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# Data Flow Diagram

*System Analysis and Design*  
**vol.1**



KEMENTERIAN PENGAJIAN TINGGI  
JABATAN PENDIDIKAN POLITEKNIK DAN KOLEJ KOMUNITI

**POLITEKNIK**  
MALAYSIA  
UNGKU OMAR

# Data Flow Diagram

*System Analysis and Design*



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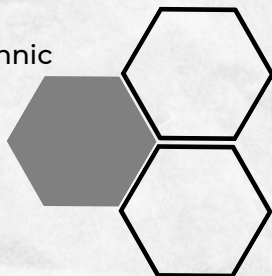
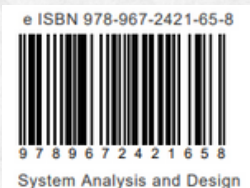
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## **DATA FLOW DIAGRAM, SYSTEM ANALYSIS AND DESIGN**

The module adheres to the Polytechnic Malaysia course syllabus for System Analysis and Design and is appropriate for readers from all backgrounds.

**DEPARTMENT OF INFORMATION TECHNOLOGY AND COMMUNICATION**

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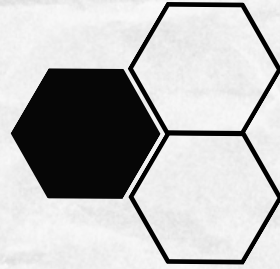
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# PREFACE



The Data Flow Diagram is explained in this book for the System Analysis and Design course. In general, this book uses the DFD symbol developed by Gane and Sarson to illustrate how DFD is produced. The creation of DFD is broken down into steps and covered in detail to make it easier for the reader to grasp and subsequently be able to construct an understandable DFD. This eBook is intended for lecturers and students as a teaching and learning material for the Logical Designs topic in System Analysis and Design.





# About the author

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A lecturer in the Information Communication and Technology Department, Ungku Omar Polytechnic. Possessed 14 years of teaching experience in Software and Application Developments' track, primarily in System Analysis and Design areas. In addition to that, the author has industrial experience and expertise working on actual software development projects, particularly as a systems/business analyst.

The author earned a degree in a Bachelor of Computer Science (Software Development) from Universiti Teknikal Malaysia Melaka (UTeM) and also holds a master's degree in Science Computer (Software Technology) from Universiti Kebangsaan Malaysia. The author is currently involved in software project development as a system analyst in the Overall Equipment Evaluation System under the Department of Polytechnic and Community College Studies. Apart from that, she also contributed to scientific writing for software (web applications, mobile applications, and security projects) development.



## Nur Syuhada binti Mohamad

She is the Head of the Diploma Program in Information Technology (Digital Technology) in the Network Systems Track. She possesses 11 years of teaching experience in the field of information technology and 3 years of working experience in the industry.

Educational Background Bachelor of Computer Science (Computer Networking) and Masters of Computer Science (Software Engineering and Intelligence) at Universiti Teknikal Malaysia Melaka (UTeM). She has also been involved in scientific writing and the presentation of innovation projects at the national and international levels.

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# OVERVIEW

System analysts use many graphical techniques to describe an information system. One of those tools is Data Flow Diagram (DFD).

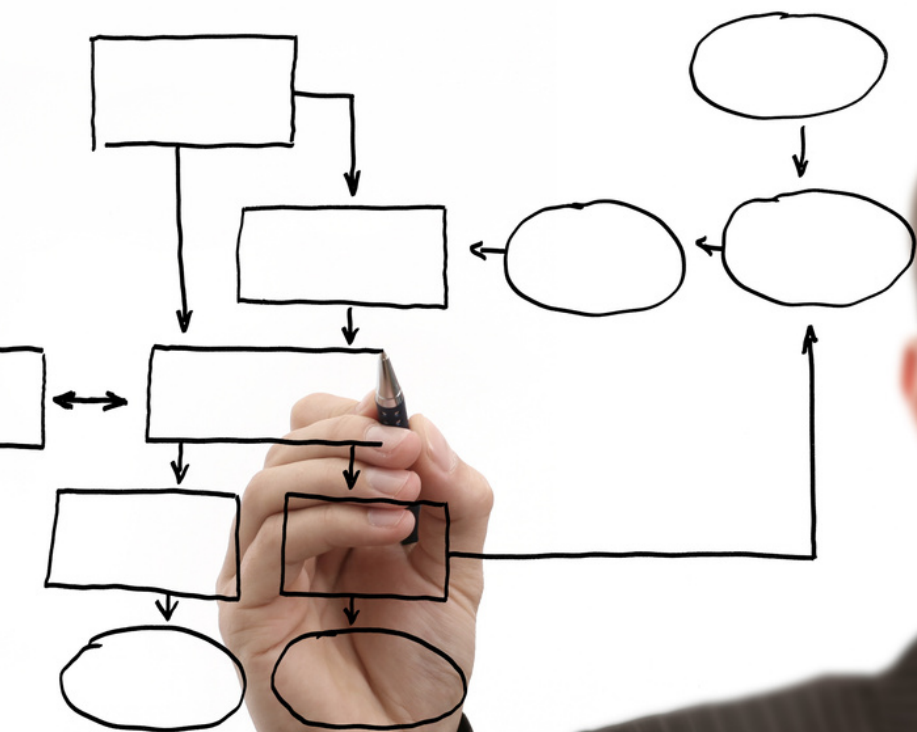
DFD is a useful communication tool between the user and the system analyst because of the visual depiction. DFD's structure allows you to start with a broad overview and work your way down to a hierarchy of specific diagrams.

