sequentially. A process labeled 5.0 would be exploded at the next level into processes numbered 5.1, 5.2, etc. A process labeled 5.2 would be exploded into 5.21, 5.22, etc.

DATA FLOW DIAGRAMS

- RULE 10: Process names should include action verbs, such as ***update***, ***prepare***, etc.
- RULE 11: Identify and label all data stores, whether temporary or permanent.
- RULE 12: Identify and label all sources and destinations. An entity can be both a source and destination. You may wish to include such items twice on the diagram, if needed, to avoid excessive or crossing lines.

DATA FLOW DIAGRAMS

- RULE 13: As much as possible, organize the flow from top to bottom and left to right.
- RULE 14: You're not likely to get it beautiful the first time, so plan to go through several iterations of refinements.
- RULE 15: On the final copy, lines should not cross. On each page, include:
  - The name of the DFD
  - The date prepared
  - The preparer's name

CREATE DFD

- You may wish to create a table with the following headings to organize your information:
  - Data Inputs
  - Processes
  - Data Outputs

CREATE DFD

Data Inputs	Processes	Data Outputs

NARRATIVE – PAYROLL PROCESS

- The first paragraph of the narrative for the payroll process reads as follows:
  - When employees are hired, they complete a new employee form. When a change to an employee's payroll status occurs, such as a raise or a change in the number of exemptions, human resources completes an employee change form. A copy of these forms is sent to payroll. These forms are used to create or update the records in the employee/payroll file and are then stored in the file. Employee records are stored alphabetically.

DATA FLOW DIAGRAMS

- The first paragraph of the narrative for the payroll process reads as follows:
  - **When employees are hired, they complete a new employee form. When a change to an employee's payroll status occurs, such as a raise or a change in the number of exemptions, human resources completes an employee change form. A copy of these forms is sent to payroll. These forms are used to create or update the records in the employee/payroll file and are then stored in the file. Employee records are stored alphabetically.**

The portion marked in red relates to activities that go on outside the boundaries of the payroll system. Consequently, these activities will not be included on the DFD.

DATA FLOW DIAGRAMS

- The first paragraph of the narrative for the payroll process reads as follows:
  - **When employees are hired, they complete a new employee form. When a change to an employee's payroll status occurs, such as a raise or a change in the number of exemptions, human resources completes an employee change form. A copy of these forms is sent to payroll. These forms are used to create or update the records in the employee/payroll file and are then stored in the file. Employee records are stored alphabetically.**

The portion marked in red suggests two data flows coming into the payroll process (new employee forms and employee change forms). The source of the inflows is the human resources department.

DATA FLOW DIAGRAMS

Data Inputs	Processes	Data Outputs
New employee forms and employee change forms (from H.R. Dept.)		

DATA FLOW DIAGRAMS

- The first paragraph of the narrative for the payroll process reads as follows:
  - **When employees are hired, they complete a new employee form. When a change to an employee's payroll status occurs, such as a raise or a change in the number of exemptions, human resources completes an employee change form. A copy of these forms is sent to payroll. These forms are used to create or update the records in the employee/payroll file and are then stored in the file. Employee records are stored alphabetically.**

The sentence marked in red suggests a process (update employee records) with the data outflow going to a data store (the employee/payroll file).

DATA FLOW DIAGRAMS

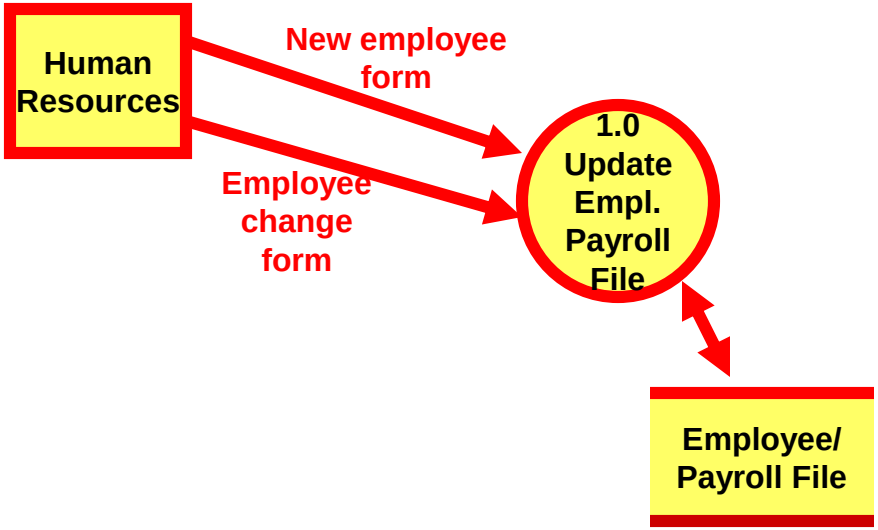
Data Inputs	Processes	Data Outputs
New employee forms and employee change forms (from H.R. Dept.)	Update records (read from file and record)	Updated employee/ payroll file

DATA FLOW DIAGRAMS

- The first paragraph of the narrative for the payroll process reads as follows:
  - **When employees are hired, they complete a new employee form. When a change to an employee's payroll status occurs, such as a raise or a change in the number of exemptions, human resources completes an employee change form. A copy of these forms is sent to payroll. These forms are used to create or update the records in the employee/payroll file and are then stored in the file. Employee records are stored alphabetically.**

The final sentence in this paragraph provides information about the physical storage of the data. Physical information is utilized in flowcharts but not in data flow diagrams.

Payroll Process DFD…..



In Lecture Exercise

- Textbook Problem 3.5

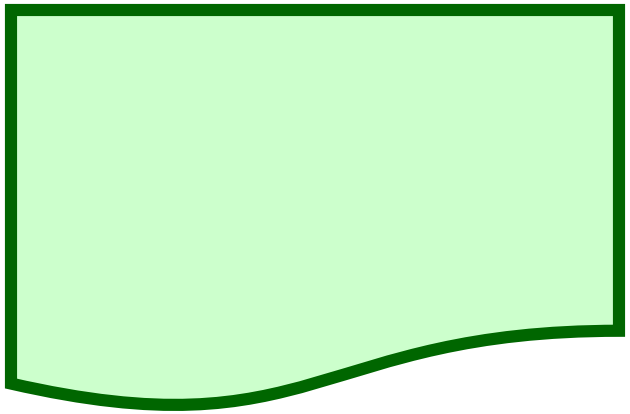
DOCUMENT FLOWCHARTS

- A document flowchart shows the flow of documents and information among areas of responsibility in an organization.
- Internal control flowcharts are document flowcharts used to evaluate the adequacy of internal controls, such as segregation of duties or internal checks.

GUIDELINES FOR PREPARING FLOWCHARTS

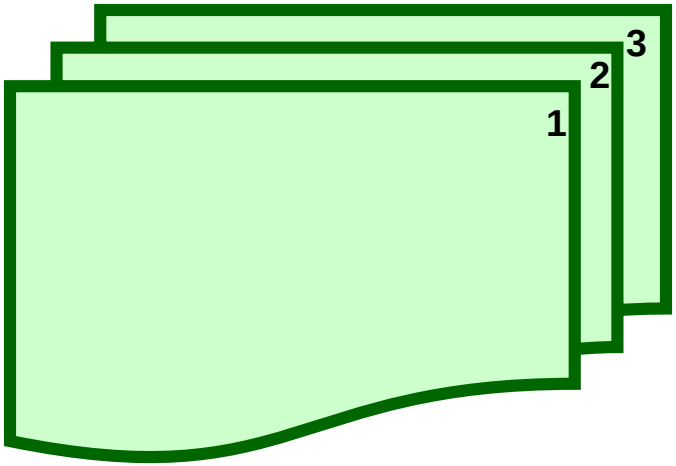
- Identify:
  - Entities to be flowcharted, e.g., departments, functions, external parties (the parties who “do” things in the story)
  - Documents or information flows
  - Processes
- As you read through a narrative, you may want to mark the preceding items with different shapes (e.g., drawing a rectangle around entities, circling documents, etc.).

