

# Structured Analysis

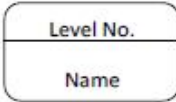
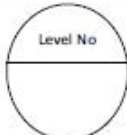
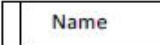

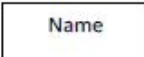
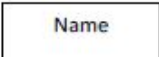
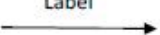
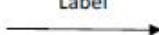
## Data Flow Diagram (DFD)

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- A **data flow diagram (DFD)** is a graphical representation of the "flow" of data through an information system.
- It differs from the system flowchart as it shows the flow of data through processes instead of hardware.
- DFDs show the flow of data from external entities into the system, showed how the data moved from one process to another, as well as its data store.
- DFDs are just framework of the system. It does not show program logic processing steps.
- A set of DFDs provides a logical model that shows *what* the system does, not *how* it does it.

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DFD Notations			
DFD Elements	Description	Gane and Sarson Symbol	Yourdon Symbol
Process	<ul style="list-style-type: none"> <li>• A name</li> <li>• A levelling number</li> <li>• At least one input data flow</li> <li>• At least one output data flow</li> </ul>		
Data store	<ul style="list-style-type: none"> <li>• A name</li> <li>• One or more input data flow</li> <li>• One or more output data flow</li> </ul>		
External entity	<ul style="list-style-type: none"> <li>• A name to describe the external entity</li> <li>• One or more input and/or output data flow</li> </ul>		
Data flow	<ul style="list-style-type: none"> <li>• Label to define the data flow</li> <li>• One or more connections to a process</li> </ul>		

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### Process notation

A process transforms incoming data flow into outgoing data flow. The symbol used for a process is rectangle with rounded corner or an oval.

Process notation contains 2 descriptive elements:

- An identification number appears in the top of the rectangle. This is allocated arbitrarily at the top level and serves as a unique reference.
- The name of the process appears inside the rectangle or oval below the identification number. For example 'Deposit Payment', 'calculate commission'.

Processing details are never shown in a DFD. For example, a process notation DEPOSIT PAYMENT does not reveal the logic behind the DEPOSIT PAYMENT process.

In DFD, a process notation can be referred to as a **black box**, because the input, output, and general functions of the process are known, but the underlying details and logic of the process are hidden.

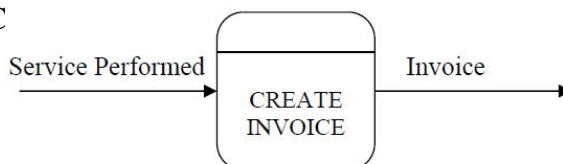
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### Data Flow notation

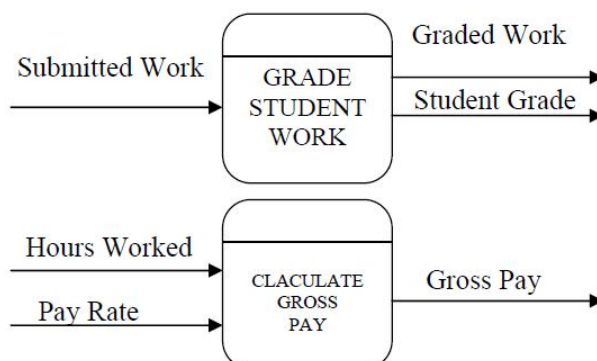
- A data flow shows the flow of information from its source to its destination.
- A data flow is represented by a line with arrow showing the direction of flow.
- The arrows must either start and/or end at a process box.
- It is impossible for data to flow from data store to data store except via a process, and external entities are not allowed to access data stores directly.
- Every data flow must be labeled shows what data is flowing.

