

SYSTEMS ANALYSIS AND DESIGN

Systems Development Life Cycle (SDLC)



**CENTRAL
UNIVERSITY**

FAITH • INTEGRITY • EXCELLENCE

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Presentation Content

➤ *SDLC – Requirements Determination*

- *Major Activities in requirement Determination*
- *Information Gathering Techniques*
 - Interviewing
 - Questionnaires
 - Review of Records, Procedures, and Forms
 - Observation
 - Secondary Research or Background Reading

➤ *Tools Used In System Requirements & Design*

- *Structured Analysis Tools*
 - Data Flow Diagrams
 - Data Dictionary
 - Decision Trees
 - Decision Tables
 - Structured English
 - Pseudocode



SDLC - Requirements

What is Requirements Determination?

- A requirement is a vital feature of a new system which may include processing or capturing of data, controlling the activities of business, producing information and supporting the management.
- Requirements determination involves studying the existing system and gathering details to find out what are the requirements, how it works, and where improvements should be made.



SDLC - Requirements

Major Activities in requirement Determination

❑ Requirements Anticipation

- *It predicts the characteristics of system based on previous experience which include certain problems or features and requirements for a new system.*
- *It can lead to analysis of areas that would otherwise go unnoticed by inexperienced analyst.*

❑ Requirements Investigation

- *It is studying the current system and documenting its features for further analysis.*
- *It is at the heart of system analysis where analyst documenting and describing system features using fact-finding techniques, prototyping, and computer assisted tools.*

❑ Requirements Specifications

- *It includes the analysis of data which determine the requirement specification, description of features for new system, and specifying what information requirements will be provided.*
- *It includes analysis of factual data, identification of essential requirements, and selection of Requirement-fulfillment strategies.*

SDLC - Requirements

Information Gathering Techniques

- The main aim of fact finding techniques is to determine the information requirements of an organization used by analysts to prepare a precise **SRS** understood by user.

There are various information gathering techniques –

- *Interviewing*
- *Questionnaires*
- *Review of Records, Procedures, and Forms*
- *Observation*
- *Secondary Research or Background Reading*

SDLC - Requirements

□ Interviewing

- Systems analyst collects information from individuals or groups by interviewing. The analyst can be formal, legalistic, play politics, or be informal; as the success of an interview depends on the skill of analyst as interviewer.
 - **Unstructured Interview** – The system analyst conducts question-answer session to acquire basic information of the system.
 - **Structured Interview** – It has standard questions which user need to respond in either close (objective) or open (descriptive) format.

□ Advantages of Interviewing

- *This method is frequently the best source of gathering qualitative information.*
- *It is useful for them, who do not communicate effectively in writing or who may not have the time to complete questionnaire.*
- *Information can easily be validated and cross checked immediately.*
- *It can handle the complex subjects.*
- *It is easy to discover key problem by seeking opinions.*
- *It bridges the gaps in the areas of misunderstandings and minimizes future problems*

SDLC - Requirements

Questionnaires

- This method is used by analyst to gather information about various issues of system from large number of persons.

There are two types of questionnaires –

- **Open-ended Questionnaires** – *It consists of questions that can be easily and correctly interpreted. They can explore a problem and lead to a specific direction of answer.*
- **Closed-ended Questionnaires** – *It consists of questions that are used when the systems analyst effectively lists all possible responses, which are mutually exclusive.*

Advantages of questionnaires

- *It is very effective in surveying interests, attitudes, feelings, and beliefs of users which are not co-located.*
- *It is useful in situation to know what proportion of a given group approves or disapproves of a particular feature of the proposed system.*
- *It is useful to determine the overall opinion before giving any specific direction to the system project.*
- *It is more reliable and provides high confidentiality of honest responses.*
- *It is appropriate for electing factual information and for statistical data collection which can be emailed and sent by post.*



Information Gathering Techniques - Advantages

Interviewing

- This method is frequently the best source of gathering qualitative information.
- It is useful for them, who do not communicate effectively in writing or who may not have the time to complete questionnaire.
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SDLC - Requirements

□ Review of Records, Procedures, and Forms

- Review of existing records, procedures, and forms helps to seek insight into a system which describes the current system capabilities, its operations, or activities.

• Advantages

- *It helps user to gain some knowledge about the organization or operations by themselves before they impose upon others.*
- *It helps in documenting current operations within short span of time as the procedure manuals and forms describe the format and functions of present system.*
- *It can provide a clear understanding about the transactions that are handled in the organization, identifying input for processing, and evaluating performance.*
- *It can help an analyst to understand the system in terms of the operations that must be supported.*
- *It describes the problem, its affected parts, and the proposed solution.*



SDLC - Requirements

□ Observation

- This is a method of gathering information by noticing and observing the people, events, and objects.
- The analyst visits the organization to observe the working of current system and understands the requirements of the system.

• Advantages

- *It is a direct method for gleaning information.*
- *It is useful in situation where authenticity of data collected is in question or when complexity of certain aspects of system prevents clear explanation by end-users.*
- *It produces more accurate and reliable data.*
- *It produces all the aspect of documentation that are ¹⁰ incomplete and outdated.*



SDLC - Requirements

❑ Secondary Research or Background Reading

- This method is widely used for information gathering by accessing the gleaned information.
- It includes any previously gathered information used by the marketer from any internal or external source.

• Advantages

- *It is more openly accessed with the availability of internet.*
- *It provides valuable information with low cost and time.*
- *It act as forerunner to primary research and aligns the focus of primary research.*
- *It is used by the researcher to conclude if the research is worth it as it is available with procedures used and issues in collecting them.*



SDLC - Requirements

□ Feasibility Study

- It can be considered as preliminary investigation that helps the management to take decision about whether study of system should be feasible for development or not.
- *It identifies the possibility of improving an existing system, developing a new system, and produce refined estimates for further development of system.*
- *It is used to obtain the outline of the problem and decide whether feasible or appropriate solution exists or not.*
- *The main objective of a feasibility study is to acquire problem scope instead of solving the problem.*
- *The output of a feasibility study is a formal system proposal act as decision document which includes the complete nature and scope of the proposed system.*



SDLC - Requirements

□ Steps Involved in Feasibility Analysis

The following steps are to be followed while performing feasibility analysis –

- *Form a project team and appoint a project leader.*
- *Develop system flowcharts.*
- *Identify the deficiencies of current system and set goals.*
- *Enumerate the alternative solution or potential candidate system to meet goals.*
- *Determine the feasibility of each alternative such as technical feasibility, operational feasibility, etc.*
- *Weight the performance and cost effectiveness of each candidate system.*
- *Rank the other alternatives and select the best candidate system.*
- *Prepare a system proposal of final project directive to management for approval.*



SDLC - Requirements

Types of Feasibilities

- Economic Feasibility
- Technical Feasibility
- Operational Feasibility
- Behavioral Feasibility
- Schedule Feasibility

Economic Feasibility

- It is evaluating the effectiveness of candidate system by using cost/benefit analysis method.
- The main aim of Economic Feasibility Analysis (EFS) is to estimate the economic requirements of candidate system before investments funds are committed to proposal.

Technical Feasibility

- It analyzes and determines whether the solution can be supported by existing technology or not.
- The analyst determines whether current technical resources be upgraded or added it that fulfill the new requirements.



❑ ***Operational Feasibility***

- It ensures that the management should support the proposed system and its working feasible in the current organizational environment.
- It analyzes whether the users will be affected and they accept the modified or new business methods that affect the possible system benefits.
- It also ensures that the computer resources and network architecture of candidate system are workable.

❑ ***Behavioral Feasibility***

- It evaluates and estimates the user attitude or behavior towards the development of new system.
- It helps in determining if the system requires special effort to educate, retrain, transfer, and changes in employee's job status on new ways of conducting business.

❑ ***Schedule Feasibility***

- It ensures that the project should be completed within given time constraint or schedule.
- It also verifies and validates whether the deadlines of project are reasonable or not.

Analysis

What is Structured Analysis?

