



HNDIT2032 System Analysis and Design

Week 9: Requirement Modeling (Traditional Approach)

Lesson outline

- At the end of this lesson student will learn about the difference between two analysis techniques called Structured SAD and Object Oriented Analysis and Design.
- Todays lesson
 - Introduction to structured analysis
 - Data Flow diagram

Introduction

- System development is done in many ways, and this diversity can confuse new system developers. Sometimes, it seems as if every company uses its own methodology.
- All system developers should be familiar with two very general approaches to software construction and modeling because these form the basis of virtually all methodologies
 - structured approach
 - object-oriented approach.
- This section reviews the major characteristics of both approaches and provides a bit of history.

Structured Approach

- Structured System Development Structured analysis, structured design, and structured programming are the three techniques that make up the structured approach.
- Also called structured analysis and design technique (SADT).

Structured Analysis

- The structured analysis technique helps the developer define
 - what the system needs to do the processing requirements)
 - what data the system needs to store and use (data requirements)
 - what inputs and outputs are needed
 - and how the functions work together to accomplish tasks.
- This includes graphically representing system data and processes using traditional structured analysis techniques.
- The key graphical model of the system requirements that are used with structured analysis is called the data flow diagram (DFD)

Object Oriented approach

- An entirely different approach to information systems the object-oriented approach views an information system as a collection of interacting objects that work together to accomplish tasks.
- An object is a thing in the computer system that is capable of responding to messages.
- Object-oriented analysis (OOA) defines the objects that do the work and determines what user interactions (called use cases) are required to complete the tasks.

DATA FLOW MODELING

Data Flow Diagram

- Systems Analysts use many graphical techniques to describe an information system. One popular method is to draw a set of Data Flow Diagrams **(DFD)**.
- A data flow diagram (DFD) uses various symbols to show how the system transforms input data into useful information.
- DFD shows how data flows within an information system.
- It is important to note that DFDs does not show program logic or processing steps in the information system.
- A set of DFDs presents a logical representation that shows what the system does, without discussion how it does it.

DFD cont....

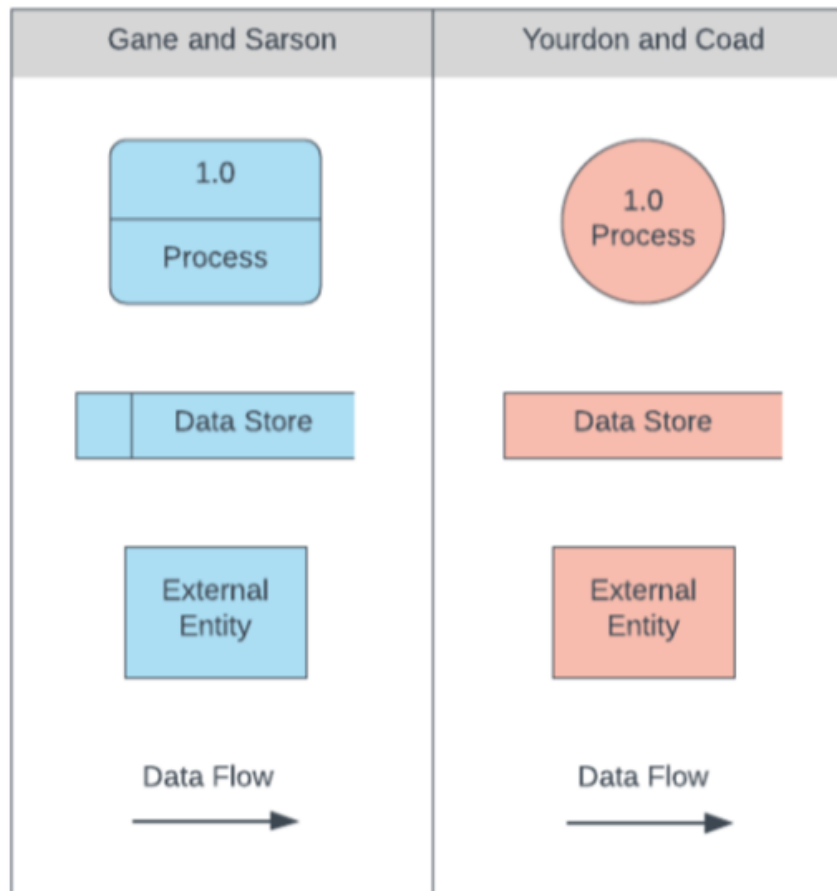
- DFDs are easier to understand by technical and nontechnical audiences
- DFDs can provide a high-level system overview, complete with boundaries and connections to other systems
- DFDs can provide a detailed representation of system components

DFD cont..

- DFDs represent the following:
 - External devices sending and receiving data
 - Processes that change that data
 - Data flows themselves
 - Data storage locations



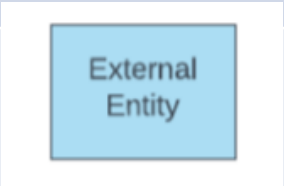
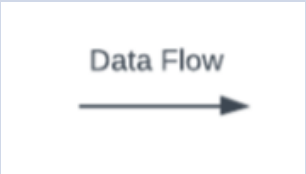
DFD Symbols cont..

- Two types of symbols can be identified.

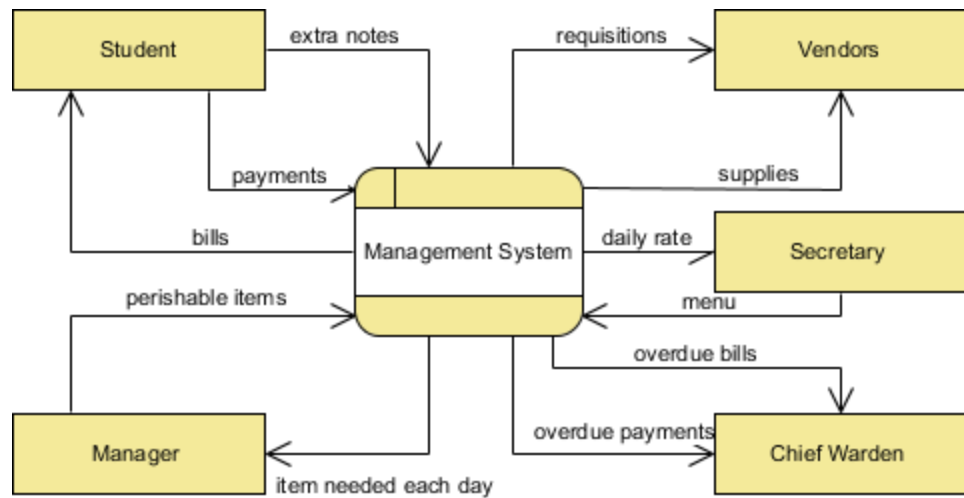
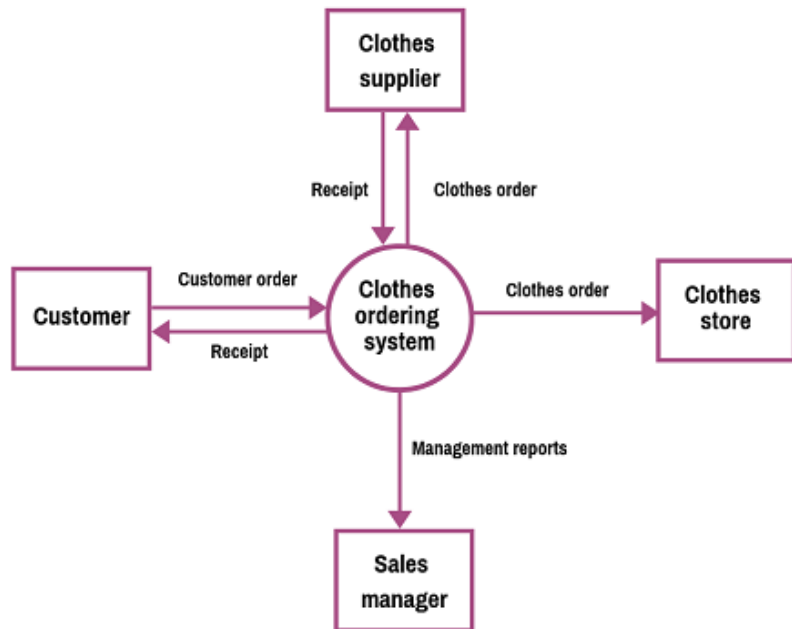