INPUT/OUTPUT SYMBOLS



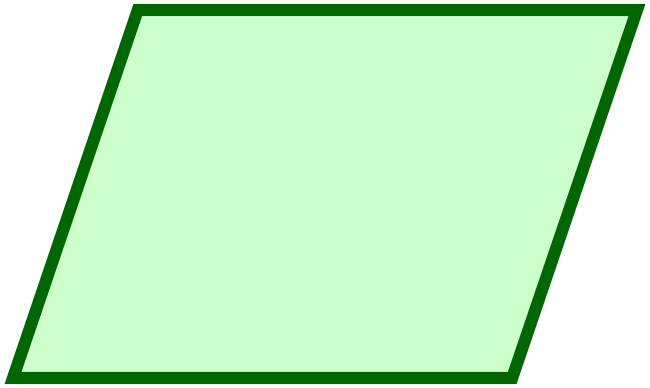
- **Document Symbol**
  - Represents a document or report that is prepared by hand or printed by a computer.

INPUT/OUTPUT SYMBOLS



- **Multiple Copies of One Document**
  - Indicates multiple copies of a paper document or report.
  - The document copies should be numbered in the upper, right-hand corner.

INPUT/OUTPUT SYMBOLS

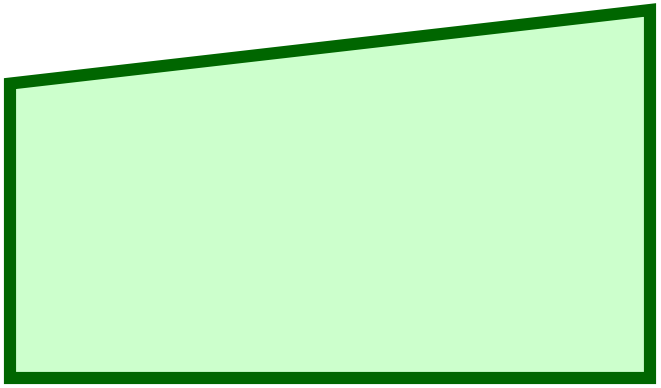


- **Journal/Ledger**
  - Represents accounting journals or ledgers in a document flowchart.

INPUT/OUTPUT SYMBOLS

- **Display**
  - Represents information displayed by an online output device such as a terminal, monitor, or screen.

INPUT/OUTPUT SYMBOLS



- **Online Keying**
  - Represents data entry by an online device such as a terminal or personal computer.

PROCESSING SYMBOLS

- **Computer Processing**
  - Represents a process performed by a computer, which usually results in a change in data or information.

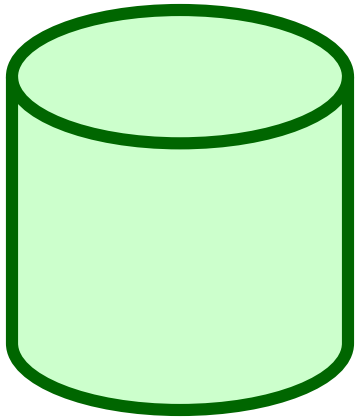
PROCESSING SYMBOLS

- **Manual Operation**
  - Represents a processing operation that is performed manually.

PROCESSING SYMBOLS

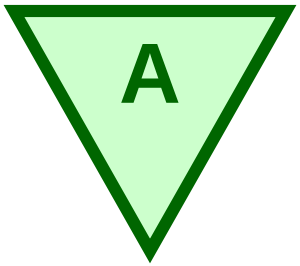
- **Off-line Keying Operation**
  - Represents an operation that uses an off-line keying device, such as a cash register or keying to a disk.

STORAGE SYMBOLS



- **Magnetic Disk/Drive**
  - Represents data stored on a magnetic disk or drive.

STORAGE SYMBOLS

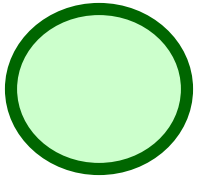


- **File**
  - Represents a file of documents that are manually stored and retrieved.
  - Letter indicates the ordering sequence:
    - A = Alphabetic order
    - D = Date order
    - N = Numeric order

FLOW AND MISCELLANEOUS SYMBOLS

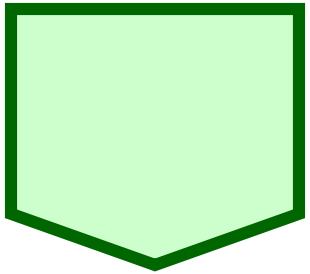
- **Document or Processing Flow**
  - Represents the direction of processing or document flow.
  - Normal flow is top to bottom and left to right.

FLOW AND MISCELLANEOUS SYMBOLS



- **On-page connector**
  - Connects processing from one location to another on the same page.
  - Used to avoid crisscrossing lines.

FLOW AND MISCELLANEOUS SYMBOLS

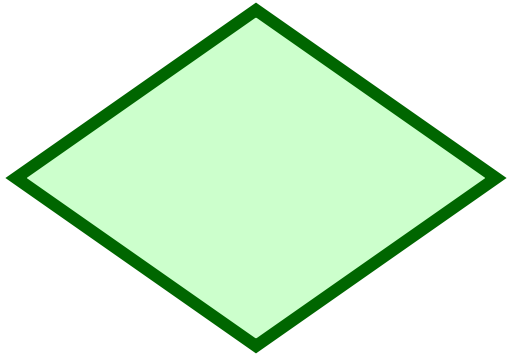


- **Off-page Connector**
  - Connects the processing flow between two different pages.
  - Signals the exit from one page and the corresponding entrance on another page.

FLOW AND MISCELLANEOUS SYMBOLS

- **Terminal**
  - Represents the beginning, end, or a point of interruption in a process or program.
  - Also used to indicate an external party.

FLOW AND MISCELLANEOUS SYMBOLS



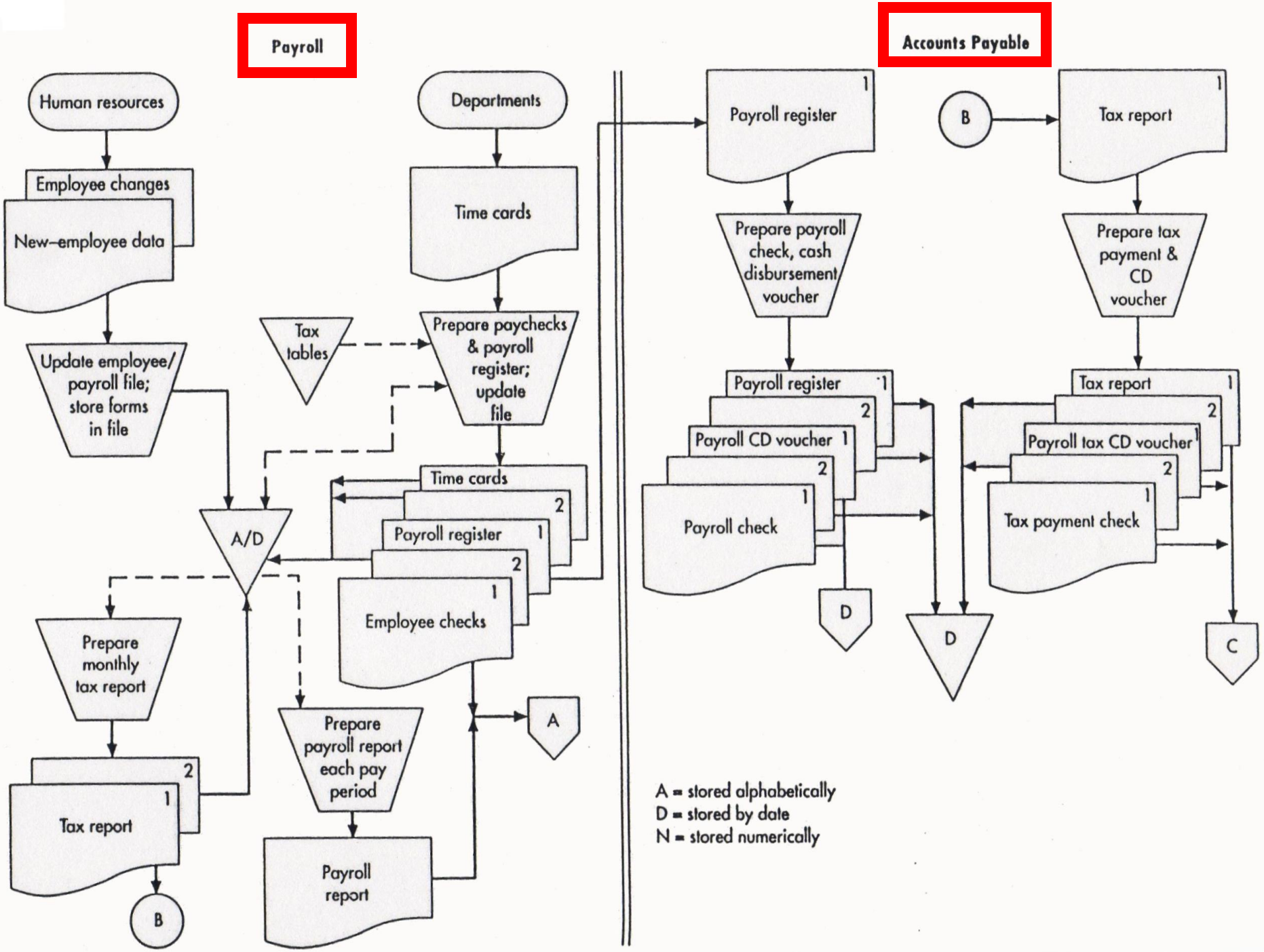
- **Decision**
  - Represents a decision-making step.
  - Used in a program flowchart to show branching to alternate paths.