A DFD can be visualised manually, automatically, or by a combination of both. DFD can be drawn with Microsoft Visio, LucidChart, or any other freeware available, or at least using productivity tools such as Microsoft Office.

A clear and concise DFD can graphically display the adequate amount of system requirements.

# CHAPTER 1

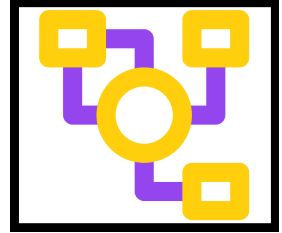
# WHAT IS DATA FLOW DIAGRAM?



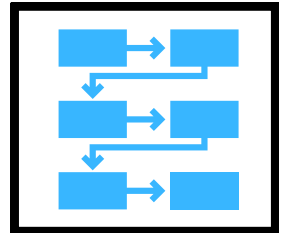
# CHAPTER 1

## WHAT IS DATA FLOW DIAGRAM?

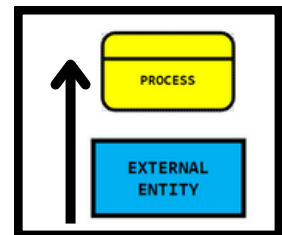
A Data Flow Diagram, or more easily known as a **DFD**, is a visual representation to describe the functions, flow of data, data store and processes within a system.



A DFD shows how data moves through an information system but does not show program logic or processing steps.



A data flow diagram (DFD) uses various symbols to show how the system transforms input data into useful information.

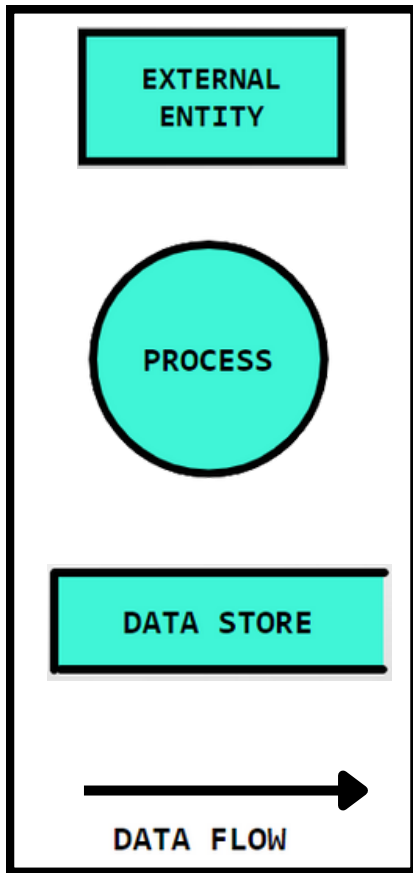




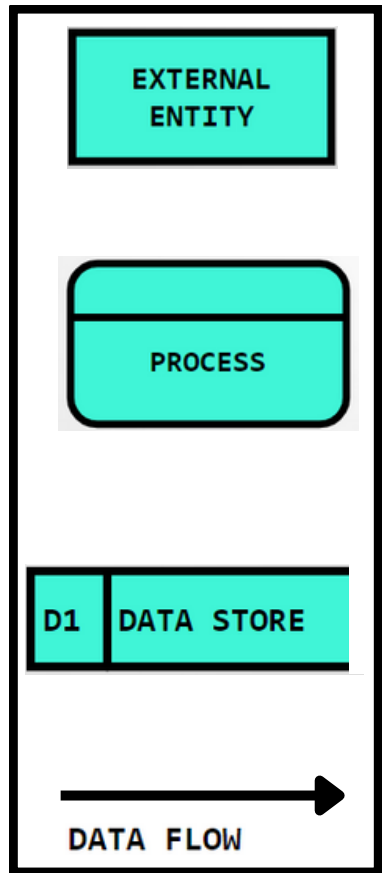
# DFD SYMBOLS

There are **TWO** types of DFD symbols

## YOURDON & COAD



## GALE AND SARSON



To ensure that the generated DFD is consistent, use only one type of symbol. The combination of these two types of symbols results in a DFD that is difficult to comprehend.

## DATA FLOW DIAGRAM SYMBOLS

### EXTERNAL ENTITY



- The entity's name appears inside the symbol.
- Only external entities that contribute data to or receive output from the system are shown in a DFD.
- A DFD depicts the system's scope and how it interacts with the outside world.
- DFD entities also are called terminators, for the reason that they are data origins or final destinations.

### PROCESS



- Receives input data and produces output that has a different content from or both.
- - Contain the business logic also called business rules.
- - Referred to as a black box.