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- Process changes the data's contents, at least one data flow must enter and one data flow must exit each process notation as shown in the CREATE INVOICE

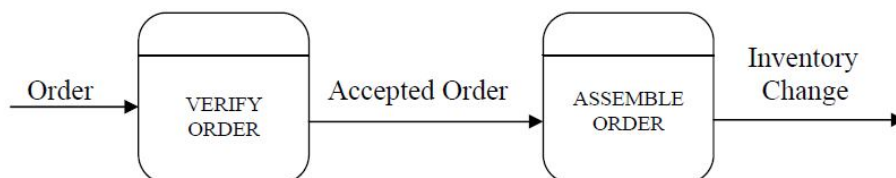


- A process can have more than one outgoing/ingoing data flow



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A process can also connect to another process as shown by the connection between VERIFY ORDER and ASSEMBLE ORDER. A data flow must have a process notation on at least one end

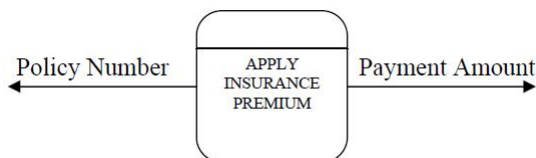


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### **Incorrect combinations of data flow and process notation**

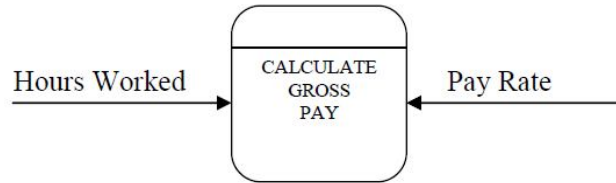
Three data flow and process combination that must be avoided

**Spontaneous generation:** The APPLY INSURANCE PREMIUM process produces outputs, but has no input data flow, that's why it is called a Spontaneous generation process

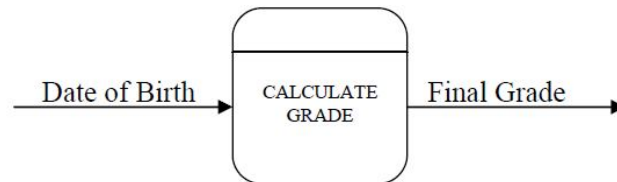


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**Black hole:** The CALCULATE GROSS PAY is a black hole process, as it has input data flow but no output data flow.



**Gray hole:** A gray hole is a process that has at least one input and one output, but the input is insufficient to generate the output. For example, a date of birth input is not sufficient to produce a final grade output in the CALCULATE GRADE process.



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### Data Store notation

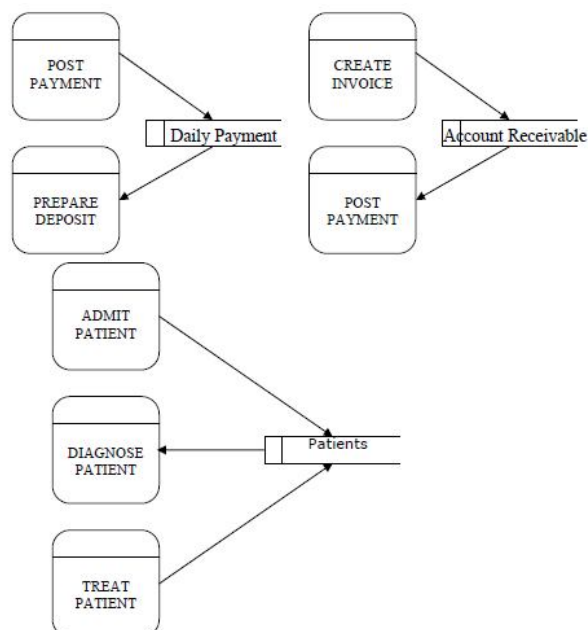
- A data store is used to store information within the system because one or more processes need to use the data at a later time.
- For example, faculties need to store student marks on test and assignment during the semester so that they can assign final grade at the end of the semester.
- Similarly, a company stores employee salary and deduction data for a month to calculate the net salary.
- A DFD does not show the detailed contents of a data store.
- The specific structure and data elements are defined in detail in the data dictionary.