FLOW AND MISCELLANEOUS SYMBOLS

- **Annotation**
  - Provides for the addition of descriptive comments or explanatory notes as clarification.

GUIDELINES FOR PREPARING FLOWCHARTS

- Use separate columns for the activity of each entity.
  - Example: If there are three different departments or functions that “do” things in the narrative, there would be three columns on the flowchart.


Payroll
Accounts Payable
Human resources
Employee changes
New-employee data
Update employee/ payroll file; store forms in file
Departments
Time cards
Tax tables
Prepare paychecks & payroll register; update file
Time cards
Payroll register
Employee checks
A/D
Prepare monthly tax report
Tax report
B
Prepare payroll report each pay period
Payroll report
A
Payroll register
Prepare payroll check, cash disbursement voucher
Payroll register
Payroll CD voucher
Payroll check
D
D
B
Tax report
Prepare tax payment & CD voucher
Tax report
Payroll tax CD voucher
Tax payment check
C
A = stored alphabetically
D = stored by date
N = stored numerically

GUIDELINES FOR PREPARING FLOWCHARTS

- Flowchart the normal course of operations, and identify exceptions with annotations.
- As much as possible, the flow should go from top to bottom, left to right.
- Use standard flowcharting symbols, and draw with a template or computer.
- Clearly label all symbols. Use annotations if necessary to provide adequate explanation.

GUIDELINES FOR PREPARING FLOWCHARTS

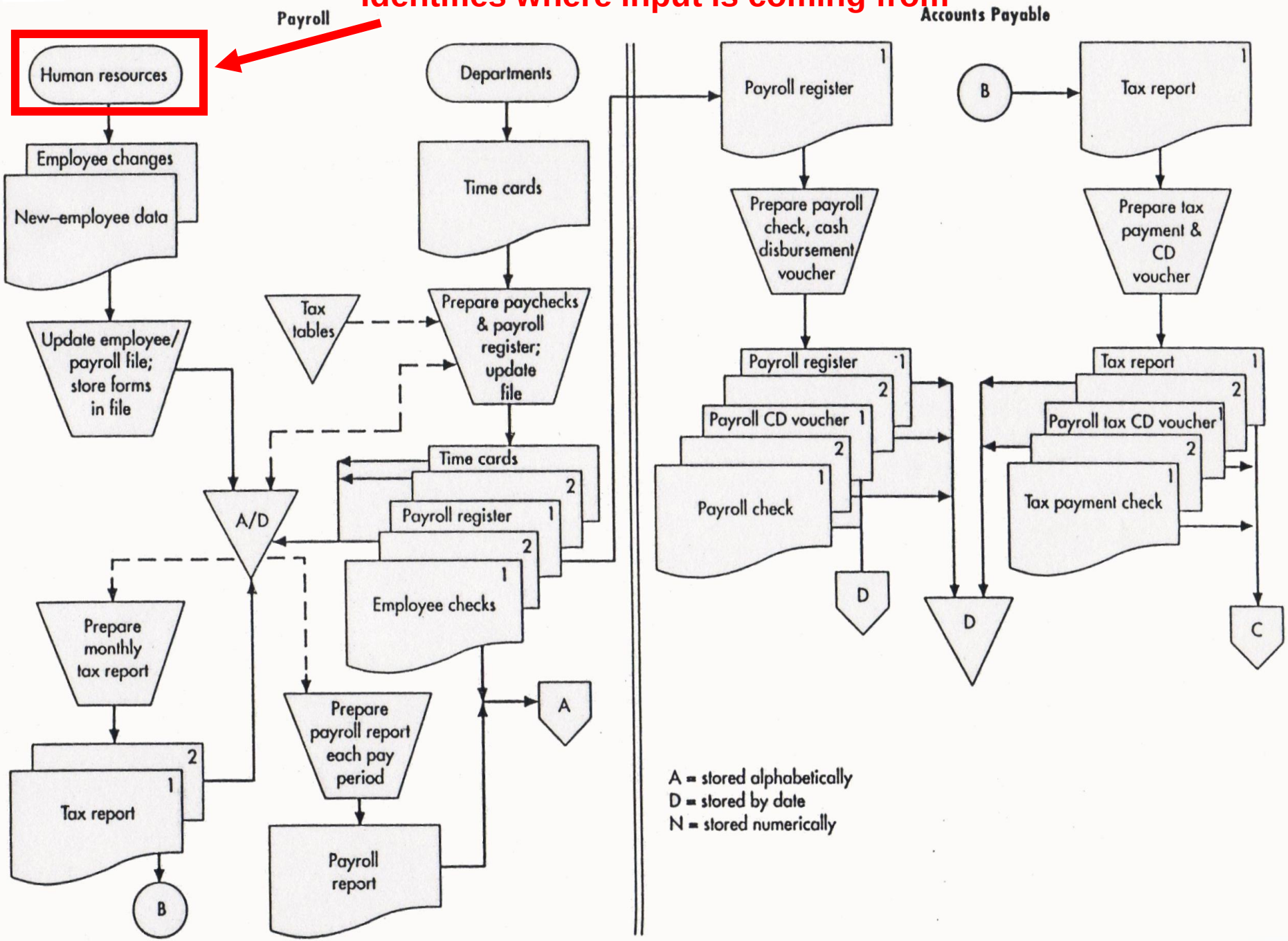
- Give the flowchart a clear beginning and ending.
  - Show where each document originated and its final disposition.
- One approach you can use is to read through the narrative and for each step define:
  - What was (were) the input(s)
  - What process was carried out
  - What was (were) the output(s)