# PROCESS

## DATA FLOW DIAGRAM SYMBOLS

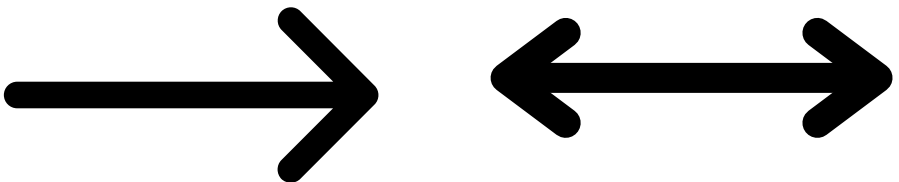
### DATA STORE



- Represent data that the system stores.
- The physical characteristics of a data store are unimportant because you are concerned only with a logical model.

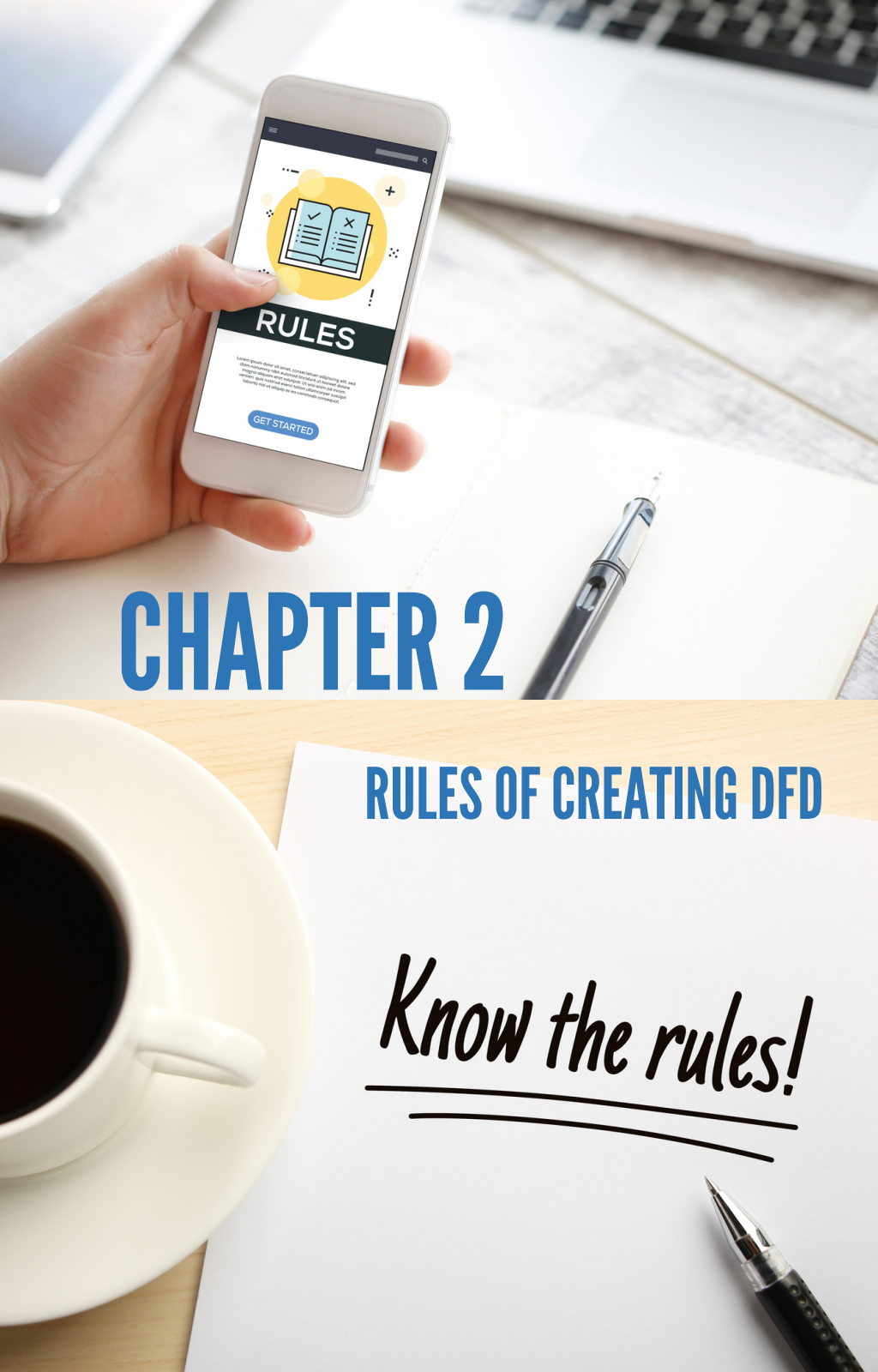


### DATA FLOW



- Represents one or more data items
- The symbol for a data flow is a line with a single or double arrowhead
  - Spontaneous generation
  - Black hole
  - Gray hole





# CHAPTER 2

## RULES OF CREATING DFD

Know the rules!

# CHAPTER 2

## RULES OF CREATING DFD

Data flows are the ways in which information moves through an information system. In a DFD, a data flow represents one or more data items. A data flow, for instance, could consist of a single data item (such as a staff ID number) or a collection of data (such as a working hour with staff ID numbers, names, and positions for a specific department). A single or double arrowhead, works as the symbol for a data flow. The name of the data flow can be placed above, below, or next to the line. A singular noun and, if required, an adjective make up a data flow name. PAYROLL, MEDICAL STATUS, SALARY, LEAVE, and OT PAYMENT are a few examples of data flow names.