- Structured Analysis is a development method that allows the analyst to understand the system and its activities in a logical way.
- It is a systematic approach, which uses graphical tools that analyze and refine the objectives of an existing system and develop a new system specification which can be easily understandable by user.

It has following attributes –

- It is graphic which specifies the presentation of application.
- It divides the processes so that it gives a clear picture of system flow.
- It is logical rather than physical i.e., the elements of system do not depend on vendor or hardware.
- It is an approach that works from high-level overviews to lower-level details.



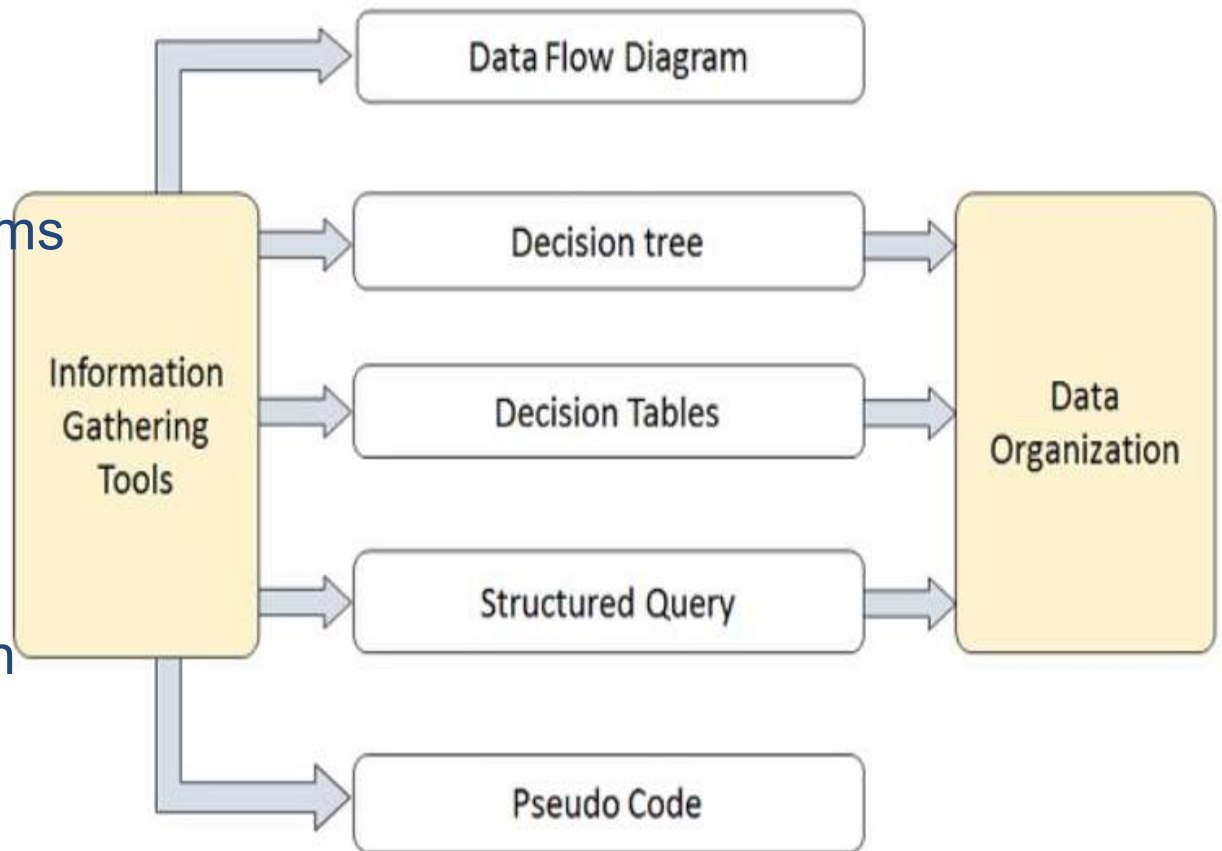
TOOLS USED IN SYSTEM REQUIREMENTS & DESIGN

Structured Analysis Tools

During Structured Analysis, various tools and techniques are used for system development.

They are –

- Data Flow Diagrams
- Data Dictionary
- Decision Trees
- Decision Tables
- Structured English
- Pseudocode



DATA FLOW DIAGRAM (DFD)

- ❑ A data flow diagram shows how data is processed within a system based on inputs and outputs.
- ❑ Visual symbols are used to represent the flow of information, data sources and destinations, and where data is stored.
 - ❑ *It is a technique developed by Larry Constantine to express the requirements of system in a graphical form.*
- ❑ They can be understood by users and are less prone to misunderstanding than textual descriptions.
- ❑ It gives an overview of what data a system processes, what transformations are performed, what data are stored, what results are produced and where they flow.
- ❑ It is an initial stage of design phase that functionally divides the requirement specifications down to the lowest level of detail.
 - ❑ *Data Flow Diagrams (DFD) also known as Bubble Chart*



DATA FLOW DIAGRAM COMPONENTS:

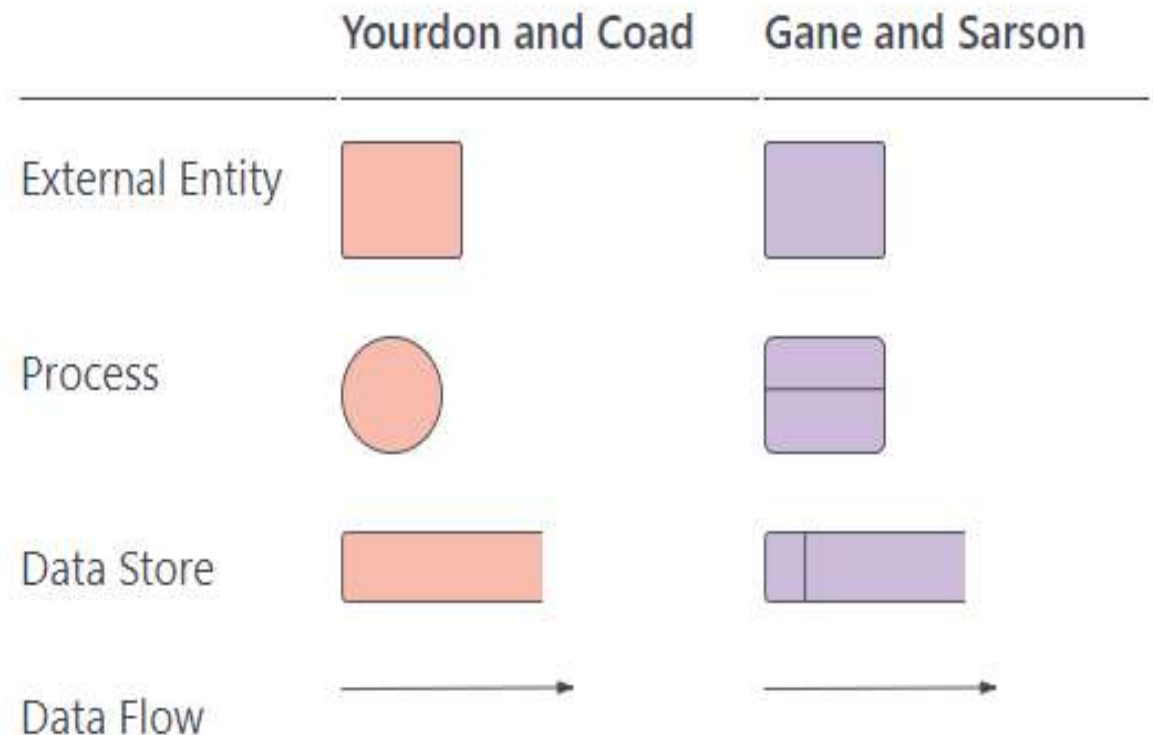
DFD are constructed using form major component:-

- External entities.