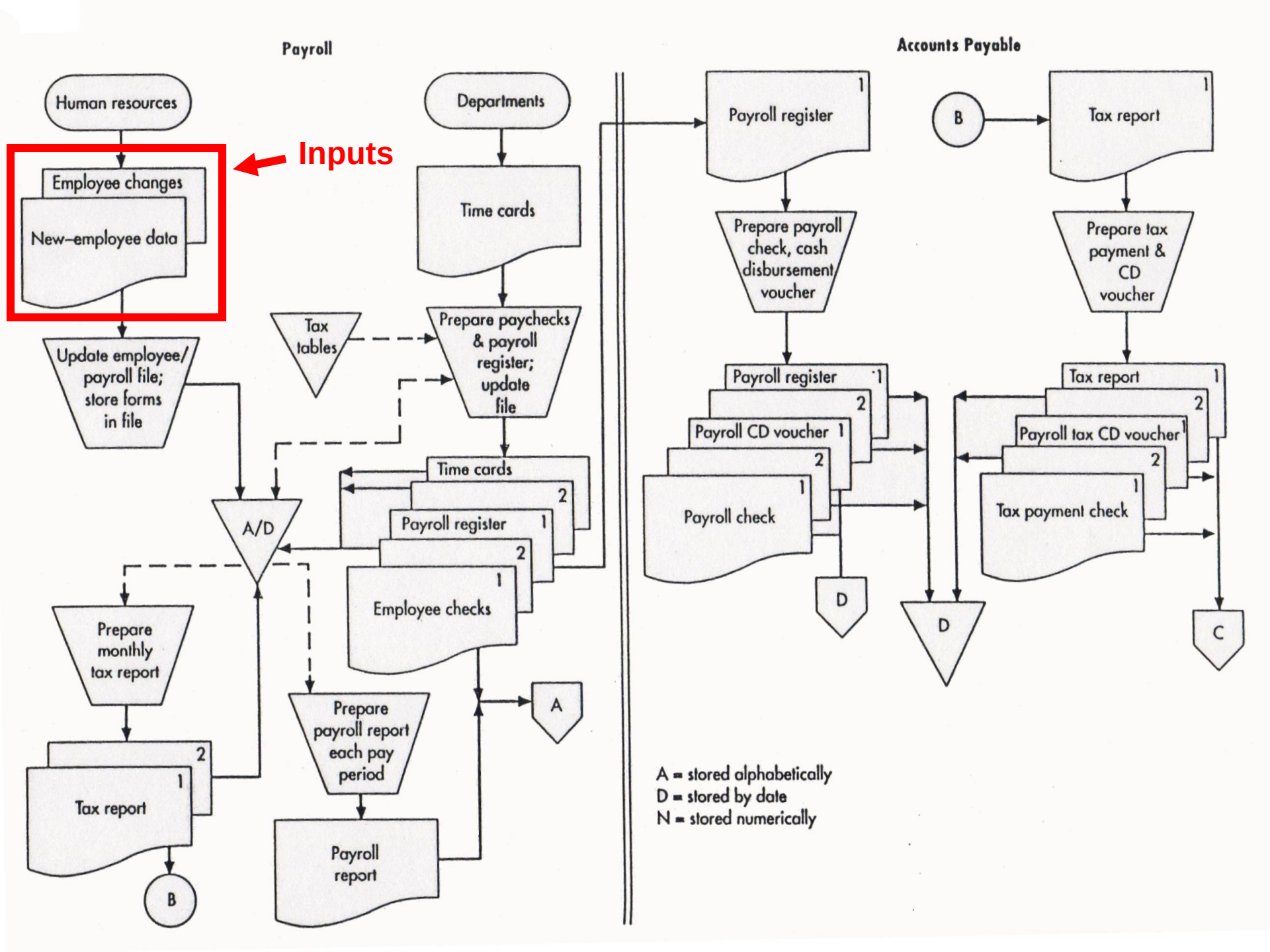
Example

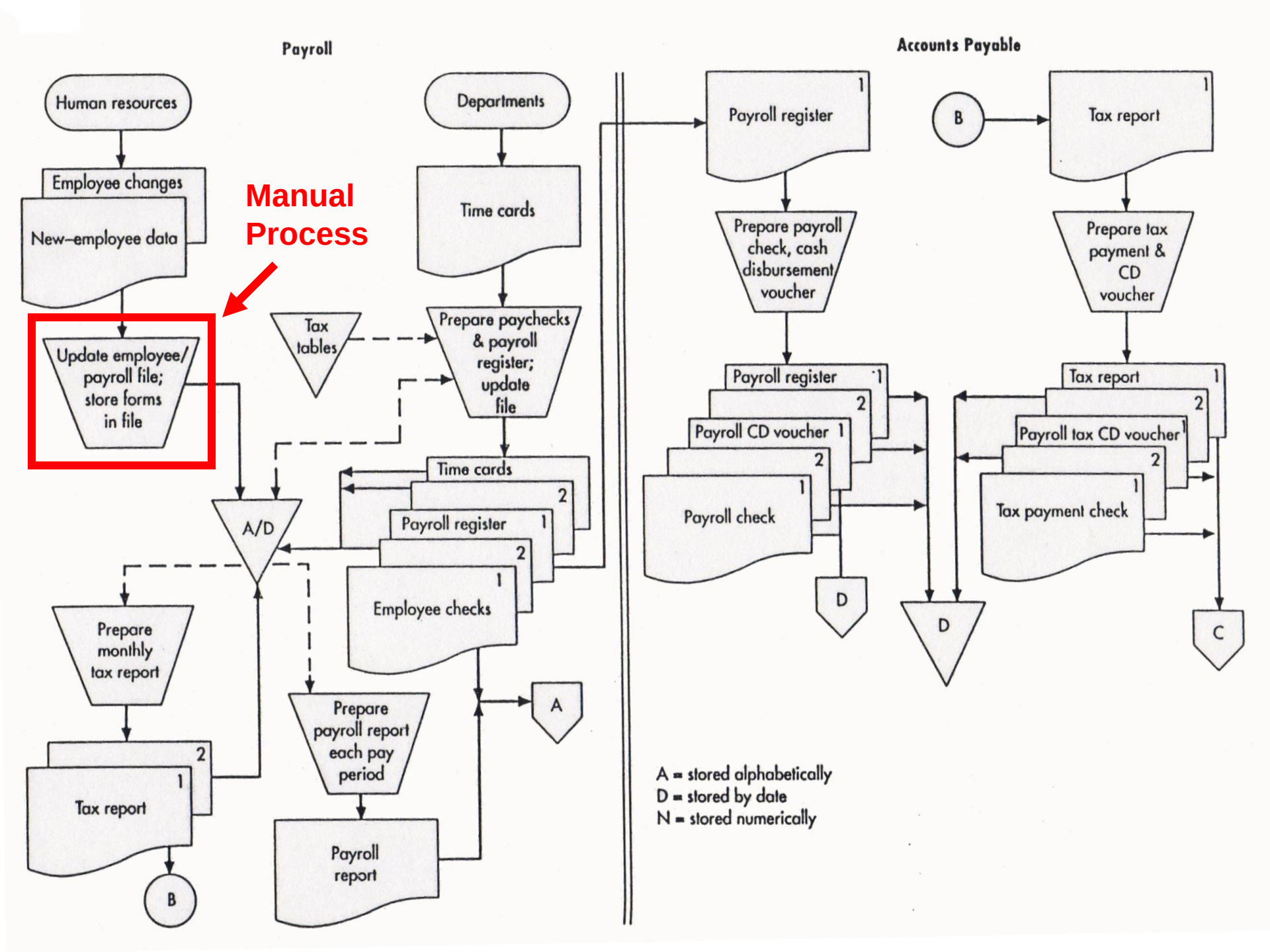
- When employees are hired, they complete a new-employee form. When a change to an employee's payroll status occurs, such as a raise or a change in the number of exemptions, human resources completes an employee change form. A copy of this forms is sent to payroll. These forms are used to create or update the records in the employee/ payroll file and are then stored in the file. Employee records are stored alphabetically.