The data store's name is displayed between the lines, representing the data it holds. A data store name is a plural name comprised of a noun and optional adjectives. STAFF, PAYROLL, ATTENDANCE, LEAVE RECORD, MEDICAL RECORD, and EMPLOYEES are some examples of data store names.

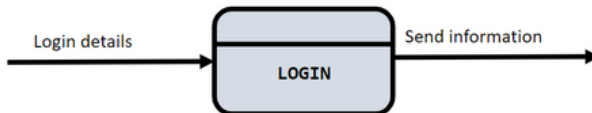


For instance, a user entity might register to initiate account creation for the booking system. A DFD demonstrates the system's perimeters and its connections to the outside world. A booking system, for instance, might receive a booking request from a client entity. Other instances of entities are a customer who reserves a hotel room in the hotel reservation system, a customer who does online shopping using an online store system, or a job hunter who submits a job application through the jobstreet system.

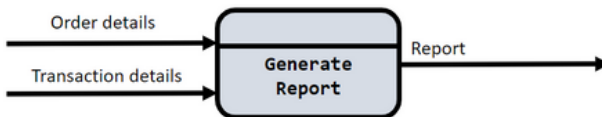
The examples of data flow, data store, and external entity compositions are illustrated on pages 7-13.

## EXAMPLES OF CORRECT DATA FLOW AND PROCESS SYMBOL COMPOSITIONS

### Example 1 - single input and single output



### Example 2 - Multiple input and single output



### Example 3 - Single input and multiple output



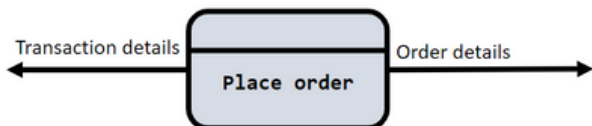
### Example 4 - Multiple processes with continuous single data flow



Input from one process can be used as the output of another - as shown in example 4.

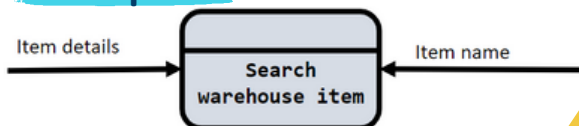
## EXAMPLES OF ERRONEOUS DATA FLOW AND PROCESS SYMBOL COMPOSITIONS

### Example 1 - SPONTANEOUS GENERATION



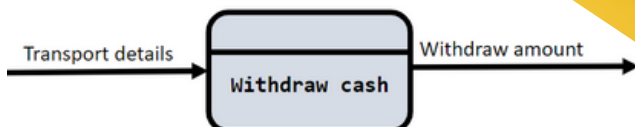
The term "spontaneous generating process" refers to a process without an input, as shown in example 1.

### Example 2 - Black Hole

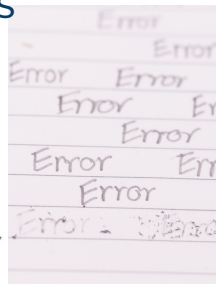


A process without an output is called Black Hole as shown in Example 2

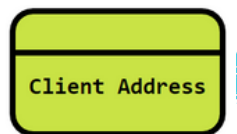
### Example 3 - Gray Hole



Example 3, illustrated Gray Hole, which is a process that has an input that is clearly unable to produce the output

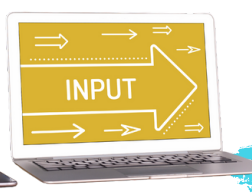
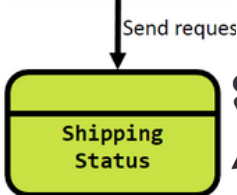