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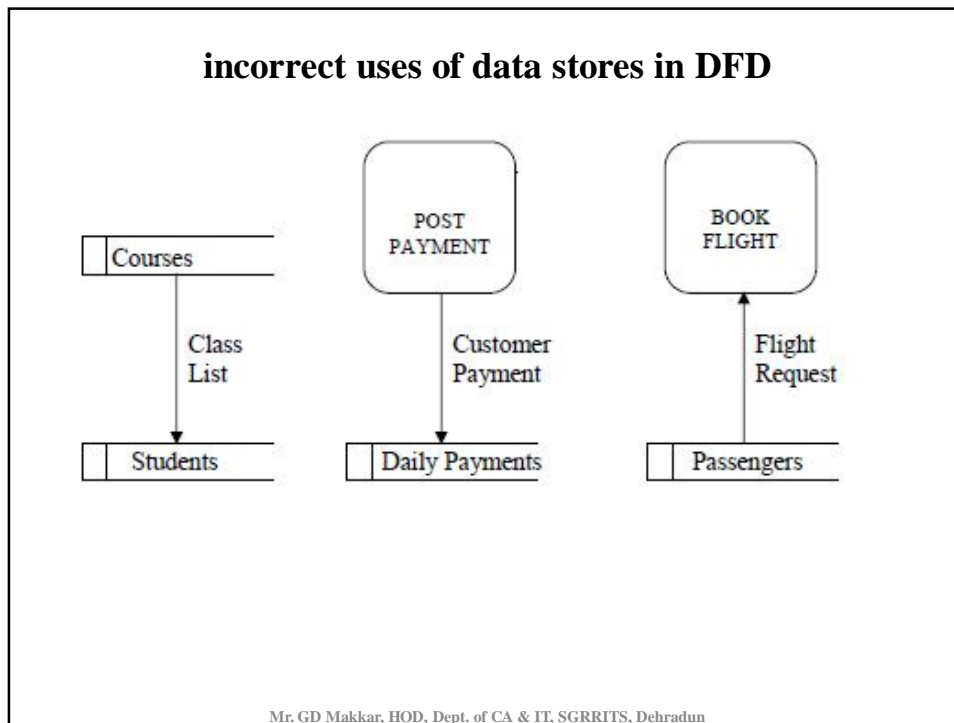
- In a DFD, Data store is represented by either flat rectangle that is open on the right side and closed on the left side (Gane & Sarson) or rectangle open on both side (Yourdon).
- The name of the data store appears between the lines and identifies the data it contains.
- For example, STUDENT, PRODUCTS, ISSUE BOOK, EMPLOYEES etc.
- In DFD, data store must be connected to a process.
- Data store must have at least one incoming and one outgoing data flow and is connected to a process with data flow
- Data flow cannot be used between two data stores without having a process between them.

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### Correct uses of data store notation in a DFD



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### External Entity

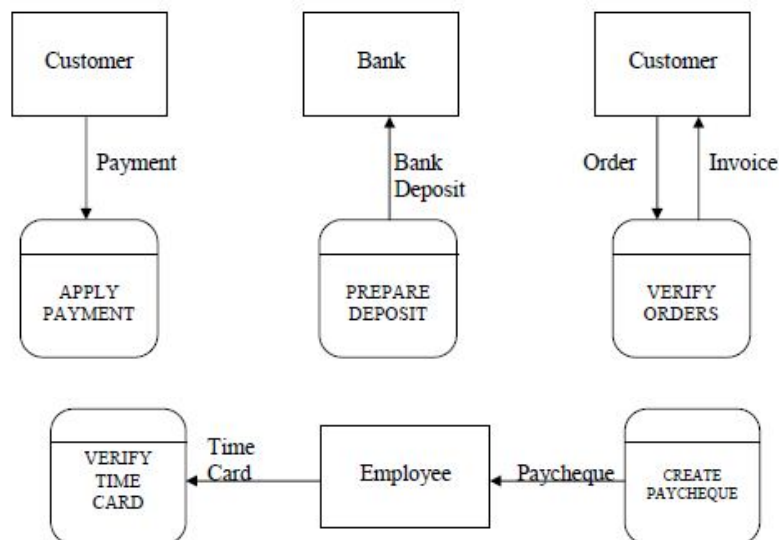
- External entities are objects outside the system, with which the system communicates.
- External entities are sources and destinations of the system's inputs and outputs.
- A DFD shows the boundaries of the system and how the system interfaces with outside world.
- For example, a customer entity submits an order to an order processing system, a homeowner receives an electricity bill from electric department or an account payable system that receives data from the company's purchasing department.

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- External entities are also called terminators, because they are data origin or final destination.
- Entity that supplies data to the system is called **source entity**
- An entity that receives data from a system is called **sink entity**.
- An external entity can be source or sink or both, but each entity must be connected to a process by a data flow.
- External entities are organizations, other information systems, departments or people, which represent a source or destination of transaction or data.
- External entity must be connected to a process by a data flow and not directly to a data store or to another external entity.