- Processes

- Data store

- Data flows







- the two main types of notation used for data flow diagrams are both named after their creators



TOOLS USED IN SYSTEM REQUIREMENTS & DESIGN

The following table shows the symbols used in designing a DFD and their significance –

Symbol Name	Symbol	Meaning
Square		Source or Destination of Data
Arrow		Data flow
Circle		Process transforming data flow
Open Rectangle		Data Store

DATA FLOW DIAGRAM COMPONENTS:

- **External entities** - represent the sources of data that enter the system or the recipient of data that leaves the system.
 - *is a person, organization, organization unit, or system that is external to the system, but interacts with it.*
 - *Also known as actors, sources or sinks, and terminators, external entities produce and consume data that flows between the entity and the system being diagrammed.*
 - Examples are clerks who enter data into the system or customers who receive letters produced by the system.
 - customer, clearinghouse, government organization, accounting system).
 - *it is external to the system, but may or may not be part of the organization.*



DATA FLOW DIAGRAM COMPONENTS:

- **Data store:** is a collection of data that is stored in some way (which is determined later when creating the physical model).
 - *A data store does not generate any operations but simply holds data for later access.*
 - *Input flows to a data store include information or operations that change the stored data. Output flows would be data retrieved from the store.*
 - *Examples are computer files , database or in a manual system, paper files held in filing cabinets*
- Manual data stores are identified as the letter M followed by a number and identifiers for computerized stores are identified by a D.



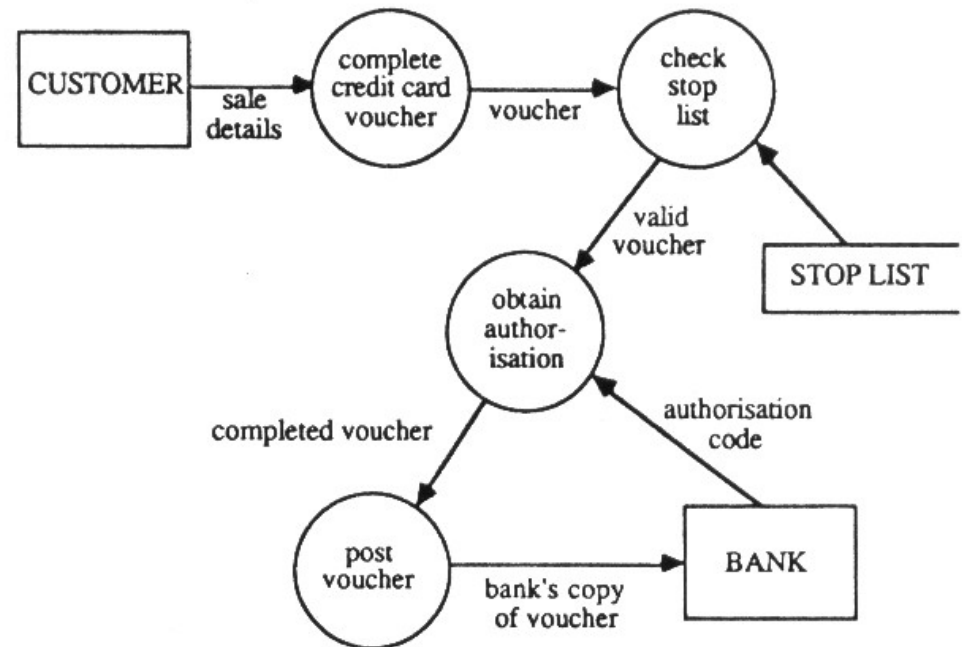
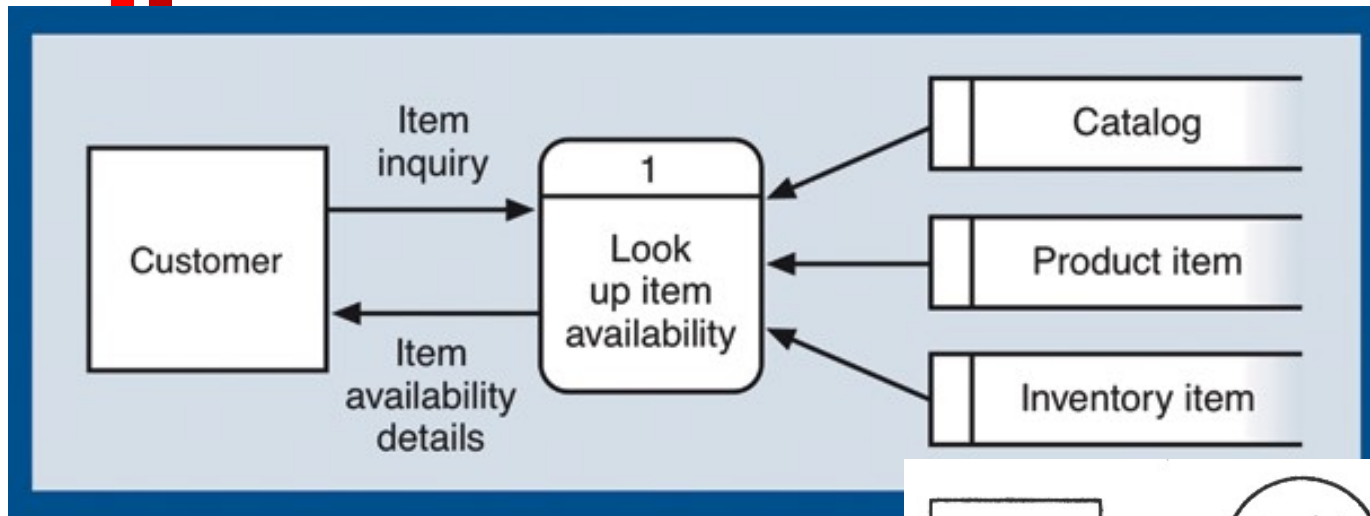
DATA FLOW DIAGRAM COMPONENTS:

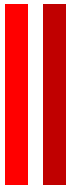
- **Process:** is an activity or a function that is performed for some specific business reason.
 - *An activity that changes or transforms data flows.*
 - *all processes must have inputs and outputs on a DFD.*
 - *Processes can be manual or computerized*
- **Data flows:** is a single piece of data (also called a data element), or a logical collection of several pieces of information (e.g., new chemical request)
 - *represents the movement of data between other components.*
 - *For example report produced by a process and sent to an external entity. They are shown as arrows connecting the other components of the diagram. Dataflows are generally shown as one way only. Data flows between external entities are shown as dotted lines.*



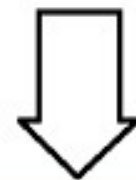
DATA FLOW DIAGRAM

- Tool that graphically shows flow of data in system

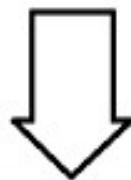




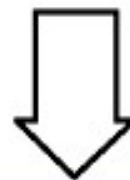
External agent, data flows, and the process come from information about the event in the event table