## EXAMPLES OF CORRECT USAGE OF DATA STORE COMPOSITIONS

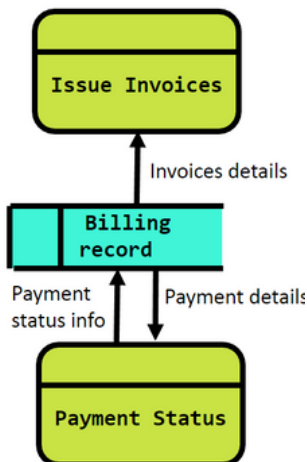


### Example 1

**Output from Data Store can be input for other processes**

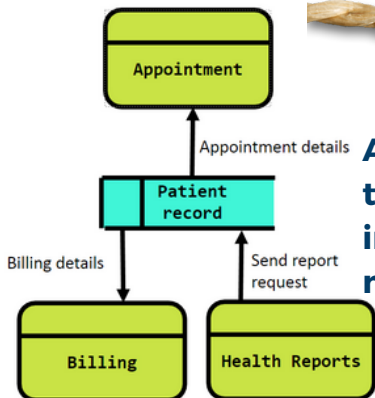


### Example 2



**A Data Store is allowed to produce input and output to the same process.**

### Example 3

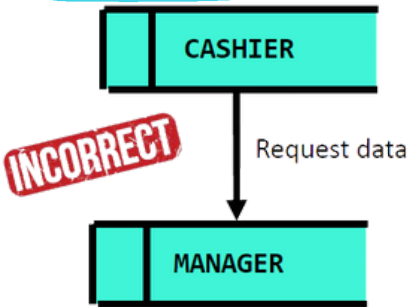


**Also Data Store is allowed to simultaneously produce input and output to the multiple processes.**



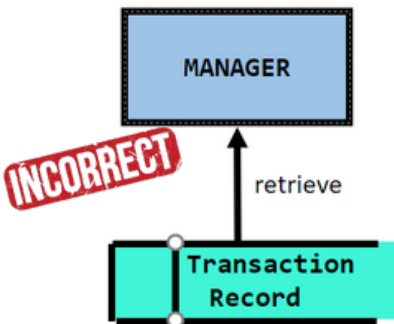
## EXAMPLES OF INCORRECT USAGE OF DATA STORE COMPOSITIONS

### Example 1 - Data Store to Data store



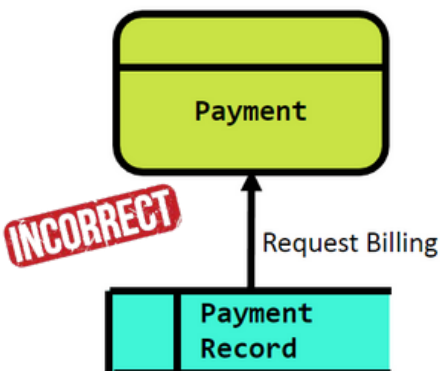
Data Store cannot be connected to another Data Store.

### Example 2- Data store to Entity



External Entity cannot be connected to Data Store

### Example 3- Data Store to Process

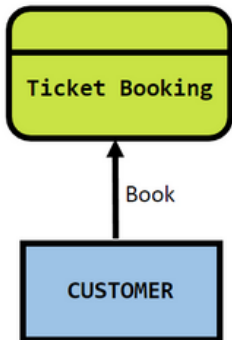


Without first receiving any data, the data store is unable to provide input to the process.



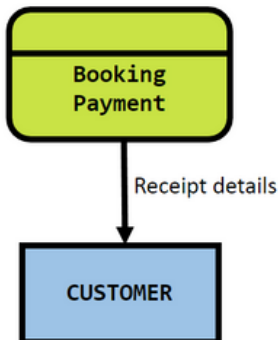
## EXAMPLES OF CORRECT USES OF EXTERNAL ENTITIES IN A DATA FLOW DIAGRAM

### Example 1



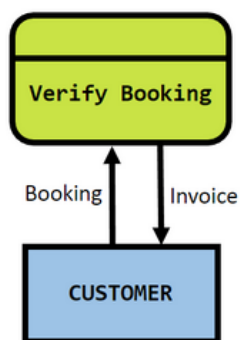
**An Entity produce single data flow to process**

### Example 2



**An Entity receives output from process**

### Example 3



**Multiple Data Flow to the Entity and vice versa**

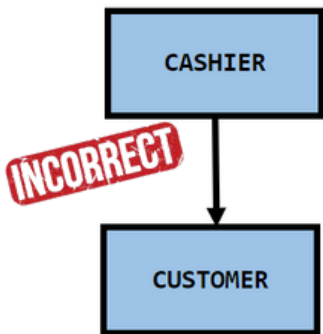
### Example 4



**An Entity can receive input from one process and produce output for another process**

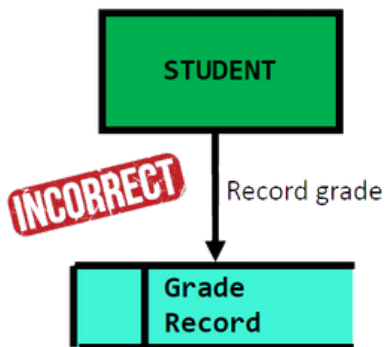


## Example 1 - External Entity to External Entity



**Data Store cannot directly connected to another Data Store.**

## Example 2- External Entity to Data Store

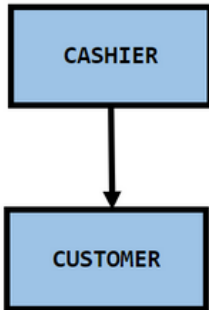


**External Entity cannot directly connected to Data Store.**

**It is not possible to connect an external entity directly to a data store or another entity; instead, an external entity must be connected by a data flow to a process.**

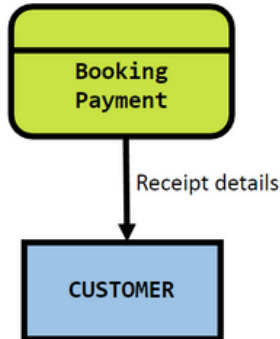
## EXAMPLES OF INCORRECT DATA FLOW DIAGRAM USE OF EXTERNAL ENTITIES

### Example 1



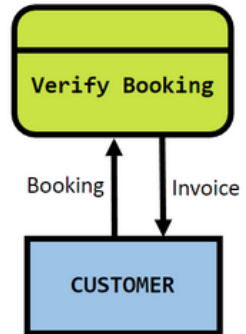
**An Entity  
produce single  
data flow to  
process**