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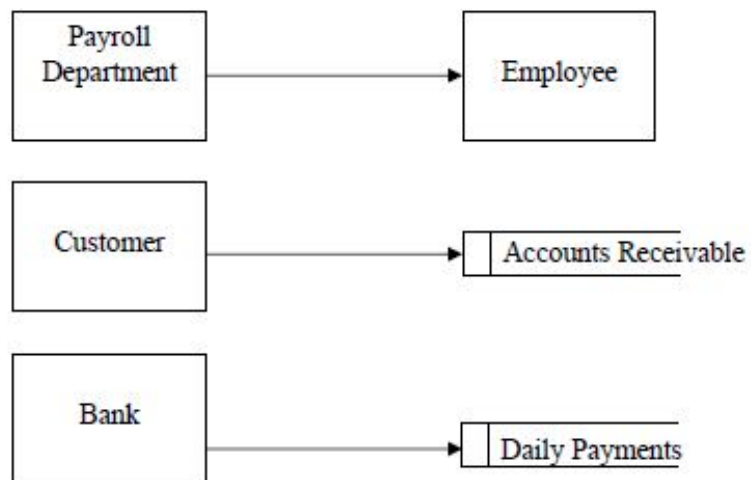
### Correct uses of external entities in a DFD



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### Incorrect uses of external entity in a DFD



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### Relationship Grid

	Process	Data Store	External Entity
Process	Y	Y	Y
Data Store	Y	N	Y
External Entity	Y	N	N

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## Types of DFD's

There are two types of DFD:

- **Physical DFD:** It is a model of the current system and is used to ensure that the current system has been clearly understood. Physical DFD shows actual devices, departments, peoples etc. involving in the current system
- .
- **Logical DFD:** These are the models of the proposed system. It shows the requirements on which the new system will be built.

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## Developing DFD

- The data flow diagram must have at least one process.
- A process must have at least one inflow and one outflow.
- In Data Flow Diagram, a system can be decomposed into subsystems, and subsystems can be decomposed into lower level subsystems, and so on.
- The first diagram that shows the main process of the system and its sub processes as an external entities connected by data flow is called **context diagram** or **zero level DFD**. Every sub process defined in the context diagram is expanded to show more detail in the next level i.e. 1<sup>st</sup> level.
- Each subsystem represents a process in which data is processed. At the lowest level, processes can no longer be decomposed.
- A data store should be connected to at least one process.
- External entities should not be connected to each other directly.

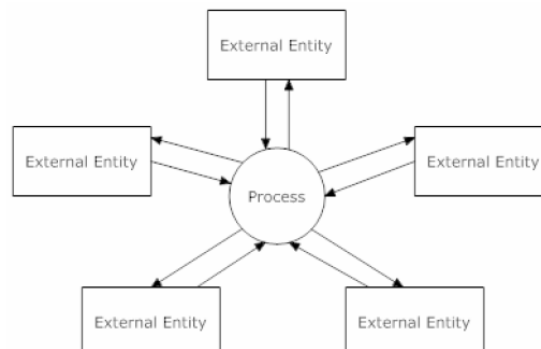
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1. **Make a list of business activities and use it to determine various**
  - External entities
  - Data flows
  - Processes
  - Data stores
2. **Create a context diagram that shows external entities and data flows to and from the system. Do not show any detailed processes or data stores.**
3. **Draw Diagram 0, the next level. Show processes, but keep them general. Show data stores at this level.**
4. **Create a child diagram for each of the processes in Diagram 0. Check for errors and make sure the labels you assign to each process and data flow are meaningful.**

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## Context diagram

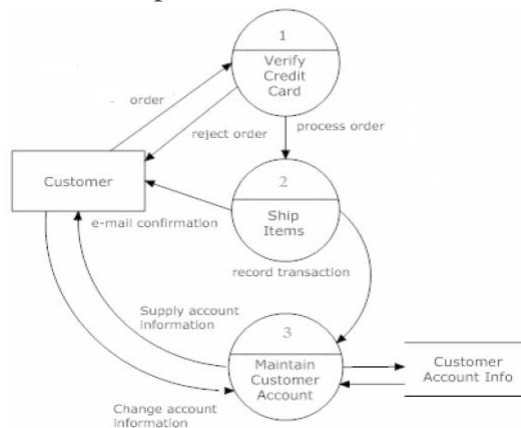
- The context diagram shows the overall business process as just one process and shows the data flows to and from external entities.
- Data stores usually are not included on the context diagram.
- All the sub process are shown as external entities.