Source



Trigger



Activity

Data stores come from the entity-relationship diagram

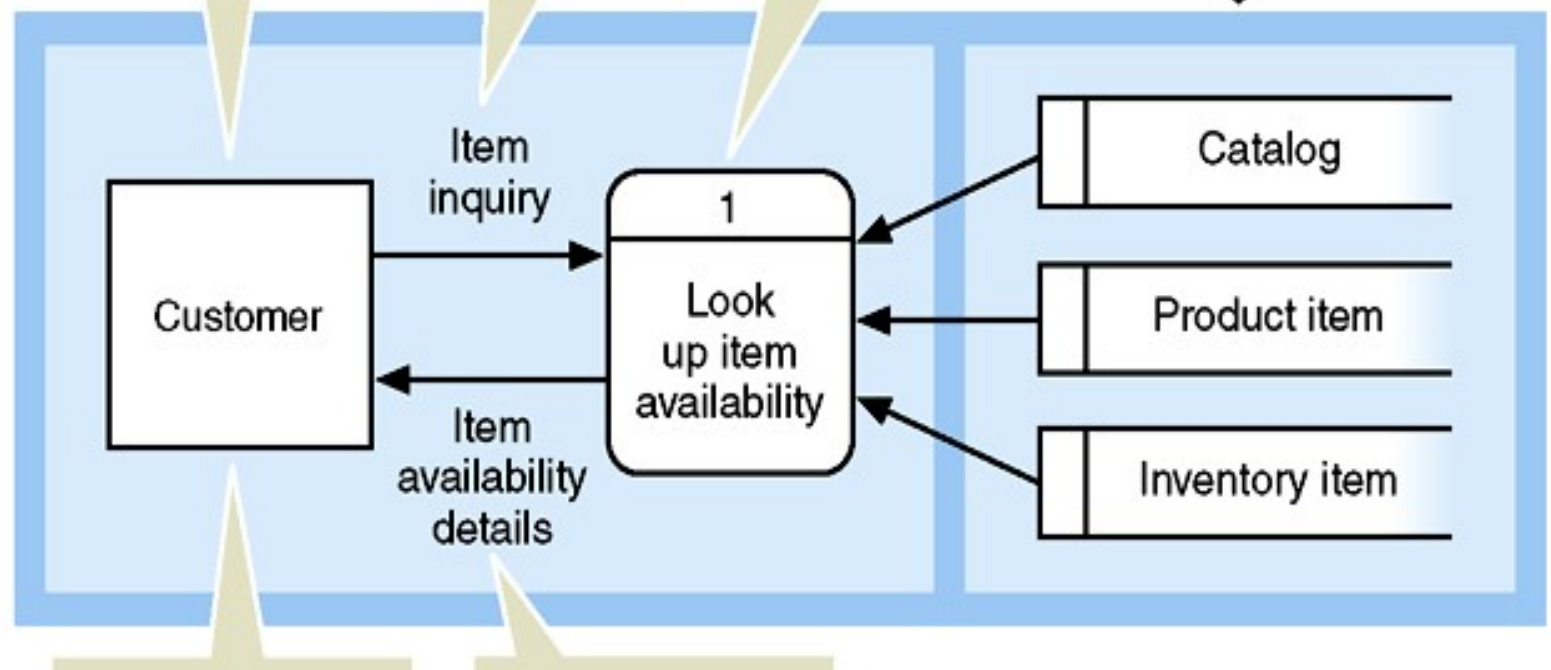
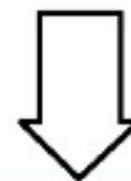
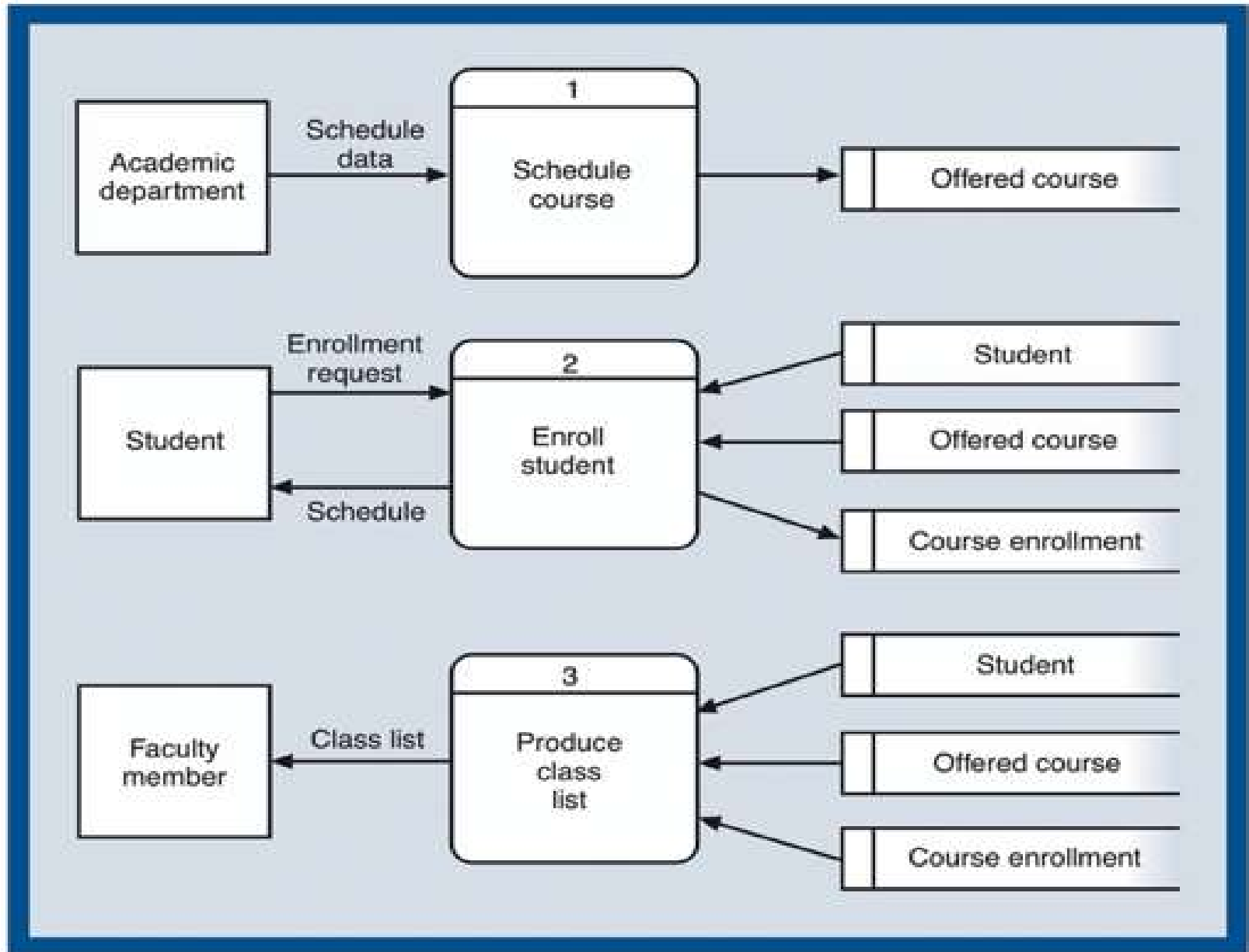


FIGURE 5-15 The complete event table for the RMO customer support system.

CUSTOMER SUPPORT SYSTEM EVENT TABLE					
Event	Trigger	Source	Activity/Use Case	Response	Destination
1. Customer wants to check item availability	Item inquiry	Customer	Look up item availability	Item availability details	Customer
2. Customer places an order	New Order	Customer	Create new order	Real-time link	Credit bureau
				Order confirmation	Customer
				Order details	Shipping
				Transaction	Bank
3. Customer changes or cancels order	Order change request	Customer	Update order	Change confirmation	Customer
				Order change details	Shipping
				Transaction	Bank
4. Time to produce order summary reports	"End of week, month, quarter and year"		Produce order summary reports	Order summary reports	Management