### Example 2



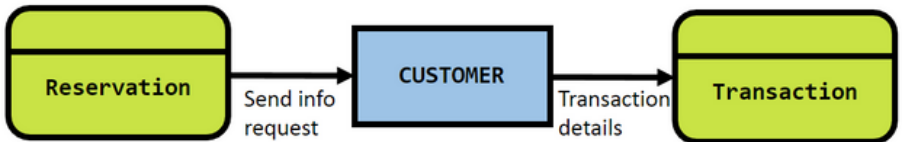
**An Entity  
receives  
output from  
process**

### Example 3



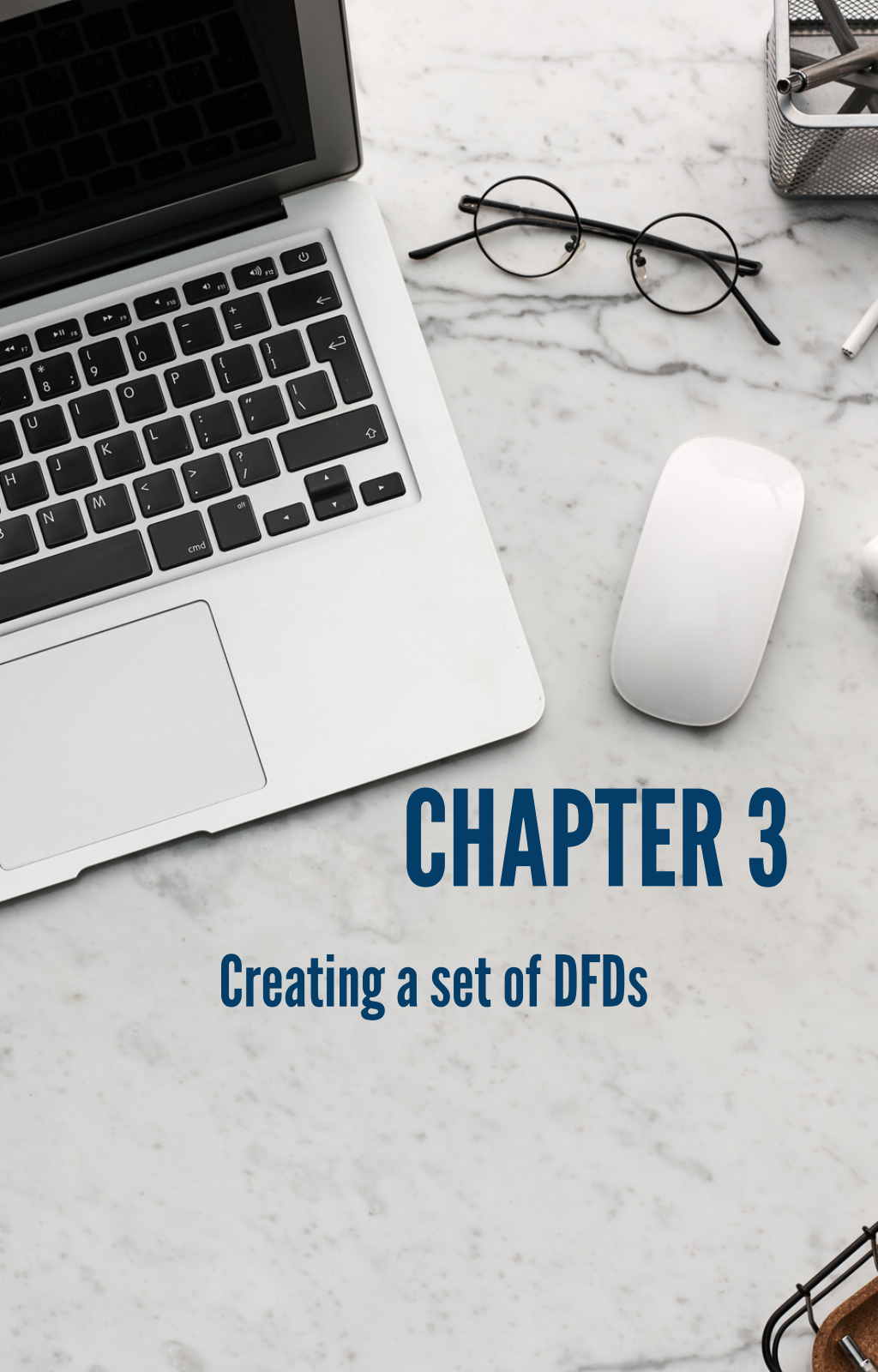
**Multiple Data  
Flow to the  
Entity and vice  
versa**

### Example 4



**An Entity can receive input from one process and  
produce output for another process**





# CHAPTER 3

Creating a set of DFDs

## CREATING A SET OF DFD

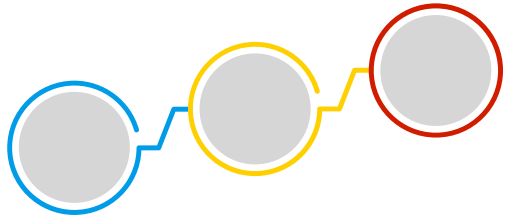
Building a DFD involves at least three steps.

STEP 1

STEP 2

STEP 3

# STEP



1

**Create Context Diagram**

2

**Create Level 0 DFD**

3

**Create Lower Diagram DFD**



**A CONTEXT DIAGRAM** is an overview of an information system that displays its parameters and scope.

Context Diagram should fit on one page.