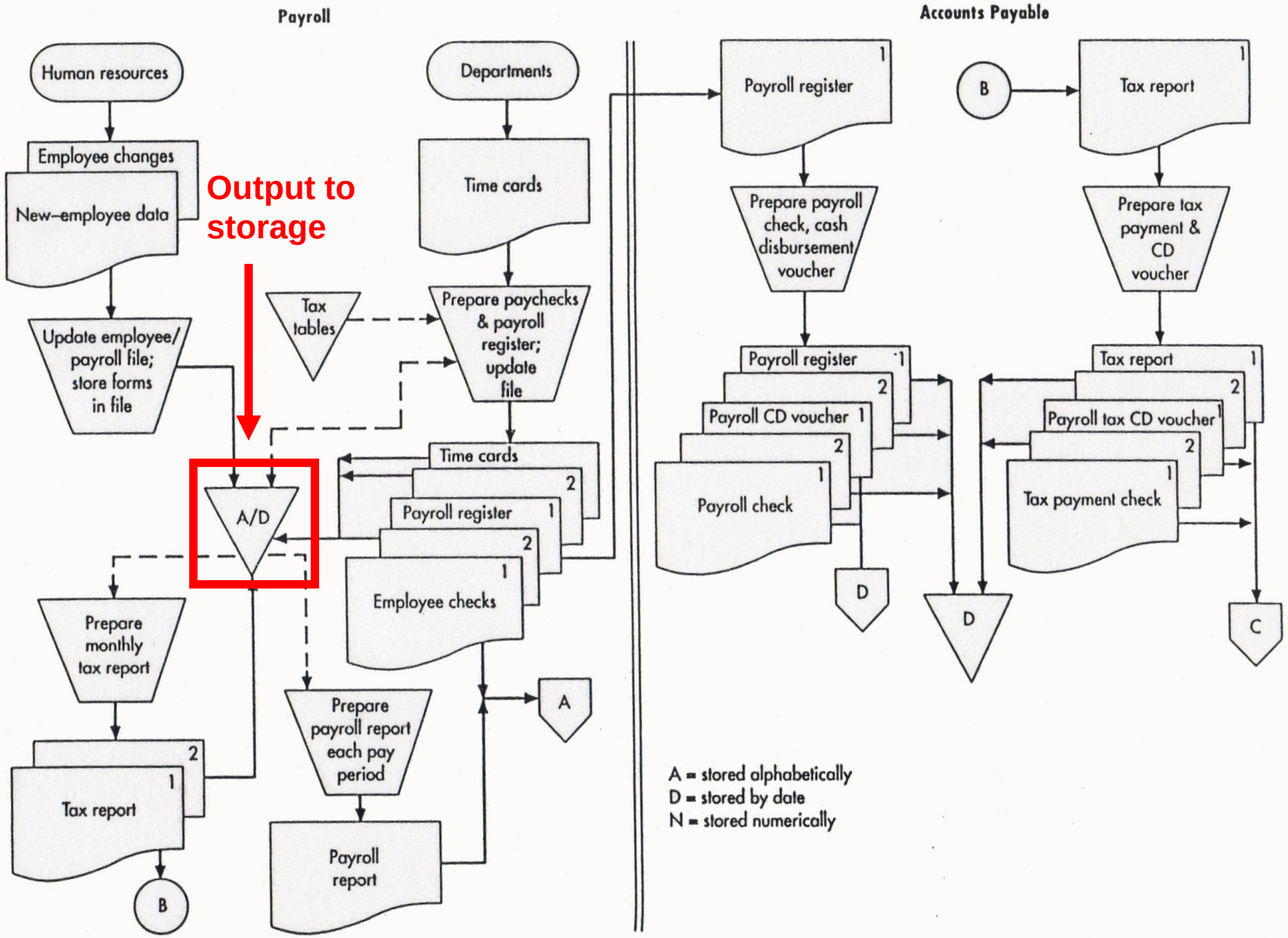
Source: p.89 of textbook

Identifies where input is coming from



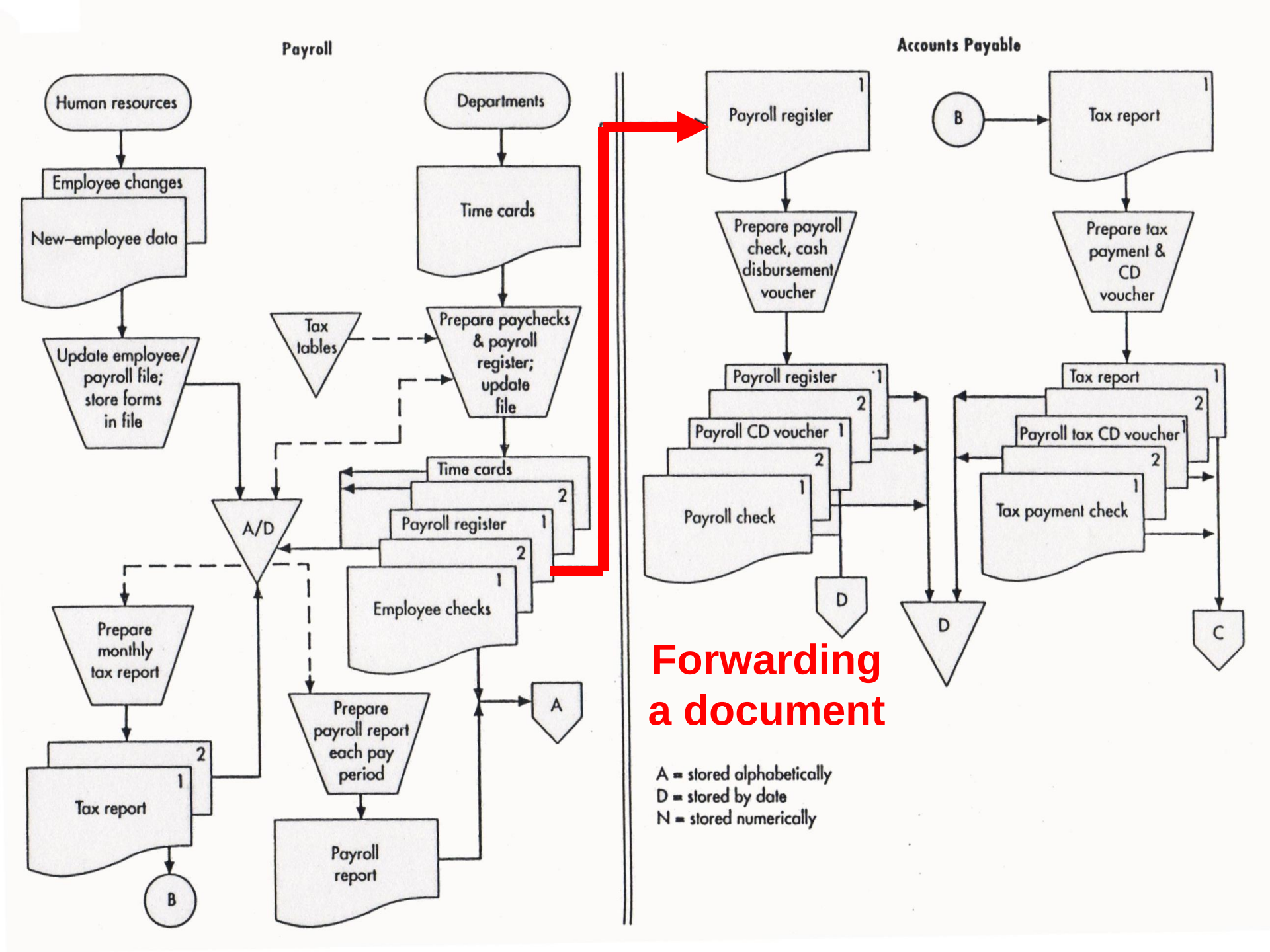

Payroll
Accounts Payable
Human resources
Departments
Inputs
Employee changes
New-employee data
Time cards
Payroll register
Tax report
B
Prepare payroll check, cash disbursement voucher
Prepare tax payment & CD voucher
Tax tables
Prepare paychecks & payroll register; update file
Update employee/ payroll file; store forms in file
Payroll register
Tax report
Payroll CD voucher
Payroll tax CD voucher
Payroll check
Tax payment check
Time cards
A/D
Payroll register
Employee checks
D
D
C
A
Prepare monthly tax report
Prepare payroll report each pay period
Tax report
Payroll report
B
A = stored alphabetically
D = stored by date
N = stored numerically