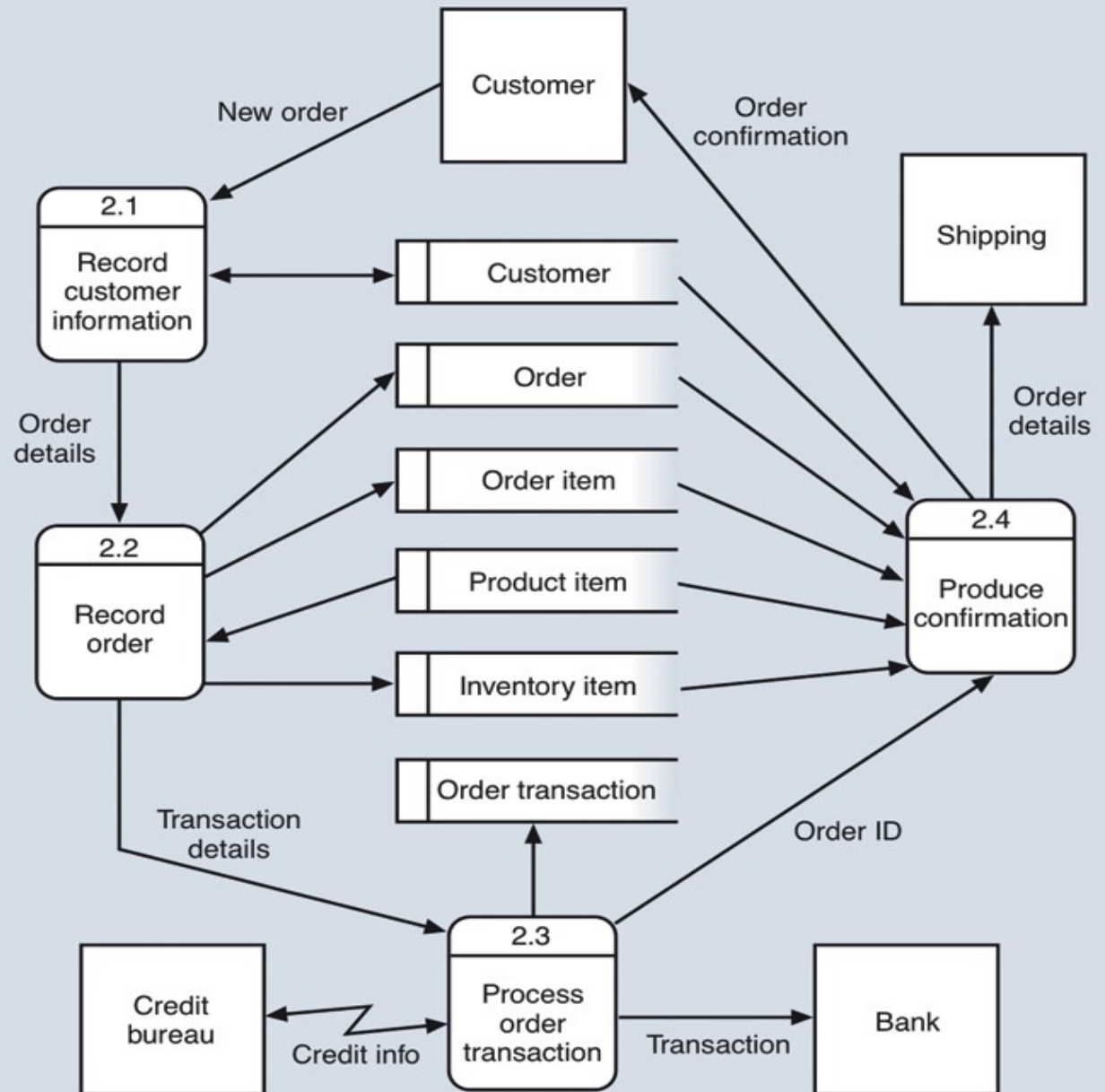
DATA FLOW DIAGRAM



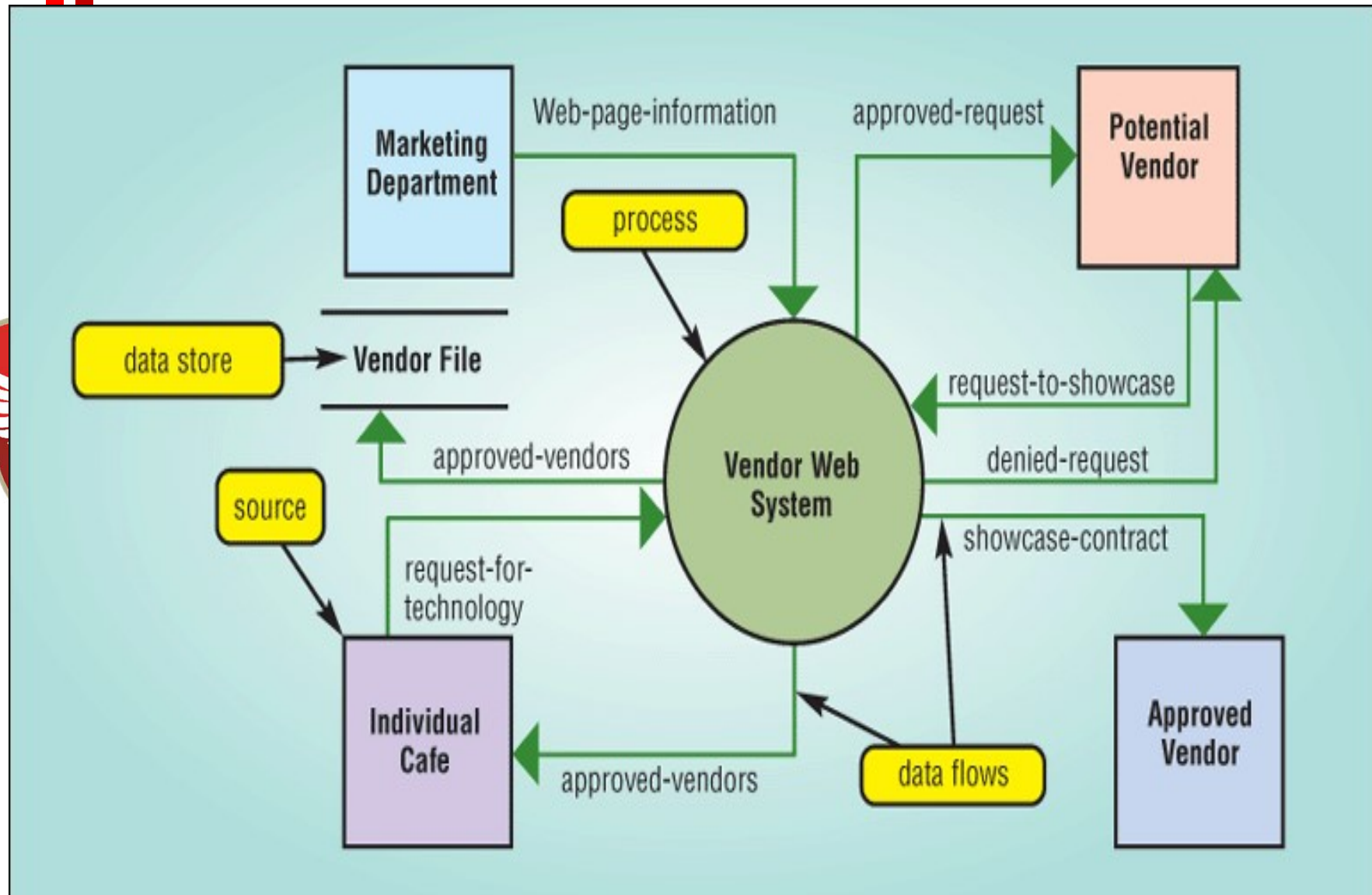
DATA FLOW DIAGRAM



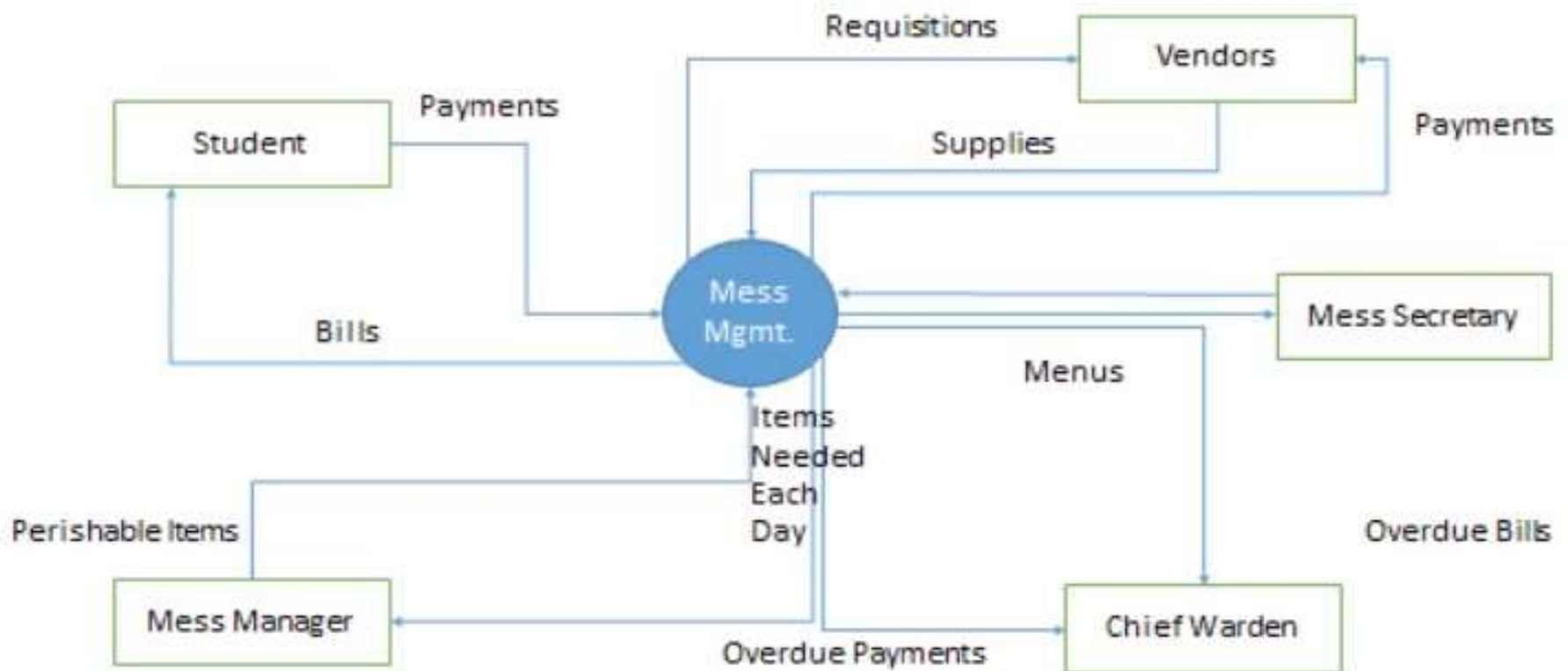
Diagram 2: Create new order



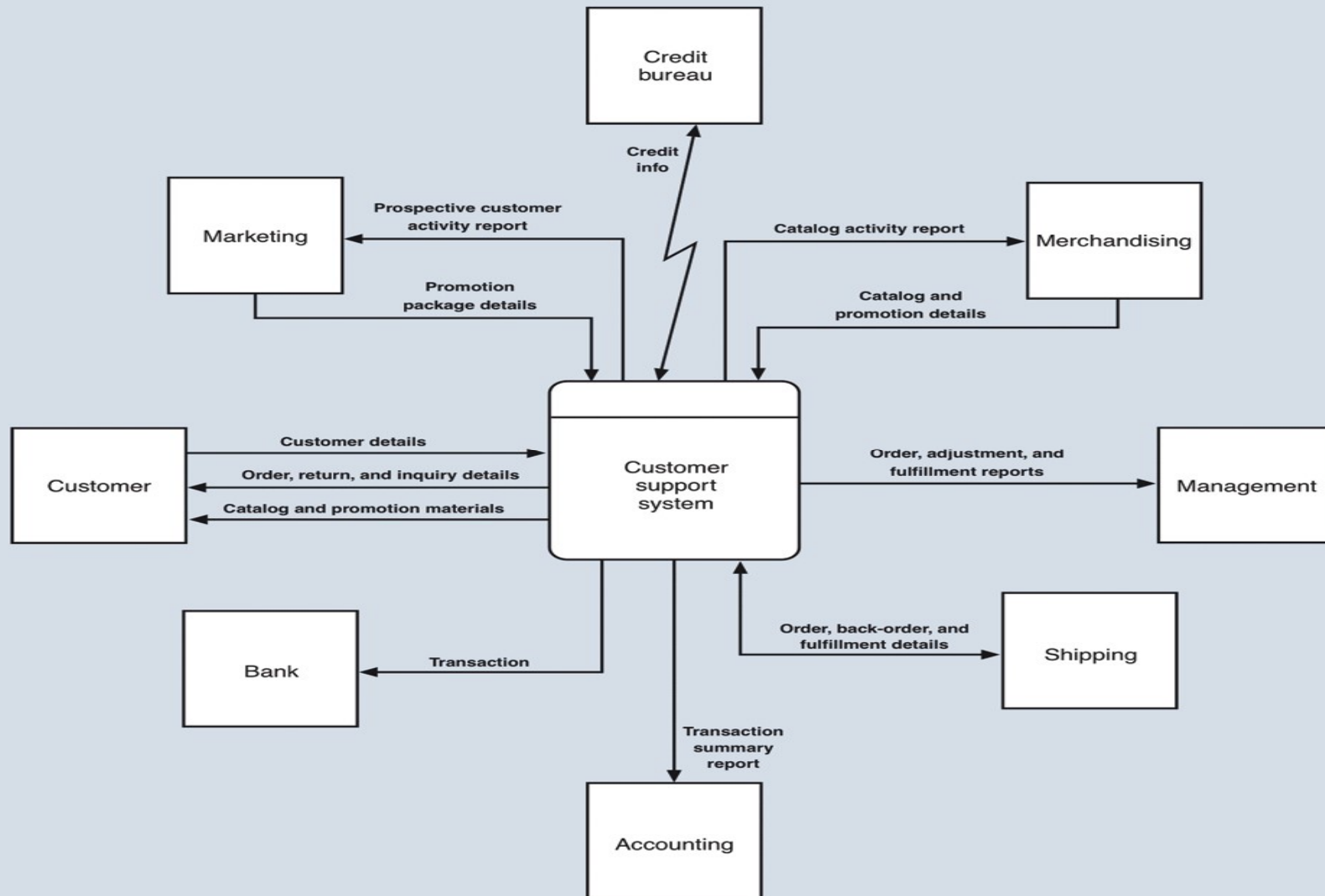
DATA FLOW DIAGRAM



TOOLS USED IN SYSTEM REQUIREMENTS & DESIGN



Context Diagram - Customer Support System



TOOLS USED IN SYSTEM REQUIREMENTS & DESIGN

Data Dictionary

- A data dictionary is a structured repository of data elements in the system. It stores the descriptions of all DFD data elements that is, details and definitions of data flows, data stores, data stored in data stores, and the processes.

Sr.No.	Data Name	Description	No. of Characters
1	ISBN	ISBN Number	10
2	TITLE	title	60
3	SUB	Book Subjects	80
4	ANAME	Author Name	15

Data Dictionaries (DD)

- Purpose:
 - *to keep data about:*
 - Data Flow and Data Item Specifications
 - File Specifications
 - Process Specifications
- Data Specification Language:
 - Notational Conventions: = , + , [] , { } , ()
 - e.g. amount due = [dollar amount, sterling amount]
- Process Specifications



Decision Tables

- Decision tables are a method of describing the complex logical relationship in a precise manner which is easily understandable.
- A tabular of conditions and actions and an indication under which conditions, which actions must be performed
 - *It is useful in situations where the resulting actions depend on the occurrence of one or several combinations of independent conditions.*
 - *It is a matrix containing row or columns for defining a problem and the actions.*
- **Advantages**
 - *Easily understood*
 - *Alternatives are shown side by side*
 - *Cause & effect relationship is shown, thus permitting easier user validation*
 - *Possible to check that all combinations of conditions have been considered*



Decision Tables

Components of a Decision Table - quadrants

- **Condition Stub** – It is in the upper left quadrant which lists all the condition to be checked.
- **Action Stub** – It is in the lower left quadrant which outlines all the action to be carried out to meet such condition.
- **Condition Entry** – It is in upper right quadrant which provides answers to questions asked in condition stub quadrant.
- **Action Entry** – It is in lower right quadrant which indicates the appropriate action resulting from the answers to the conditions in the condition entry quadrant.