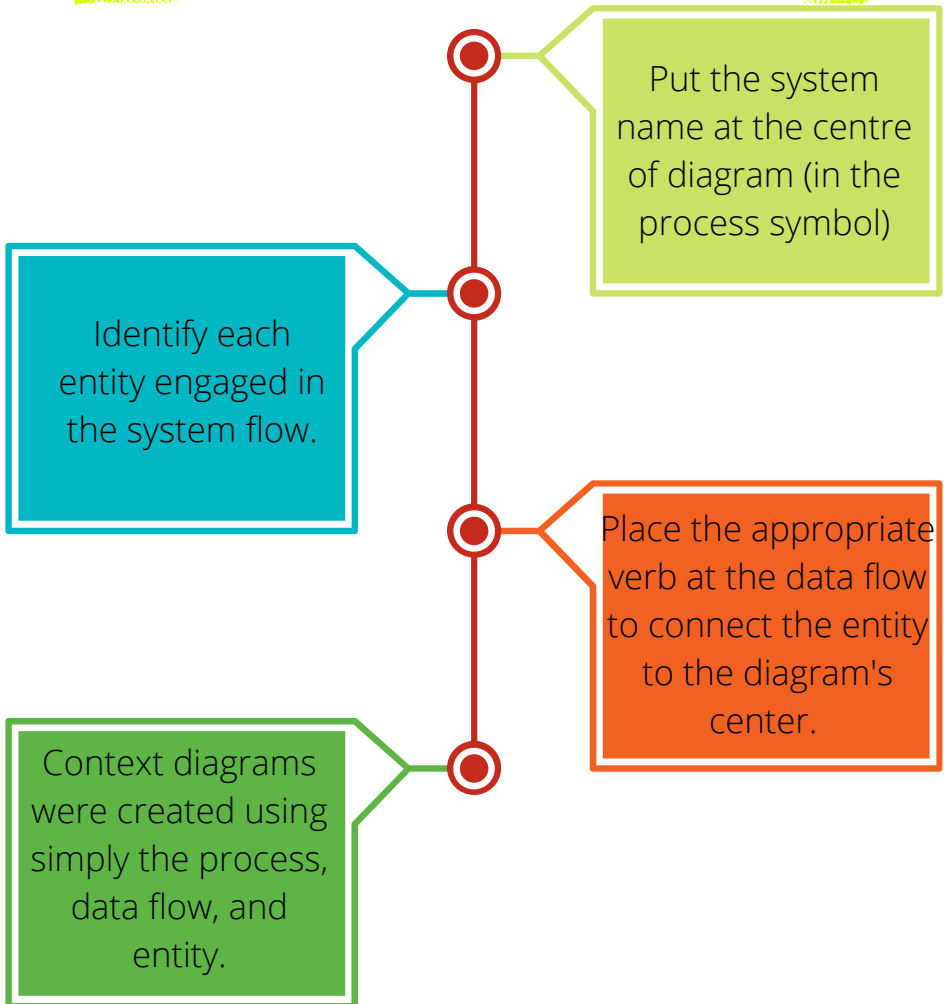
Let's understand the rules and standards for drawing a context diagram before we start to draw it.

In the context diagram, label the process with the name of the information system.

Each set of symbols should use unique names.



**At the centre of your diagram, place the project or product you want to contextualise. At this point, you must also determine the flow and processes that should be included within this boundary.**