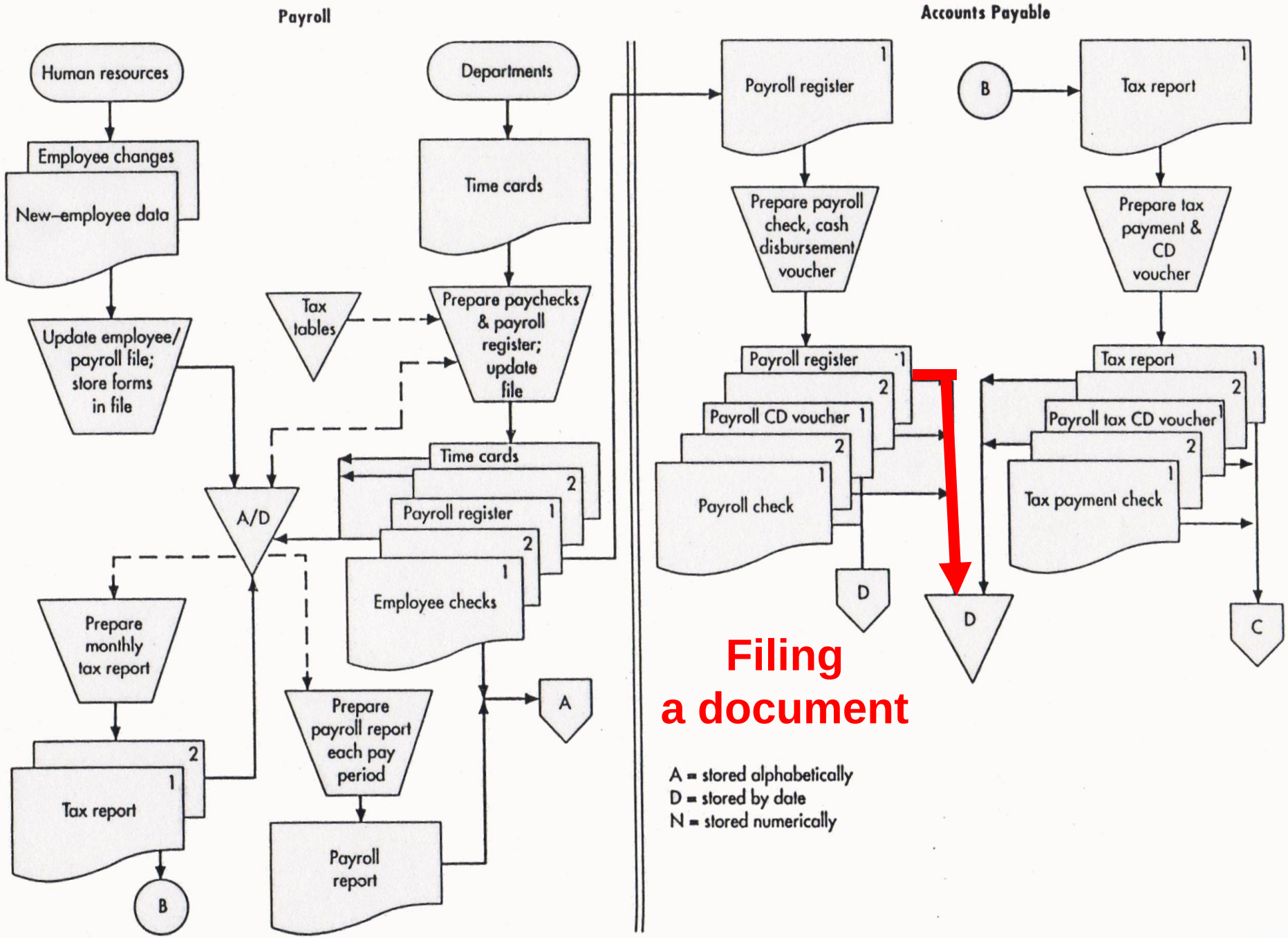

Payroll
Accounts Payable
Human resources
Employee changes
New-employee data
Manual Process
Update employee/ payroll file; store forms in file
Departments
Time cards
Tax tables
Prepare paychecks & payroll register; update file
Time cards
Payroll register
Employee checks
A/D
Prepare monthly tax report
Tax report
B
Prepare payroll report each pay period
Payroll report
A
Payroll register
Prepare payroll check, cash disbursement voucher
Payroll register
Payroll CD voucher
Payroll check
D
B
Tax report
Prepare tax payment & CD voucher
Tax report
Payroll tax CD voucher
Tax payment check
D
C
A = stored alphabetically
D = stored by date
N = stored numerically


Payroll
Accounts Payable
Human resources
Departments
Employee changes
New-employee data
Time cards
Output to storage
Update employee/ payroll file; store forms in file
Tax tables
Prepare paychecks & payroll register; update file
Time cards
A/D
Payroll register
Employee checks
Prepare monthly tax report
Prepare payroll report each pay period
Tax report
Payroll report
A
B
Payroll register
Prepare payroll check, cash disbursement voucher
Payroll register
Payroll CD voucher
Payroll check
D
D
B
Tax report
Prepare tax payment & CD voucher
Tax report
Payroll tax CD voucher
Tax payment check
C
A = stored alphabetically
D = stored by date
N = stored numerically

GUIDELINES FOR PREPARING FLOWCHARTS

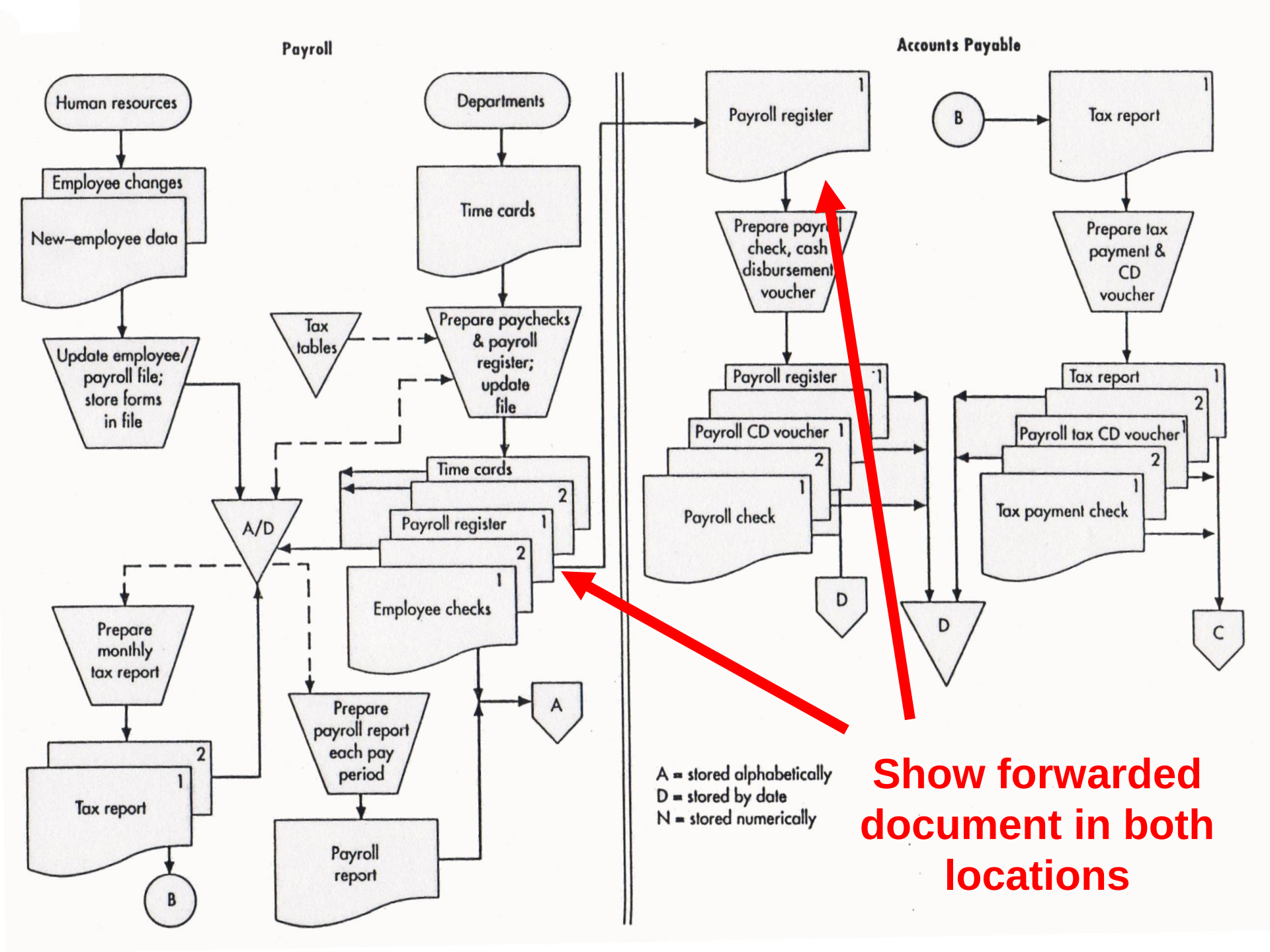
- Every manual process should have at least one input and at least one output.
- Show all data entered into or retrieved from a computer file as passing through a process first.
- Do not show process symbols for:
  - Forwarding a document to another entity
  - Filing a document


Payroll
Accounts Payable
Human resources
Employee changes
New–employee data
Update employee/ payroll file; store forms in file
Departments
Time cards
Tax tables
Prepare paychecks & payroll register; update file
Time cards
Payroll register
Employee checks
A/D
Prepare monthly tax report
Tax report
B
Prepare payroll report each pay period
Payroll report
A
Payroll register
Prepare payroll check, cash disbursement voucher
Payroll register
Payroll CD voucher
Payroll check
D
B
Tax report
Prepare tax payment & CD voucher
Tax report
Payroll tax CD voucher
Tax payment check
D
C
Forwarding a document
A = stored alphabetically
D = stored by date
N = stored numerically


Payroll
Accounts Payable
Human resources
Employee changes
New-employee data
Update employee/ payroll file; store forms in file
Departments
Time cards
Tax tables
Prepare paychecks & payroll register; update file
Time cards
Payroll register
Employee checks
A/D
Prepare monthly tax report
Tax report
B
Prepare payroll report each pay period
Payroll report
A
Payroll register
Prepare payroll check, cash disbursement voucher
Payroll register
Payroll CD voucher
Payroll check
D
B
Tax report
Prepare tax payment & CD voucher
Tax report
Payroll tax CD voucher
Tax payment check
C
D
Filing a document
A = stored alphabetically
D = stored by date
N = stored numerically