Condition Stub

*a list of all possible conditions
that can arise within the process
possible*

Rules

*contains selectors which identify
different combinations of the
conditions*

Action Stub

*a list of all possible actions that
be occur within the process*

Action Entries

*indicators which select the actions to
performed*



Decision Tables

- The entries in decision table are given by Decision Rules which define the relationships between combinations of conditions and courses of action. In rules section

CONDITIONS	Rule 1	Rule 2	Rule 3	Rule 4
Advance payment made	Y	N	N	N
Purchase amount = Rs 10,000/-	-	Y	Y	N
Regular Customer	-	Y	N	-
ACTIONS				
Give 5% discount	X	X	-	-
Give no discount	-	-	X	X
CONDITIONS	Rule 1	Rule 2	Rule 3	Rule 4

Decision Tables

Can summarize complex decision logic better than structured English

Incorporate logic into the table structure to make descriptions more readable

YTD purchases > \$250	YES						NO					
Number of Items (N)	N ≤ 3			N ≥ 4			N ≤ 3			N ≥ 4		
Delivery Day	Next	2nd	7th	Next	2nd	7th	Next	2nd	7th	Next	2nd	7th
Shipping Charge (\$)	25	10	N*1.50	N*6.00	N*2.50	Free	35	15	10	N*7.50	N*3.50	N*2.50

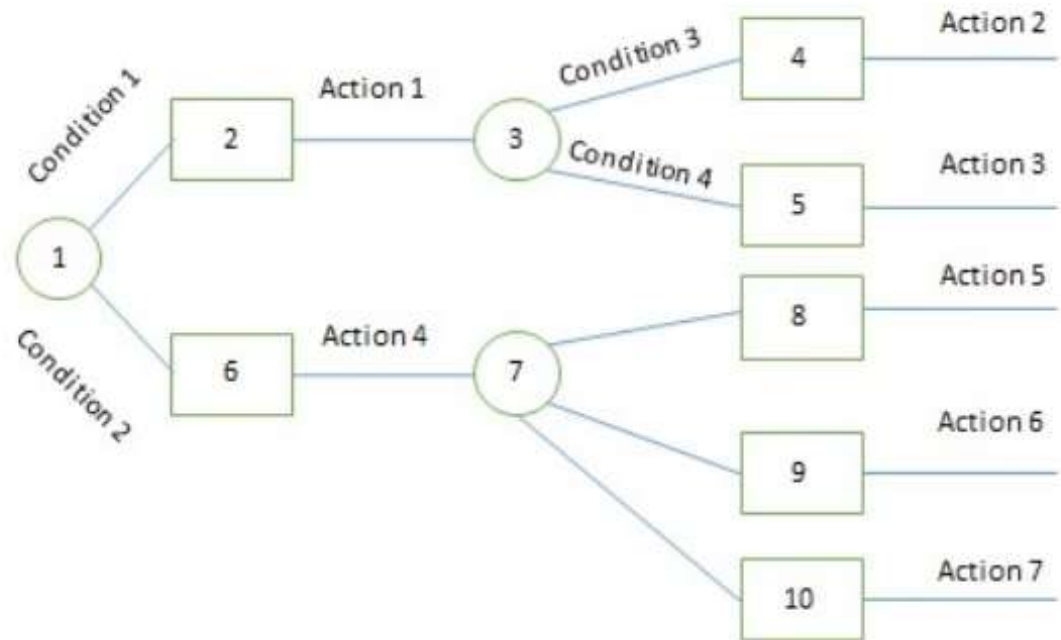
Decision Trees

- Decision trees are a method for defining complex relationships by describing decisions and avoiding the problems in communication.
 - A decision tree is a diagram that shows alternative actions and conditions within horizontal tree framework.
 - *Thus, it depicts which conditions to consider first, second, and so on.*
 - Decision trees depict the relationship of each condition and their permissible actions. A square node indicates an action and a circle indicates a condition. It forces analysts to consider the sequence of decisions and identifies the actual decision that must be made.
 - *Alternative to Decision Tables*
 - *Employ tree structures which show conditions and actions within a problem*
- *Advantage:*
- Easy to understand, no need for special training
 - *Root of tree -> name of process*
 - *Nodes -> conditions*
 - *Leaves -> actions to be performed*

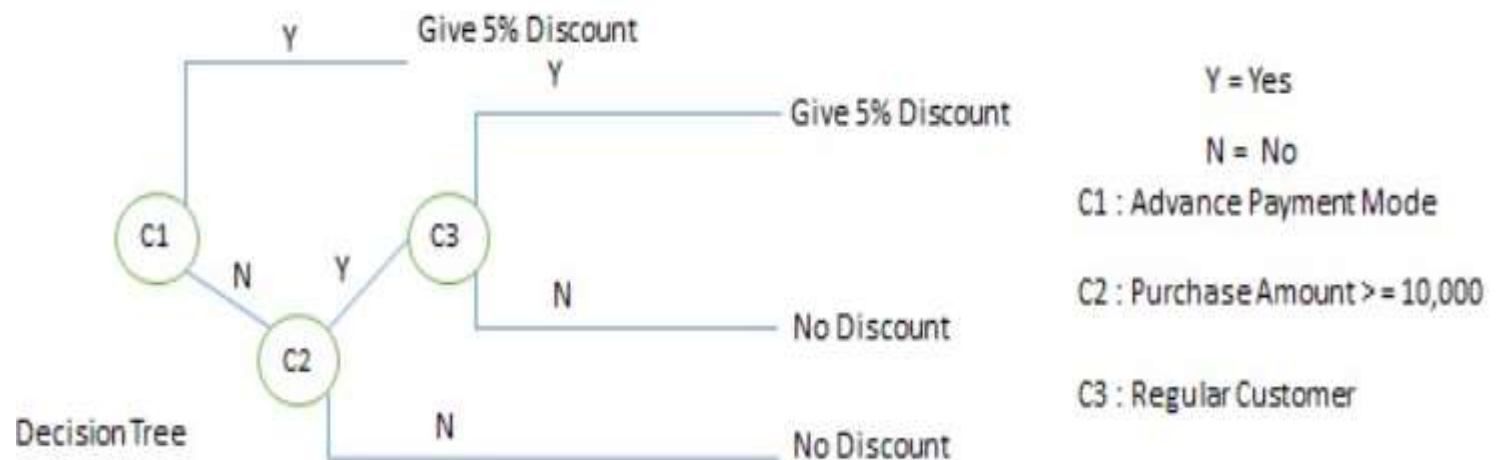


Decision Tree Example

The major limitation of a decision tree is that it lacks information in its format to describe what other combinations of conditions you can take for testing. It is a single representation of the relationships between conditions and actions.