Data flow diagram symbols, symbol names, and examples of the Gane and Sarson and Yourdon symbol sets.

DFD Symbols

| Symbol | name | description |
|---|-----------------|--|
|  | Process | <p>The process is the action that transforms on data.</p> <p>For instance, performing computations, making decisions, or directing data flows based on business rules.</p> |
|  | | <p>That means a process receives input and generates some output</p> |
|  | Data source | <p>A data store is a place that a process stores data. Files and tables are example data stores.</p> |
|  | External Entity | <p>An entity is considered as the source or destination of data.</p> <p>Entities either produce data to the system (i.e., source) or accept data from it (i.e., sink)</p> |
| | Data flow | <p>Data flow is the movement of data between the entity, the process, and the data store</p> |

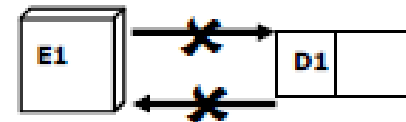
Example



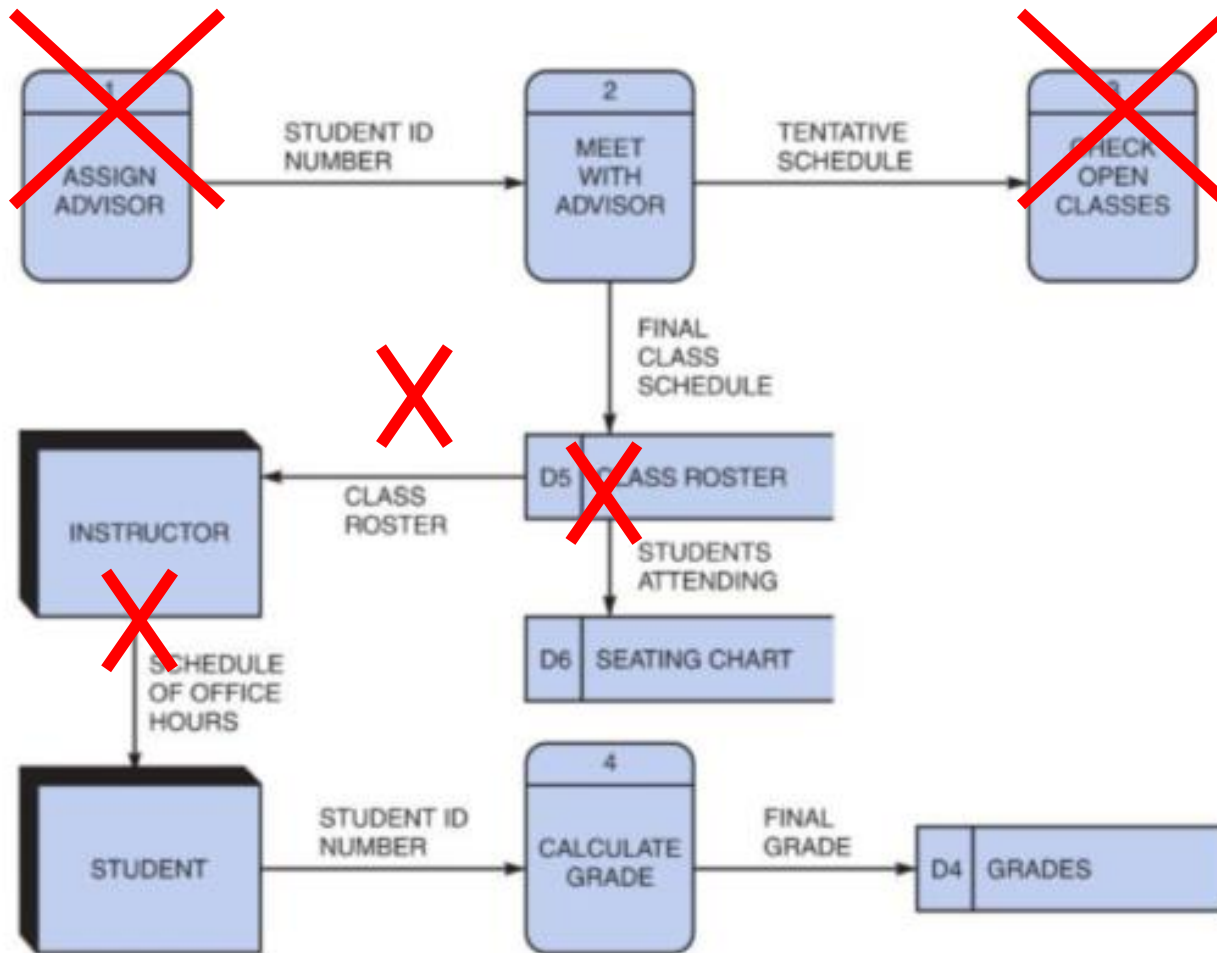
Rules to draw a DFD

- Process
 - No process can have only input
 - No process can have only output
 - Use verb-phrase label
- Data store
 - Always data should passes through a process
 - Use noun-phrase label
- source/sink
 - Always data should passes through a process
 - Use noun-phrase label
- Data flow
 - One can have only one direction
 - Noun-phrase label

Illegal Data Flows



Find the errors in following DFS?



DFD

- The DFD s are develop in levels.
- 3 common levels can be identified
 - Context diagram
 - Level 0 diagram
 - Level 1 diagram

Context Diagram

- It includes identifying things that are inside and outside of the system, and what is the relationship of the system with these external entities.
- It include
 - External entities
 - Data flow
 - System as a single process

Context Diagram cont..