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## N<sup>th</sup> level DFD

The first level DFD shows the main processes within the system. Each of these processes can be broken into further processes until no process can be decomposed further



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## Example

Students send in an application form containing their personal details, and their desired course to enroll. The university checks that the course is available and that the student has necessary academic qualifications. If the course is available the student is enrolled in the course, and the university confirms the enrolment by sending a confirmation letter to the student. If the course is unavailable the student is sent a rejection letter.

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Identify:

**External entities (EE):** People/Organizations/Things that supply information to or use information from the system

**Processes (P):** Actions/Doing words/Verbs

**Data flows (DF):** Movement/Exchange of information/Data between external entities to processes, and processes to processes

**Data stores (DS):** Store/Record information/Data

- A **student** (EE) sends in an **application form** (DF) containing their personal details, and their desired course
- The university **checks** (P) that the course is available.
- If the course is available the student is **enrolled** (P) in the course, and the university **confirms** (P) the enrolment by sending a confirmation letter (DF) that they are registered for the course to the student.
- Or if the course is unavailable the student is sent a **rejection letter** (DF).

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### Context diagram (0 level DFD)

- It is the highest level DFD.
- Have data flows, external entities, one process (system in focus) and no data stores.
- Shows the system boundary and interactions with external entities.

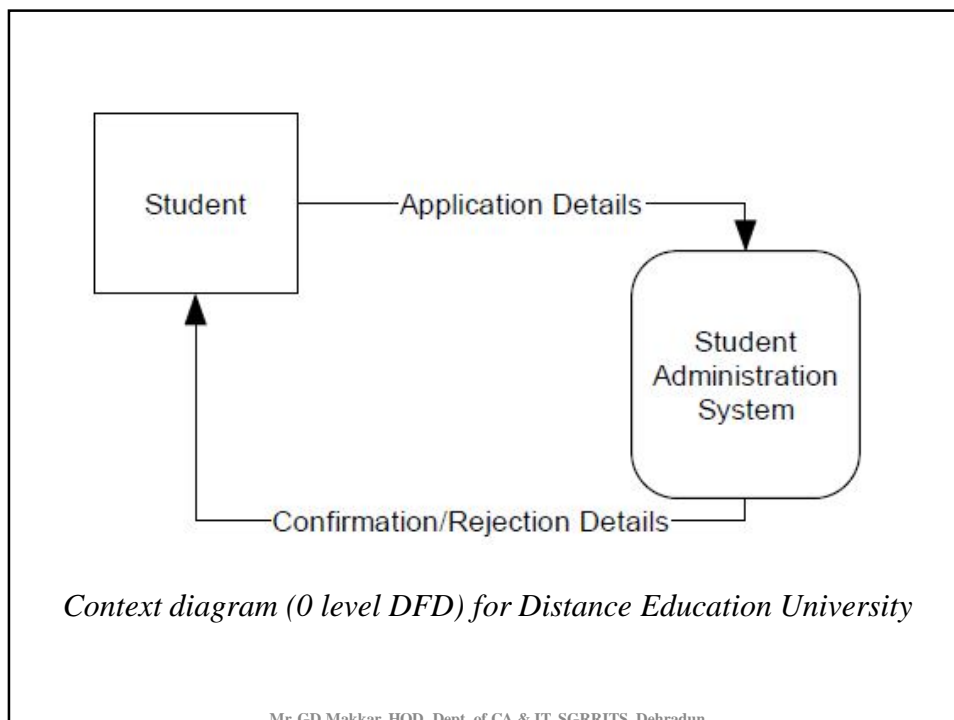
In this case:

**External entity** - Student

**Process** - Student Administration process application

**Data Flows** - Application Form, Confirmation/Rejection Letter

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### 1<sup>st</sup> Level DFD

External entity	- Student
Processes	- Check available, Enroll student, Confirm Registration
Data Flows	- Application Form, Course Details, Course Enrolment Details, Student Details, Confirmation/Rejection Letter
Data Stores	- Courses, Students.

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