GUIDELINES FOR PREPARING FLOWCHARTS

- Do not connect two documents except when forwarding to another column.
  - When a document is forwarded, show it in both locations.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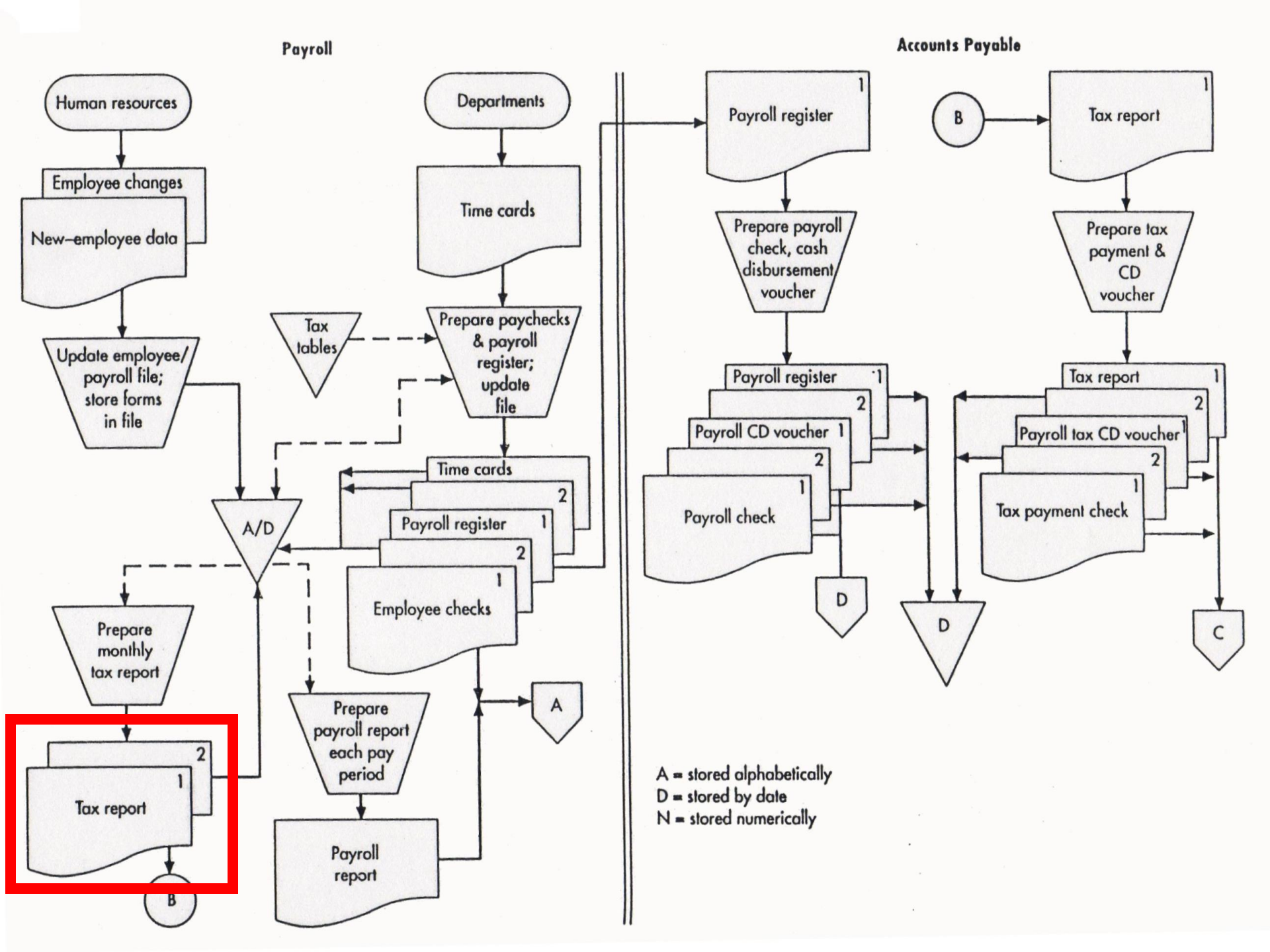
Prepare payr check, cash disbursement voucher
Payroll register
Payroll CD voucher
Payroll check
D
D
B
Tax report
Prepare tax payment & CD voucher
Tax report
Payroll tax CD voucher
Tax payment check
C
A = stored alphabetically
D = stored by date
N = stored numerically
Show forwarded document in both locations

GUIDELINES FOR PREPARING FLOWCHARTS

- When using multiple copies of a document, place document numbers in the upper, right-hand corner.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D
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Tax report
Prepare tax payment & CD voucher
Tax report
Payroll tax CD voucher
Tax payment check
D
C
A = stored alphabetically
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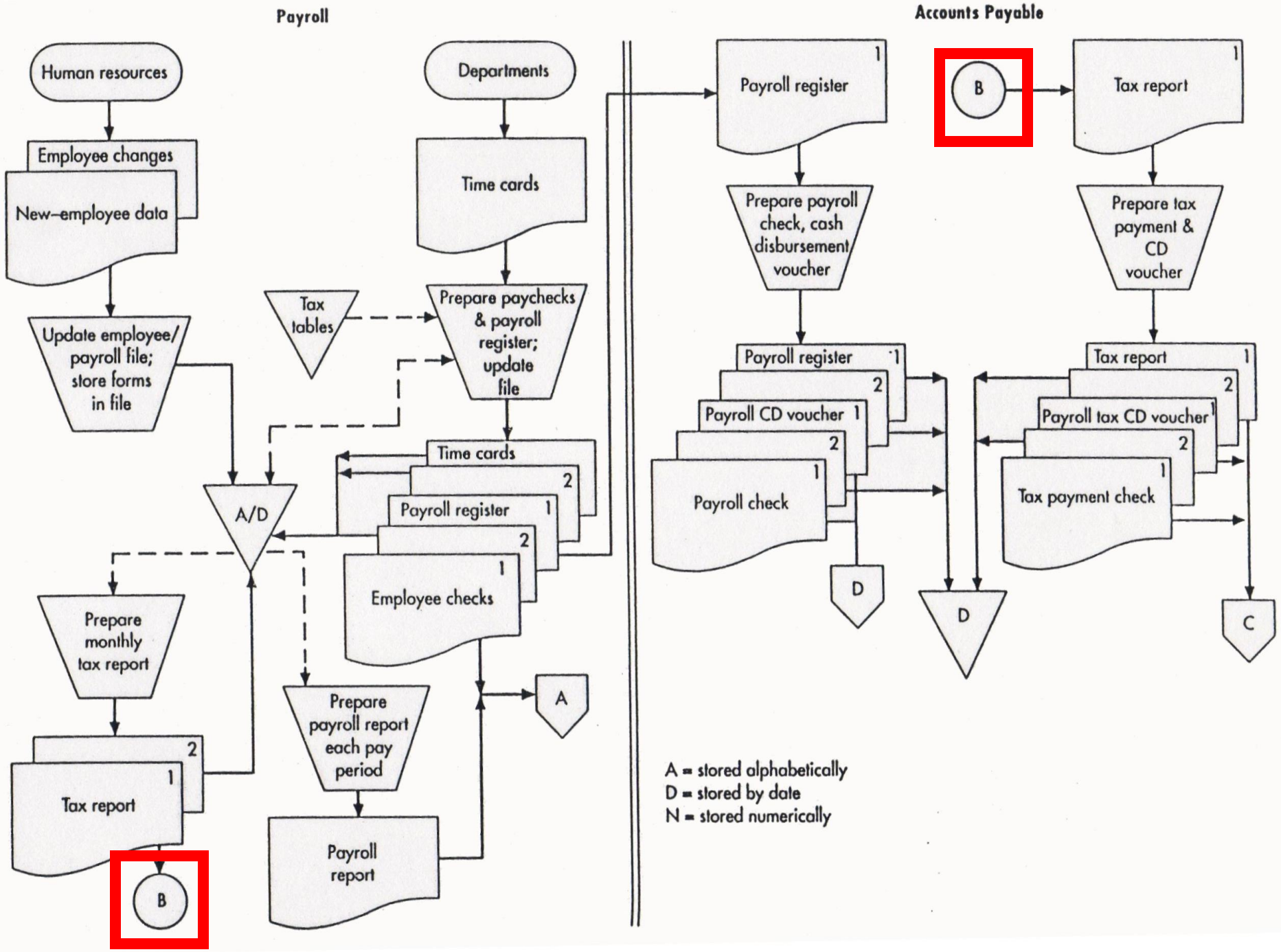
GUIDELINES FOR PREPARING FLOWCHARTS

- Show on-page connectors and label them clearly to avoid excess flow lines.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Payroll check
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Tax report
Payroll tax CD voucher
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SYSTEM FLOWCHARTS