Follow the steps when drawing a context diagram

1. Identify data-flows
2. Identify external entities by recognizing sources and recipients of the data-flows that lie outside of the system.
3. Draw a process box denoting the entire system.
4. Draw external entities around the process box.
5. Add the data-flows between the external entities and the system box

Example

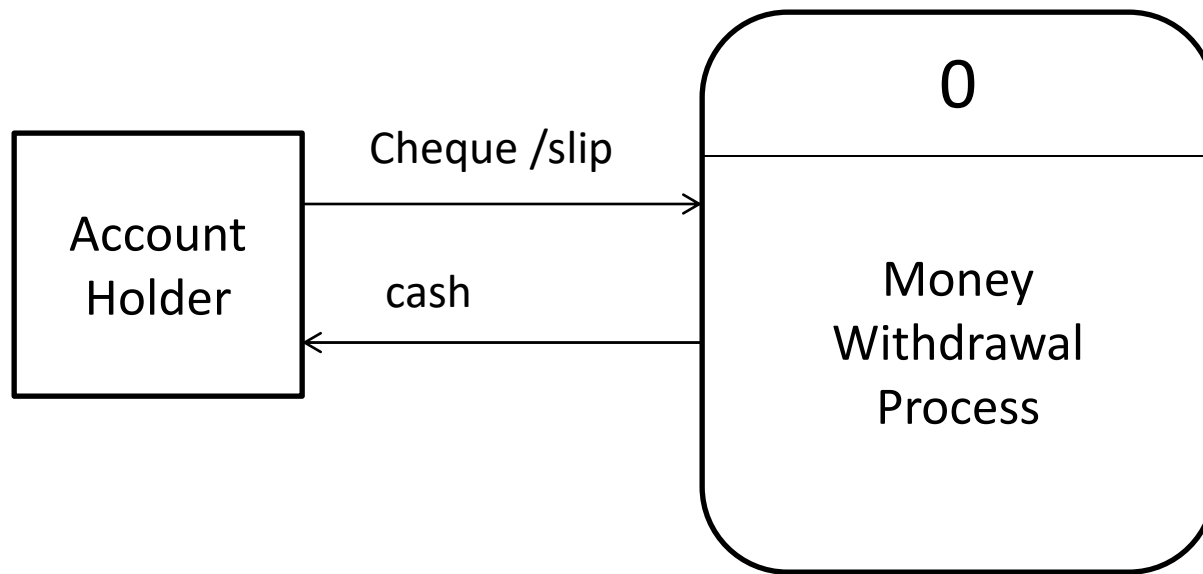
Consider a system in a bank whereby account holders get their withdrawals.

- Whenever an account holder wants to withdraw some cash, he/she presents a cheque or withdrawal slip.
- The account is checked for appropriate balance if balance exists the cash is paid and the account is updated.

Example

Consider a system in a bank whereby account holders get their withdrawals.

- Whenever an **account holder** wants to withdraw some cash, he/she presents a cheque or withdrawal slip.
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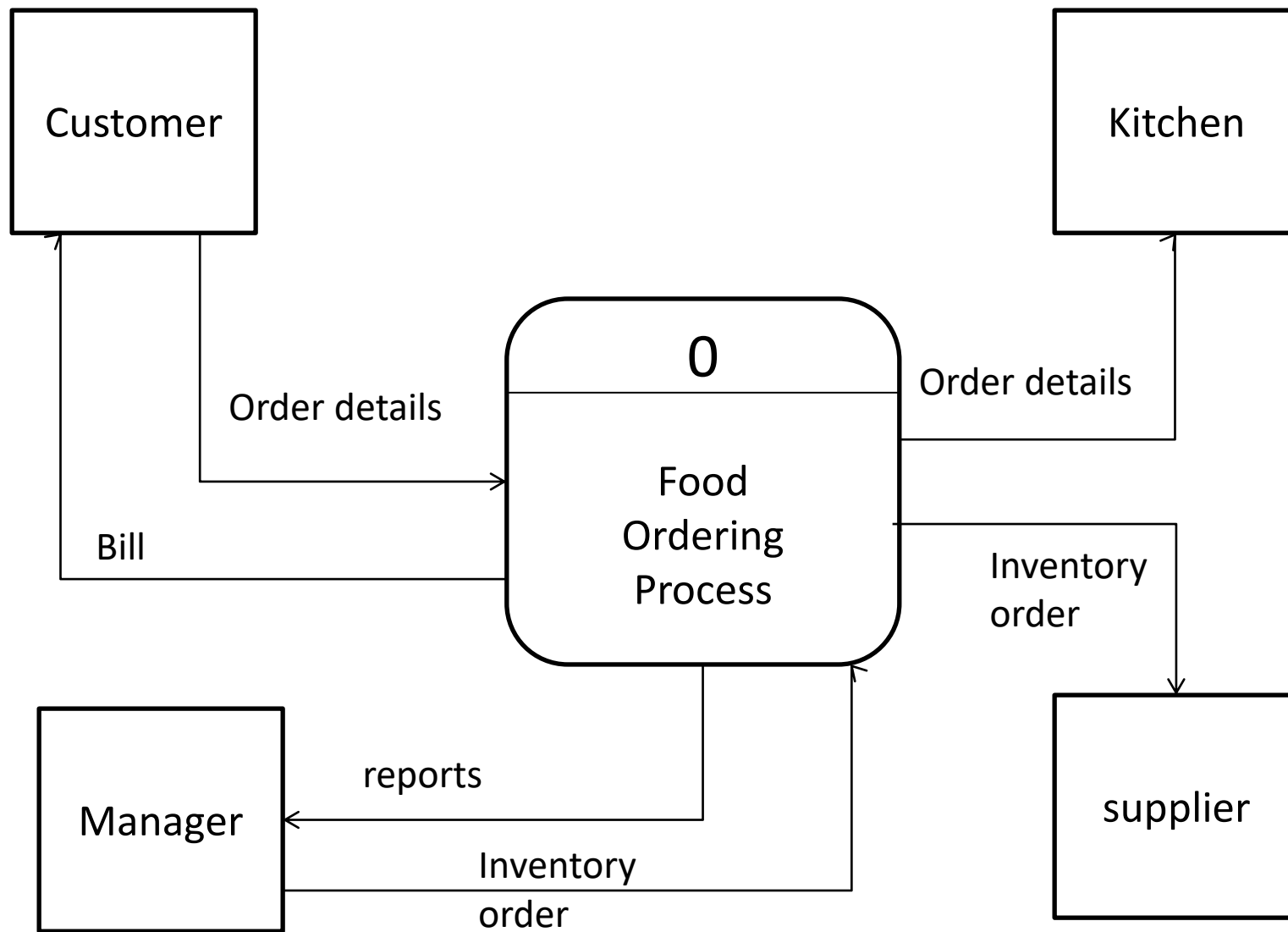


Example

- Draw the context diagram for the Food ordering system mentioned below.
 - Customer can place an order. System receives the order and forwards it to the kitchen, The process also deliver a bill to the customer.
 - Manager can receive reports .
 - Manager also make inventory order. The process forwards the inventory order to the supplier

Example

- Draw the context diagram for the Food ordering system mentioned below.
 - **Customer** can place an order. System receives the order and forwards it to the **kitchen**, The process also deliver a bill to the customer.
 - **Manager** can receive reports.
 - Manager also make inventory order. The process forwards the inventory order to the **supplier**