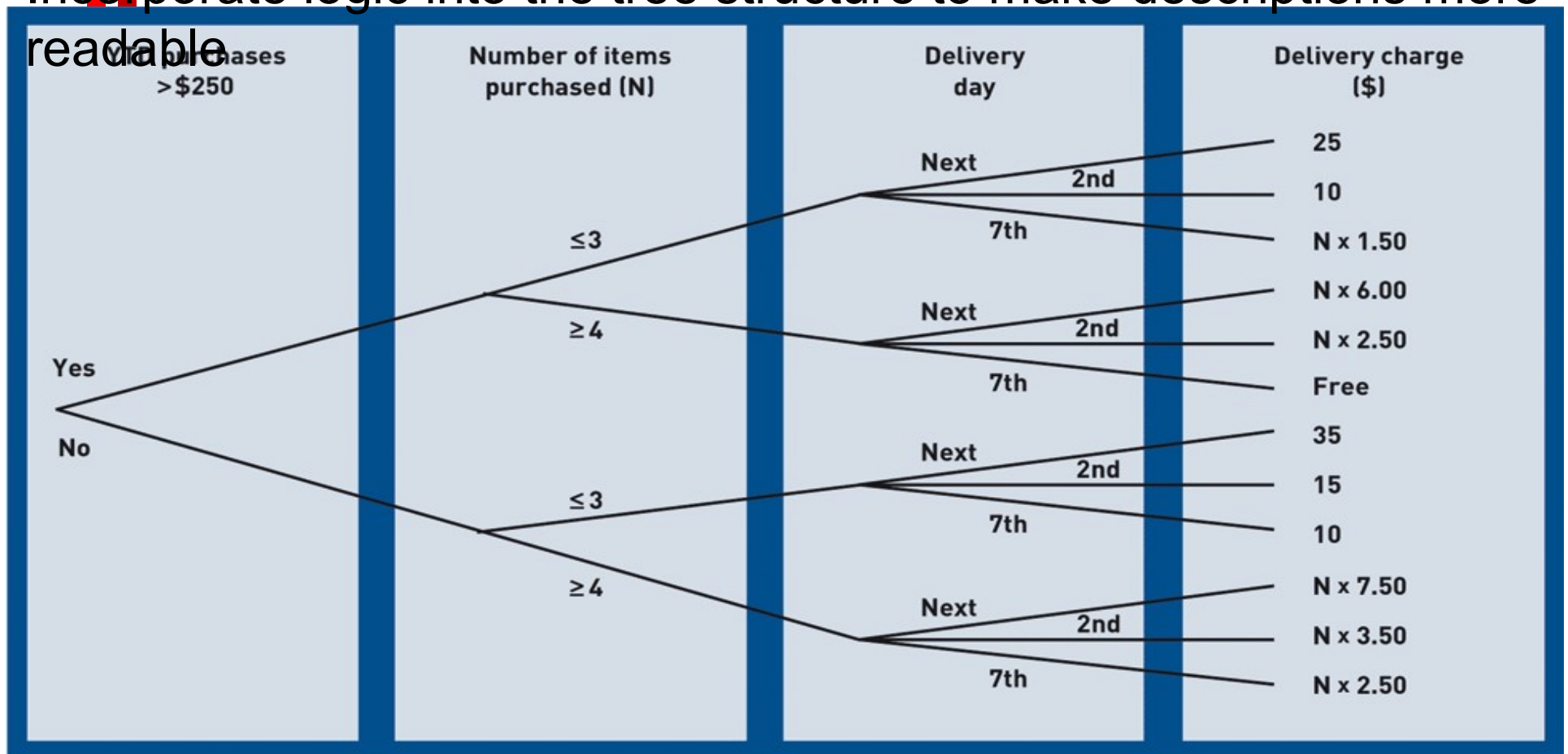
For example, refer the following decision tree



Decision Tree for Calculating Shipping Charges

Can summarize complex decision logic better than structured English

Incorporate logic into the tree structure to make descriptions more readable



Structured English

- Structure English is derived from structured programming language which gives more understandable and precise description of process.
- It is based on procedural logic that uses construction and imperative sentences designed to perform operation for action.
- *Result: A language containing a limited set of conditional and logic statements with nouns and strong verbs*
- **A rigid subset of the English language** omitting adjectives, adverbs, compound and complex sentences, all verb modes except imperative and most punctuation

Structured English

- It is best used when sequences and loops in a program must be considered and the problem needs sequences of actions with decisions.
- It does not have strict syntax rule. It expresses all logic in terms of sequential decision structures and iterations.
- Possesses the three standard control constructs of:
 - sequence
 - selection
 - iteration

These constructs permit the specification of any

Structured English (cont.)

Control Constructs

- **Sequences:** represent actions taking place in sequence without interruption. They are defined by the successive appearance of a set of primitive actions
- **Selections:** describe a series of alternative policies from which only one is selected



IF *<condition>*
 <statement>

ELSE

<statement>

CASE

WHEN <condition> <statements>

WHEN <condition> <statements>

... ..

- **Iterations:** A policy or series of actions is repeated within some bounds. Represented by *DO...WHILE* construct or a *REPEAT ... UNTIL* construct

Structured English

For example, see the following sequence of actions –

```
if customer pays advance
  then
    Give 5% Discount
  else
    if purchase amount >=10,000
      then
        if the customer is a regular customer
          then Give 5% Discount
          else No Discount
        end if
      else No Discount
    end if
  end if
end if
```

Structured English (cont.)

Total_charge = 0

REPEAT

get_next_room

IF room_type = 'EXECUTIVE'

total_charge = total_charge + 60

ELSE

total_charge = total_charge + 35

UNTIL all_booked_rooms_processed

OR total_charge > credit_limit

- Conditional statement: IF-THEN example

BEGIN IF

IF Customer Age > 65

THEN Billing Rate = Senior Citizen Rate

ELSE Billing Rate = Standard Rate

END-IF

- Conditional statement: SELECT CASE example

SELECT CASE

CASE 1 (State = "AZ")

Sales Tax = 0.075

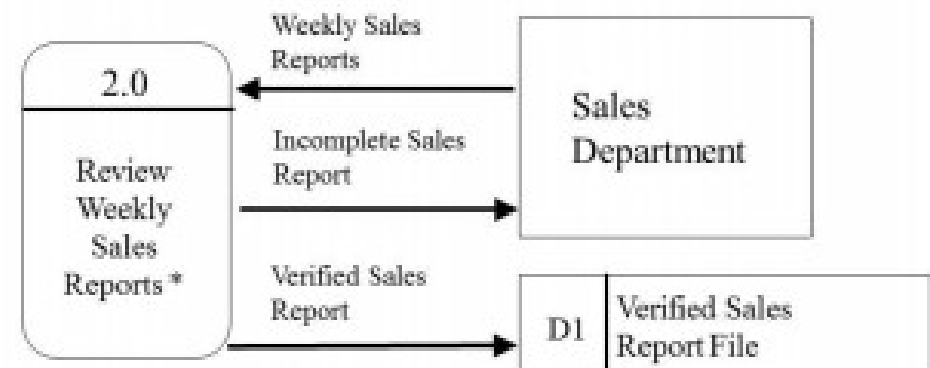
CASE 2 (State = "CA")

Sales Tax = 0.05

END-CASE



Structured English (cont.)



- Repetition: DO-WHILE example

RECEIVE Weekly Sales Reports from Sales Department

DO WHILE there are Sales Reports to process

BEGIN IF

IF Sales Report has a value for each required element in data structure

THEN Verification Code = "Complete"

Verified Sales Report = Sales Report + Verification Code
+ Review Date + Reviewer Name

STORE Verified Sales Report in Verified Sales Report File

ELSE Verification Code = "Not Complete"

Incomplete Sales Report = Sales Report + Verification Code
+ Review Date + Reviewer Name + Reviewer Comment

SEND Incomplete Sales Report to Sales Department

END-IF

END-DO WHILE



Structured English (cont.)

Advantages:

- concise and precise, allow easy reading without ambiguity & misunderstanding
- language notation may be tailored to suit user
- must exist a cross-referencing with any dfd & dd entries thus permitting thorough verification

Disadvantages:

- formality may be alien when first read or write

Avoid assuming that anything written in SE is correct



Pseudocode

- A pseudocode does not conform to any programming language and expresses logic in plain English.
- It may specify the physical programming logic without actual coding during and after the physical design.
- It is used in conjunction with structured programming.
- It replaces the flowcharts of a program.



Guidelines for Selecting Appropriate Tools

- Use the following guidelines for selecting the most appropriate tool that would suit your requirements –
- Use DFD at high or low level analysis for providing good system documentations.
- Use data dictionary to simplify the structure for meeting the data requirement of the system.
- Use structured English if there are many loops and actions are complex.
- Use decision tables when there are a large number of conditions to check and logic is complex.
- Use decision trees when sequencing of conditions is important and if there are few conditions to be tested.

Assignment



- Compare and contrast the role of the systems analyst, business analyst, and infrastructure analyst in a systems development team.
- Explain the SDLC phases in one of the following system for GIMPA:
 - *Student Management System, Staff Management System, Logistics Management System, Transport Management System, Library Management System*



➤ Requirements

- Give your system a befitted Title
- The selected system must be documented based on the SDLC phases
- Hard copy and softcopy should be presented