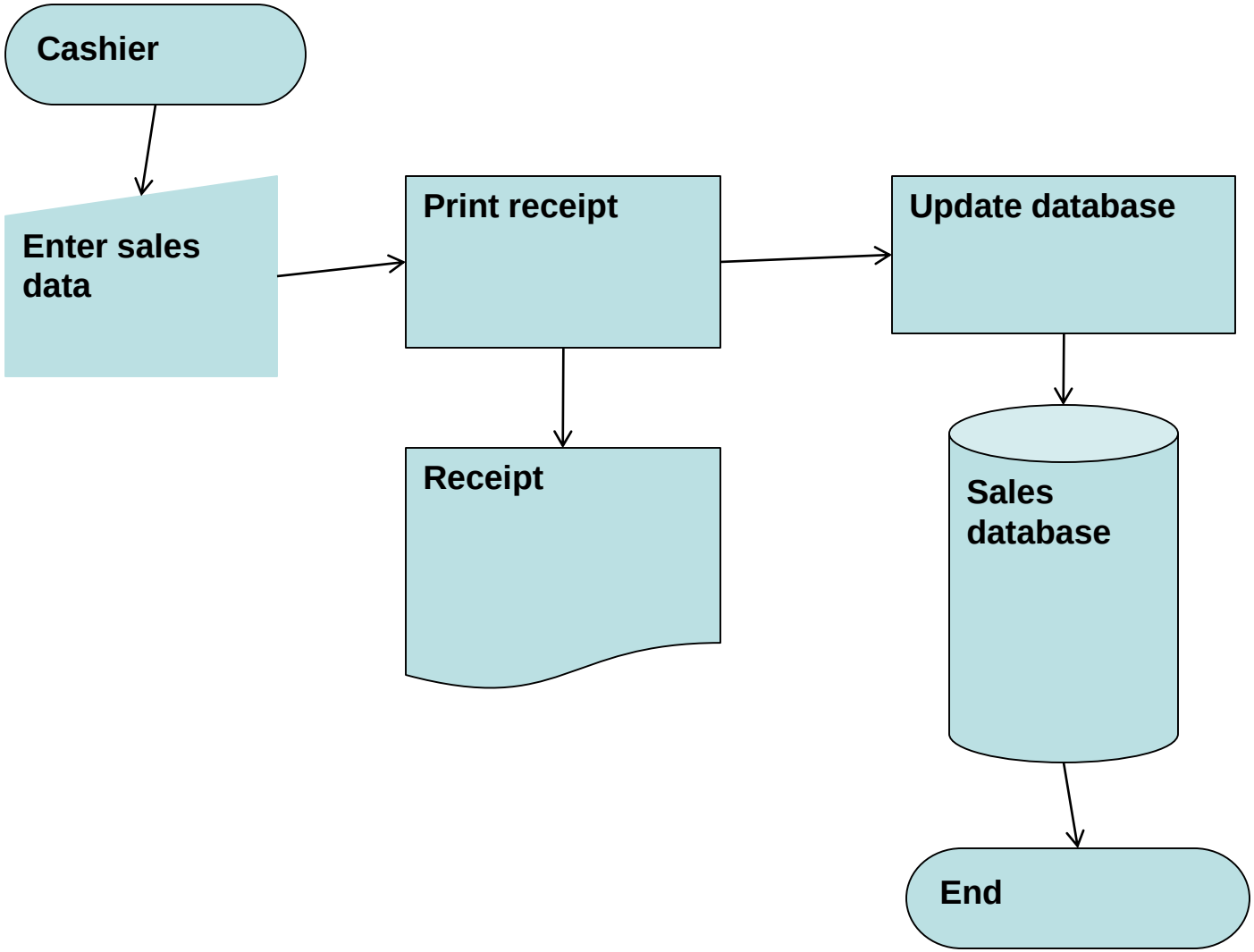
- A system flowchart depicts the relationship among the inputs, processes, and outputs of an AIS.
  - The system flowchart begins by identifying the input to the system.
  - Each input is followed by a process, i.e., the steps performed on the data.
  - The process is followed by output, i.e., resulting new information.
  - **In other words, it's the same basic input—process—output pattern that we saw in the document flowchart.**

Your Practice Time

Please draw the system flowchart for this process:

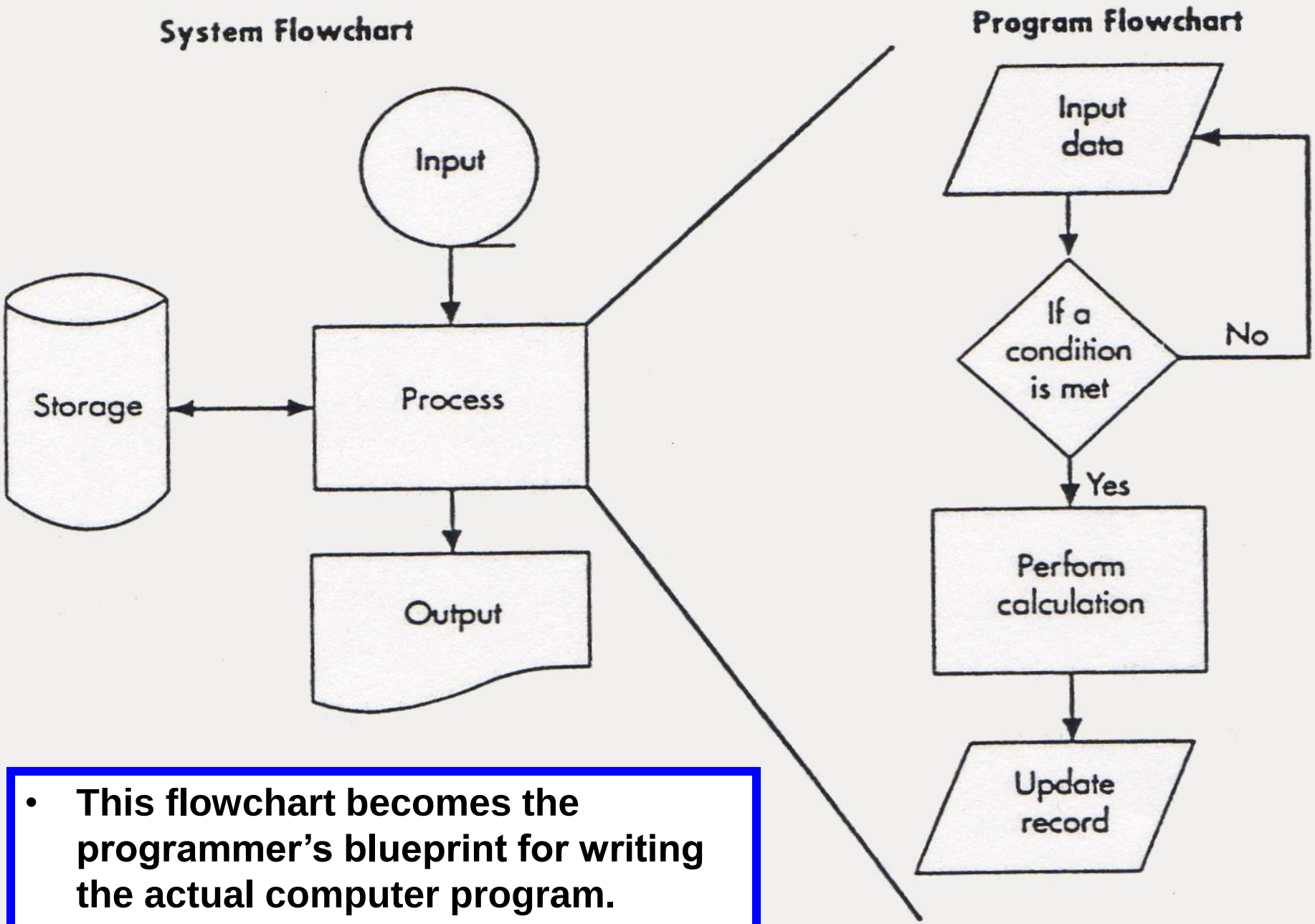
- Cashier enters the sales data into the sales terminal and prints a customer receipt. All sales data will be stored in a sales data file on a disk.

Suggested Solution



PROGRAM FLOWCHARTS

- Program flowcharts illustrate the sequence of logical operations performed by a computer in executing a program.
- They also follow an input—process—output pattern.



- **This flowchart becomes the programmer's blueprint for writing the actual computer program.**

FLOWCHARTS VS. DFDs

- DFDs place a heavy emphasis on the logical aspects of a system.
- Flowcharts place more emphasis on the physical characteristics of the system.
- Changes in the physical characteristics of the process affects the flowchart but have little or no impact on the DFD.