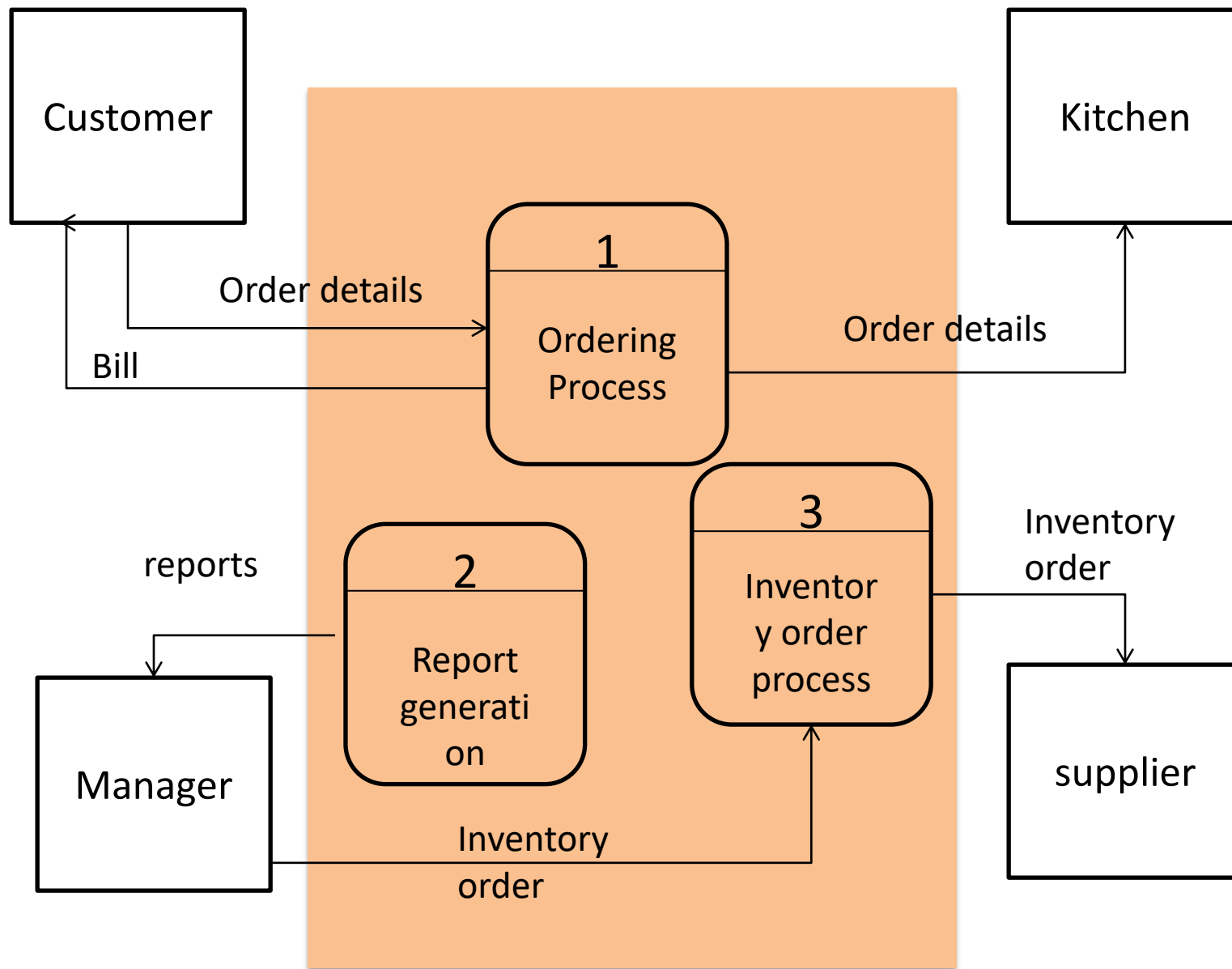


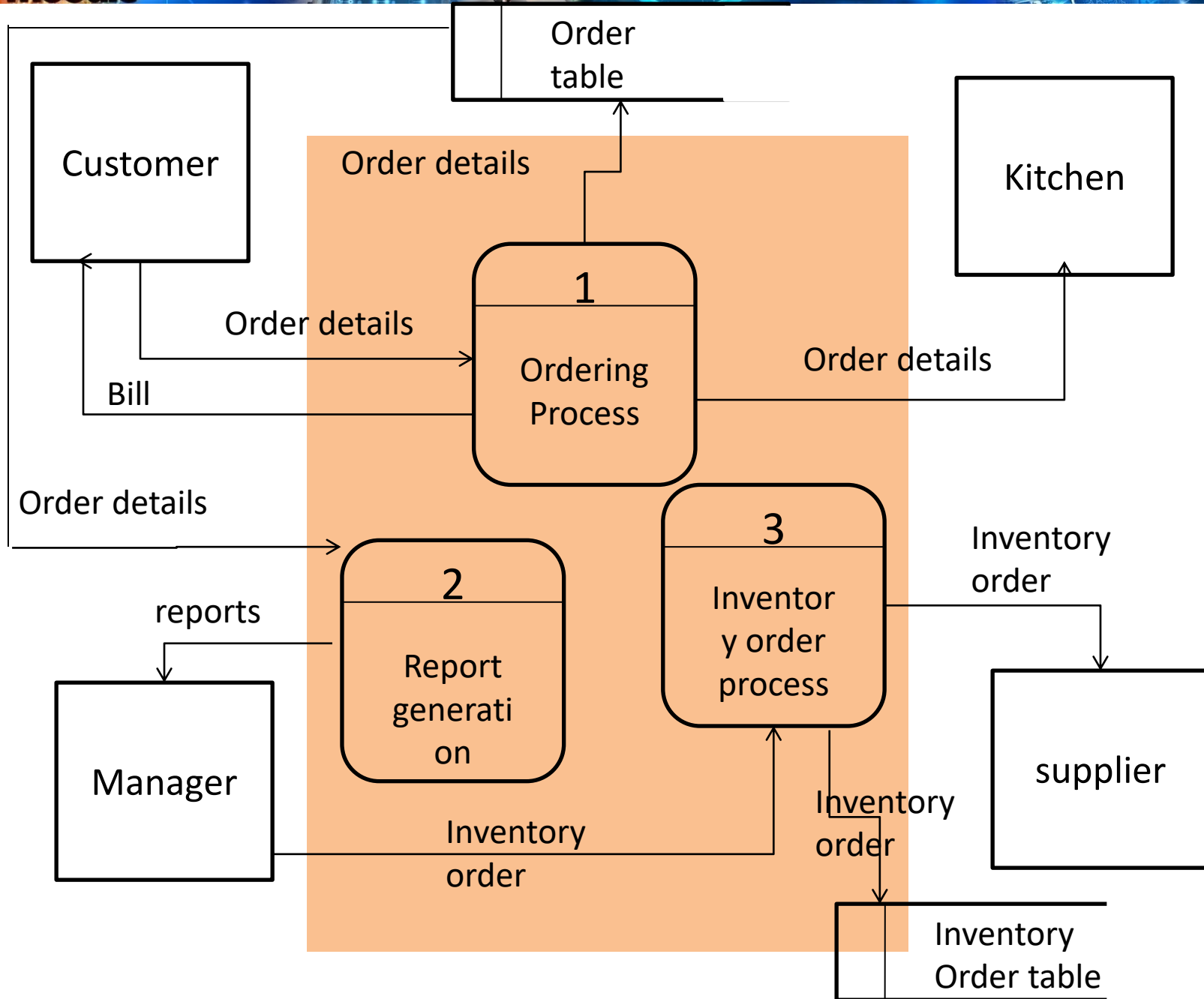
Level 0 DFD

- Each of the main sub-processes that collectively build the entire system.
- Depicts basic modules in system and data flow among them
- Mention basic process and data sources of information

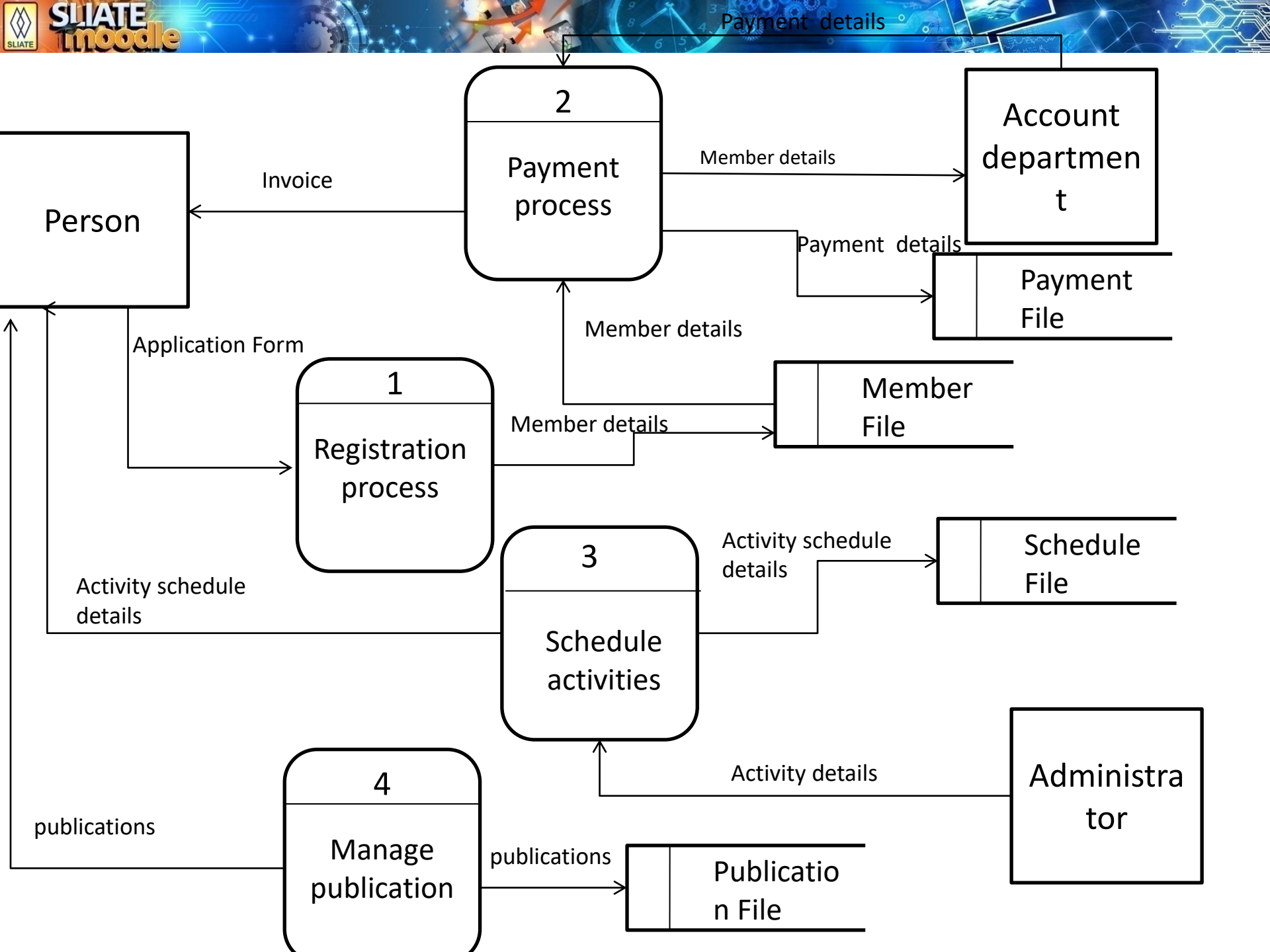
Example

- Let us draw the Level 0 for previous example





- Young inventors club decided to implement new web site to motivate their members. They carryout various activities that aid the members to make their dreams a reality.
- Web site contains the following information:
 - People who have sufficient qualifications are asked to apply by completing and submitting the application form. Member details are stored in 'member file'.
 - The Accounts department using information from the member file decides the membership fee and sends invoice to the relevant member. Membership Payments made are registered on the 'payment file'.
 - Administrator can schedule activities for the members but members who have paid the fees can participate in those activities. 'Schedule file' maintains all the scheduled details.
 - System maintains all the publications in 'publication file' and Members can view the publications.



Leveling

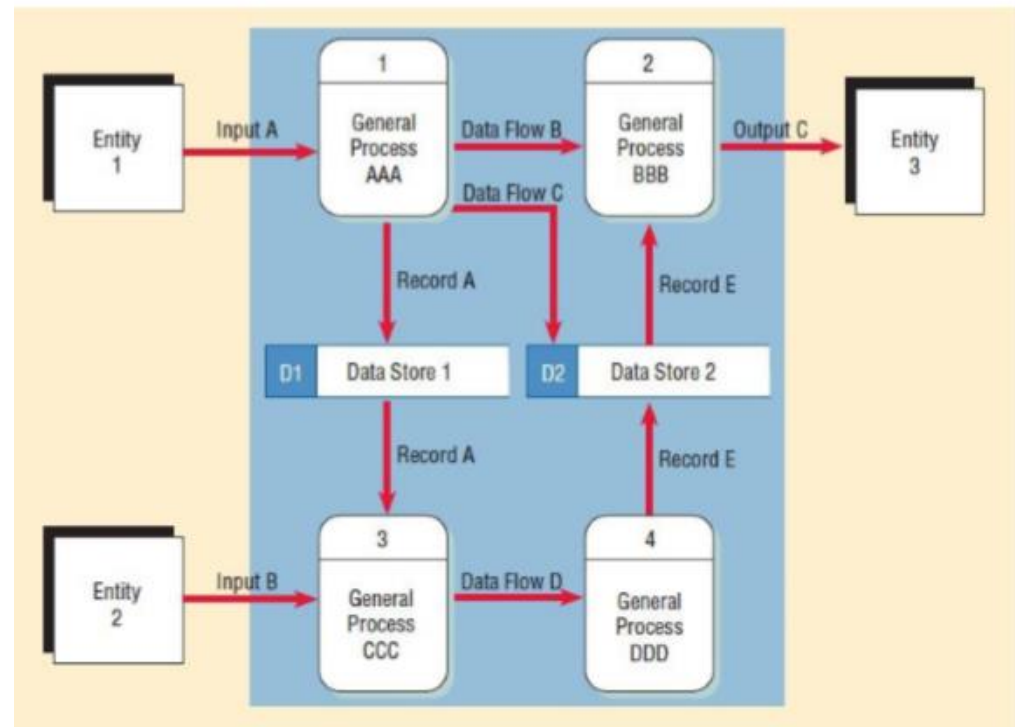
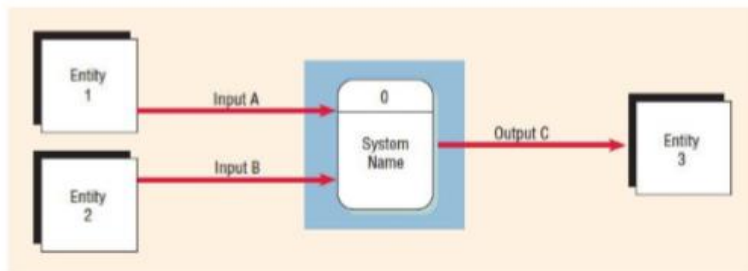
- Always bear in mind that leveling is meant to simplify and clarify the diagrams, and if this cannot be done then it may be best to leave the diagram as it is.

Balancing

- To be particular, all the inputs and outputs of the system which appear on the context diagram must appear on the level one diagram and there should be no other inputs and outputs on the level one diagram.

Balancing Example

- Number of inputs in context diagram and Level 0 is similar.



PROCESS MODELING

Introduction

- A process model is a graphical way of describing how a business system should operate.
- It demonstrates the processes and how data move among them.
- A process description documents the functional details of the system and describes a particular set of processing steps and business logic.

Modular Design

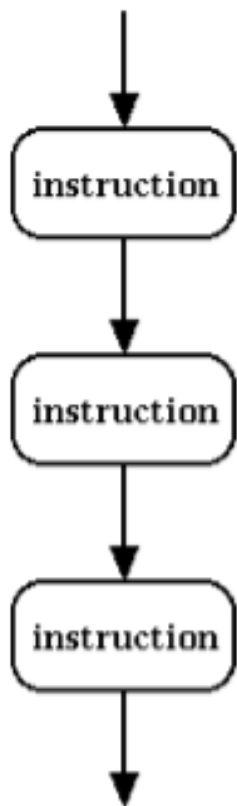
- When analyzing a functional primitive, the processing steps are broken down into smaller units in a process.
- The foundation of modular design is a mixture of three logical structures, which serve as building blocks for the process. Sometimes they are called as **control structures** as well.

Control Structures

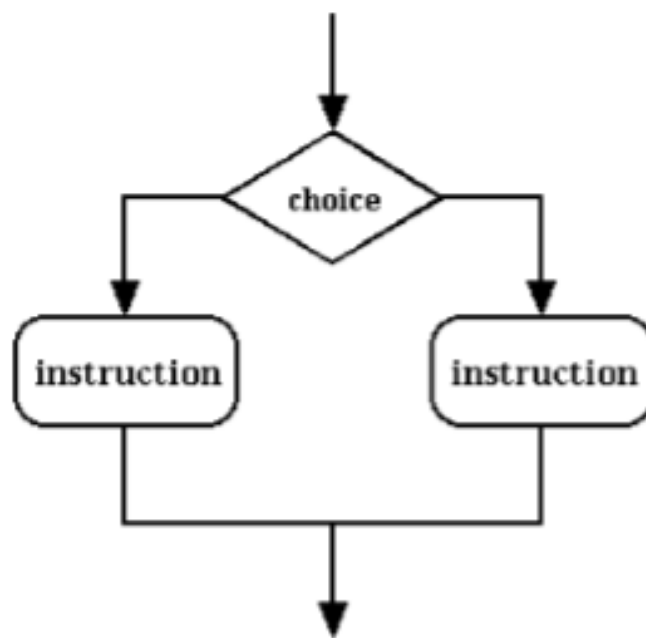
- Each of these logical structures should have a single entry and exit point.
- The three structures are
 - Sequence
 - Selection(Decision)
 - Iteration.

Control Structure Cont...

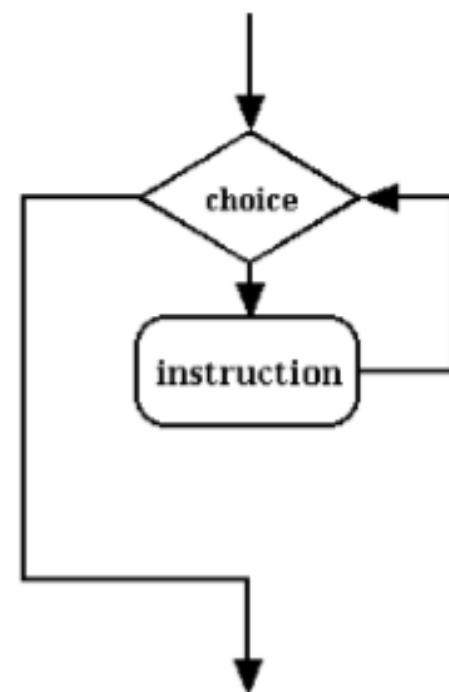
Sequence



Selection



Looping



Process description tool

- The followings are known as standard process description tools:
 - Structured English
 - Decision tables
 - Decision trees

Structured English

- When the processing logic includes formulas or iteration, or when structured decisions are not complicated, Structured English is a suitable technique for analyzing the decision process.

| Structured English Type | Example |
|---|---|
| Sequential Structure A block of instructions in which no branching occurs | Action #1 Action #2 Action #3 |
| Decision Structure Only IF a condition is true, complete the following statements; otherwise, jump to the ELSE | IF Condition A is True THEN implement Action A ELSE implement Action B ENDIF |
| Case Structure A special type of decision structure in which the cases are mutually exclusive (if one occurs, the others cannot) | IF Case #1 implement Action #1 ELSE IF Case #2 Implement Action #2 ELSE IF Case #3 Implement Action #3 ELSE IF Case #4 Implement Action #4 ELSE print error ENDIF |
| Iteration Blocks of statements that are repeated until done | DO WHILE there are customers. Action #1 ENDDO |

Structured English tips

- Capitalize keywords such as GET, IF, THEN, ELSE, END IF, CASE, DO WHILE, etc.
- Try to avoid complex statements, if possible
- Express actions as concise, simple commands:
 - RECEIVE Paycheck Request from Employee
 - GET the employee's Employee Record from Employee File
 - SEND the employee's Paycheck to Employee
 - STORE the employee's updated Employee Record to Employee File
 - APPEND the employee's ID number and salary to Manager Salary List

Consider these also

- Express all logic concerning one of these four types: sequential structures, decision structures, case structures, or iterations.
- Use indentation for readability.
- Use a restricted vocabulary, including standard terms used in the data dictionary and specific words that describe the processing rules.

Keyword to use in structured English

- BEGIN
- END
- IF
- ELSE IF
- CASE
- DO WHILE
- GET
- RECEIVE
- SEND
- APPEND
- STORE
- MATCH
- RETURN
- DISPLAY

Exercise

1. If final mark is greater than 40 the grade of a student will be pass else fail. Display the grade.

BEGIN IF

IF final_mark > 40

THEN grade = "pass"

ELSE

grade = "fail"

END IF

Exercise

1. Write the structured English for the DFD follows. If OT hours is 0 OT payment is 0 else OT payamount=OT hours* standardrate

RECEIVE OT pay amount request

GET Employee Time Card

BEGIN IF

IF OT_Hours=0

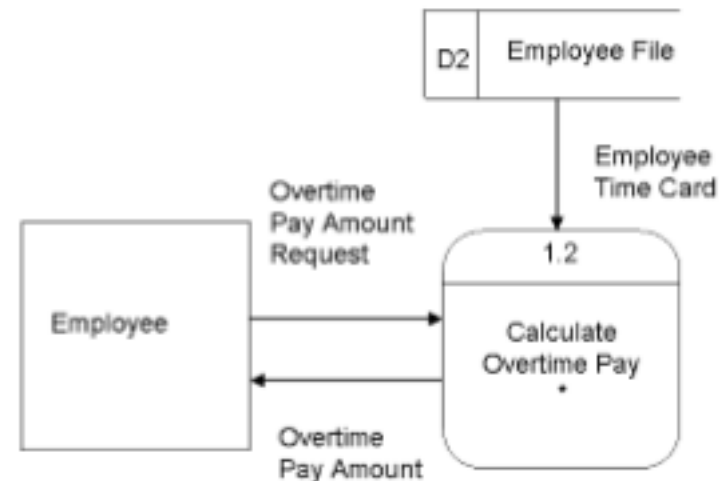
THEN OT_Payment=0

ELSE

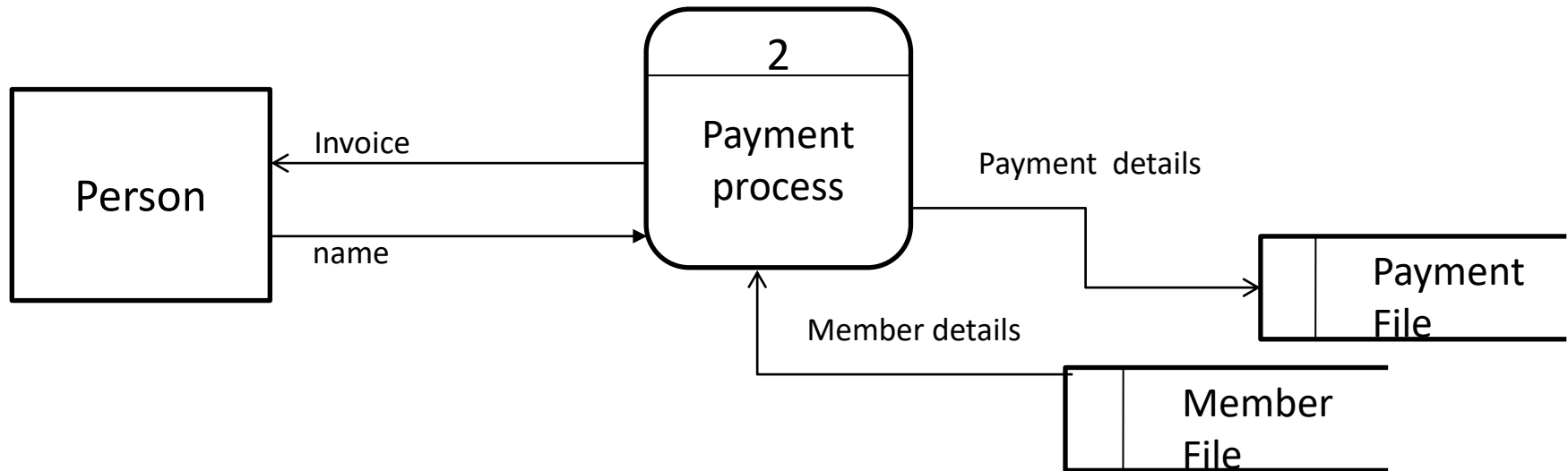
OT_Payment= OT_Hou

END IF

RETURN OT_Payment



Exercise



3. Write the Structured English for the following scenario.

Young inventors club decided to implement new web site to motivate their members. Web site contains the following information.

When user enter name, member type will be taken in to the process from member file then decides the membership fee according to the criteria given below

- If it is a gold type member membership fee is 5000
- If it is a silver type member membership fee is 3000
- Else membership fee is 1000

and sends the membership fee to the relevant member. And payment details will be stored in payment file.

Answer

RECEIVE MemberName from Member

GET MemberType From Member File by giving
MemberName

BEGIN IF

IF MemberType="gold"

THEN membershipFee=5000

ELSE IF MemembrType="silver"

THEN membershipFee=3000

ELSE membershipFee=1000

END IF

SEND membershipFee to the Member

STORE membershipFee of relevant member in PaymentFile

Decision Table

- A decision table is a concise visual representation that shows every combination of conditions and their outcomes

Rules

Conditions

Actions

| | Rule 1 | Rule 2 | Rule 3 | Rule 4 |
|-------------------------|--------|--------|--------|--------|
| Credit status is Ok | Y | Y | N | N |
| Product is in the stock | Y | N | Y | N |
| | | | | |
| Accept order | X | | | |
| Reject order | | X | X | X |

Example

- Draw the decision table

1. I'm going to a restaurant for dinner.

I will put a good comment and tell my friends if they made tasty food. If the food or service is bad I will probably make a complain and still tell my friends.

- How many conditions are in the above statement?

- Food is taste
- Service is good

2 conditions means 2^2 number of possible combinations of rules.

- How many actions are there in the above statement?

- Put a good comment
- complain
- Tell my friends

Example

| Conditions | Rule 1 | Rule 2 | Rule 3 | Rule 4 |
|---------------------|--------|--------|--------|--------|
| Food is tasty | Y | Y | N | N |
| Service is good | Y | N | Y | N |
| Actions | | | | |
| Make a good comment | X | X | | |
| Make a complain | | X | X | X |
| Tell my friends | X | X | | |

Exercise

- Draw decision table

Student will be eligible to the final exam of a subject if he/she has more than 50% for the assignment or more than 80% attendance. Anyhow subject lecturer should give the permission.

| Conditions | Rule 1 | Rule 2 | Rule 3 | Rule 4 | Rule 5 | Rule 6 | Rule 7 | Rule 8 |
|--------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|
| More than 50% assignment marks | Y | Y | Y | Y | N | N | N | N |
| More than 80% attendance | Y | Y | N | N | Y | Y | N | N |
| Lecturer Permission | Y | N | Y | N | Y | N | Y | N |
| Actions | | | | | | | | |
| Eligible | X | | X | | X | | | |
| Not Eligible | | X | | X | | X | X | X |

Simplifying rules

| Conditions | Rule 1 | Rule 2 | Rule 3 | Rule 4 | Rule 5 | Rule 6 | Rule 7 | Rule 8 |
|--------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|
| More than 50% assignment marks | Y | Y | Y | Y | N | N | N | N |
| More than 80% attendance | Y | Y | N | N | Y | Y | N | N |
| Lecturer Permission | Y | N | Y | N | Y | N | Y | N |
| Actions | | | | | | | | |
| Eligible | X | | X | | X | | | |
| Not Eligible | | X | | X | | X | X | X |

| Conditions | Rule 1 & 3 | Rule 2 | Rule 4 | Rule 1 & 5 | Rule 6 | Rule 7 | Rule 8 |
|--------------------------------|------------------|-----------|-----------|------------------|-----------|-----------|-----------|
| More than 50% assignment marks | Y | Y | Y | - | N | N | N |
| More than 80% attendance | - | Y | N | Y | Y | N | N |
| Lecturer Permission | Y | N | N | Y | N | Y | N |
| Actions | | | | | | | |
| Eligible | X | | | X | | | |
| Not Eligible | | X | X | | X | X | X |

| Conditions | Rule 1 & 3 | Rule 2, 4,6,8 | Rule 1 & 5 | Rule 7 |
|-----------------------------------|------------------|---------------------|------------------|-----------|
| More than 50% assignment marks | Y | - | - | N |
| More than 80% attendance | - | - | Y | N |
| Lecturer Permission | Y | N | Y | Y |
| Actions | | | | |
| Eligible | X | | X | |
| Not Eligible | | X | | X |

| Conditions | Rule 1 | Rule 2 | Rule 3 | Rule 4 |
|--------------------------------|-----------|-----------|-----------|-----------|
| More than 50% assignment marks | Y | - | - | N |
| More than 80% attendance | - | - | Y | N |
| Lecturer Permission | Y | N | Y | Y |
| Actions | | | | |
| Eligible | X | | X | |
| Not Eligible | | X | | X |

Example

Simplify the following example

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|----------------------------|---|---|---|---|---|---|---|---|
| Credit status is OK | Y | Y | Y | Y | N | N | N | N |
| Product is in stock | Y | Y | N | N | Y | Y | N | N |
| Waiver from credit manager | Y | N | Y | N | Y | N | Y | N |
| Accept order | X | X | | | X | | | |
| Reject order | | | X | X | | X | X | X |

Exercise

- Simplify using suitable combination rule

| Conditions and Actions | Rules | | | | | | | |
|--|-------|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Customer ordered from Fall catalog. | Y | Y | Y | Y | N | N | N | N |
| Customer ordered from Christmas catalog. | Y | Y | N | N | Y | Y | N | N |
| Customer ordered from specialty catalog. | Y | N | Y | N | Y | N | Y | N |
| Send out this year's Christmas catalog. | | X | | X | | X | | X |
| Send out specialty catalog. | | | X | | | | X | |
| Send out both catalogs. | X | | | | X | | | |

Exercise

- Draw decision table and simplify

3. Finding the largest number among three numbers.

Conditins:-

$$A > B$$

$$A > C$$

$$B > C$$

Actions:

A is largest

B is largest

C is largest

Answer

| Conditions | Rule 1 | Rule 2 | Rule 3 | Rule 4 | Rule 5 | Rule 6 | Rule 7 | Rule 8 |
|------------|--------|--------|--------|--------|--------|--------|--------|--------|
| $A > B$ | Y | Y | Y | Y | N | N | N | N |
| $A > C$ | Y | Y | N | N | Y | Y | N | N |
| $B > C$ | Y | N | Y | N | Y | N | Y | N |
| Actions | | | | | | | | |
| A | X | X | | | | | | |
| B | | | | | X | | X | |
| C | | | | X | | | | X |

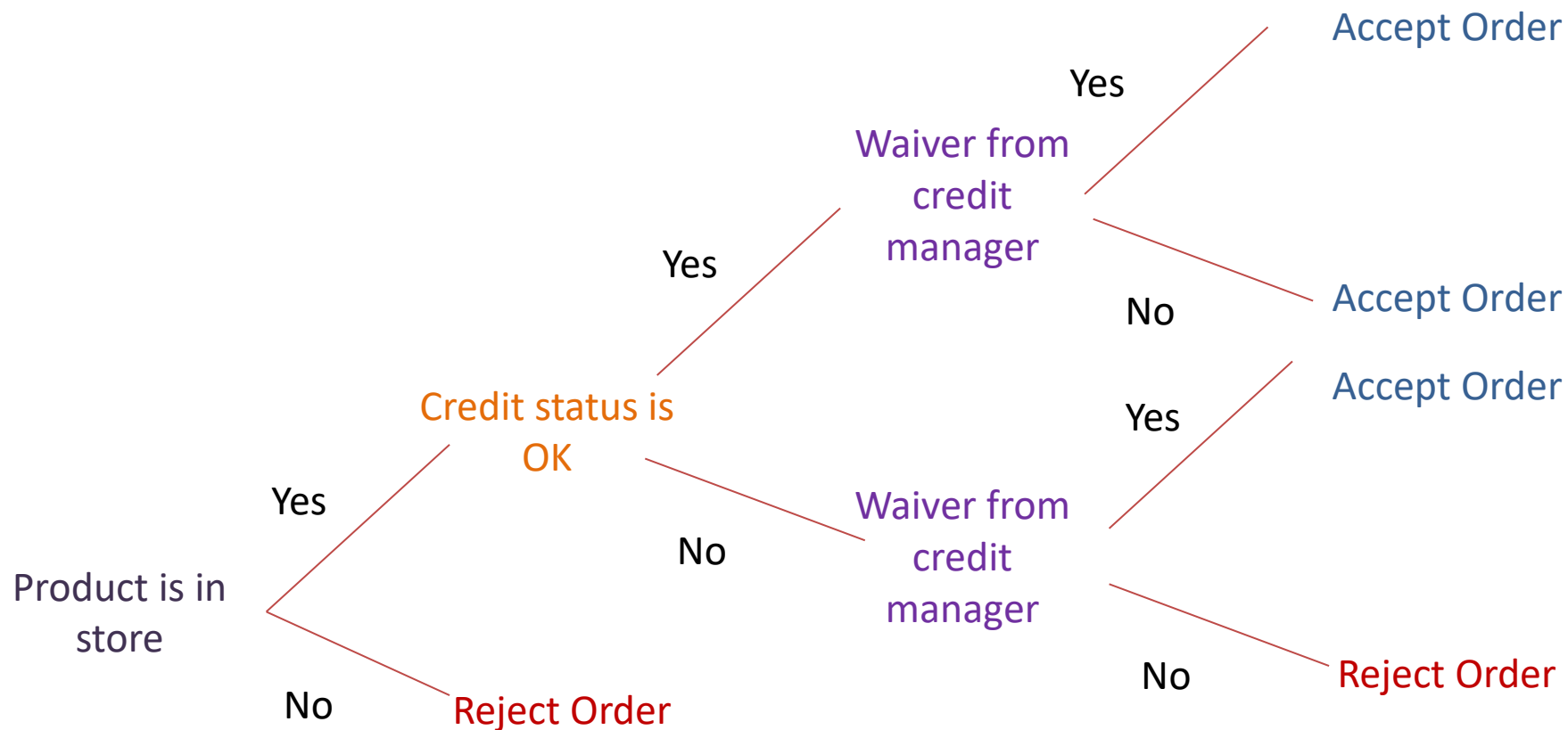
After simplifying

| Conditions | Rule 1 | Rule 4 | Rule 5 |
|------------|-----------|-----------|-----------|
| $A > B$ | Y | - | N |
| $A > C$ | Y | N | - |
| $B > C$ | - | N | Y |
| Actions | | | |
| A | X | | |
| B | | | X |
| C | | X | |

Decision Tree

- A Decision tree is a flowchart like tree structure, where each internal node denotes a test on an attribute, each branch represents an outcome of the test.

Decision Tree



Guidelines for Selecting Appropriate Tools

- Use DFD at high level analysis for providing good system documentations.
- 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.

| Condition | Recommendation |
|---|--------------------|
| Many repetition and actions are complex | Structured English |
| Communication to end users is important | Structured English |
| Complex combination of conditions, rules | Decision Tables |
| The sequence of the conditions are important and few condition to be tested | Decision Trees |

Thank You !