## CONTEXT DIAGRAM'S EXAMPLE

## EXAMPLE

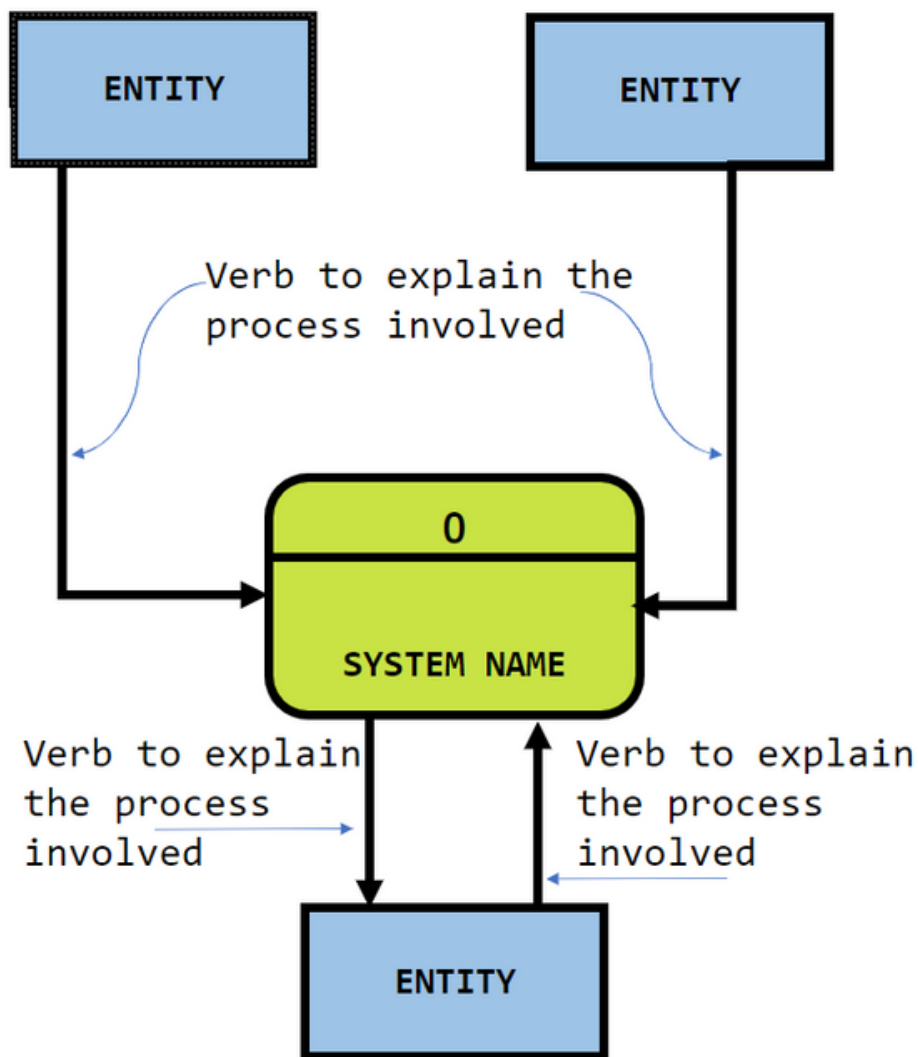


Figure 3.1



**Draw a context  
diagram for a  
library system in  
PUO**

**THINK**

What is the system  
name?

Who involved (entities)?

What is the process  
involved?

What is the process  
reference number?





What is the system name?



**PUO Library Management system**

Who involved (entities)?



**Student, Librarian and Administrator**

What is the process involved?



**Borrow books, record borrowing transaction, view report**

What is the process reference number?



**0**

# Answers



## DRAW A CONTEXT DIAGRAM

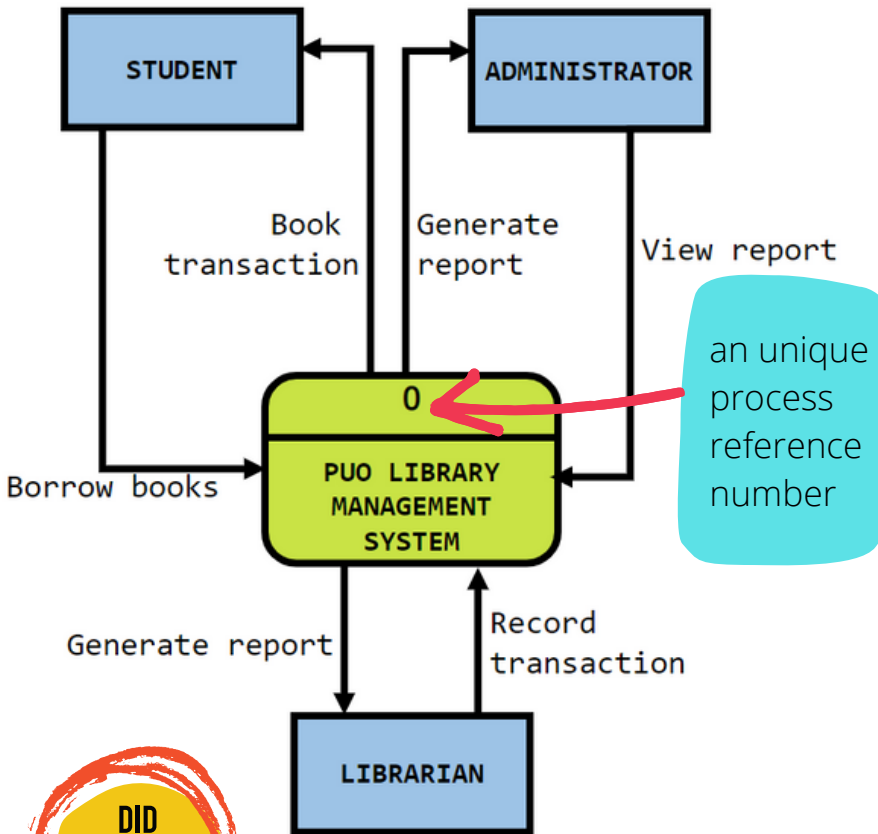


Figure 3.2

**DID YOU KNOW?**

In this step, there is no **data store** involved.

You must include the **system name** in the process.

Note that on page 18, the PUO LIBRARY MANAGEMENT SYSTEM process is at the centre of the diagram, and three entities surround the process.

The outgoing data flow for the **STUDENT** -borrow books- to provide book borrowing details to the system. Whereas the incoming data flow -book transaction- to send the book transaction details to **STUDENT**.

The **LIBRARIAN** entity incoming data flow –generate report– that is, receiving book transaction records report that shows the book borrowing date, book title, book author, ISBN, and quantity. The outgoing data flow -record transaction- is to store the book transaction record such as book borrowing date, book title, book author, ISBN, and quantity.

Finally, the outgoing data flow -view report- for the **ADMINISTRATOR** is to send a viewing report request. The incoming data flow -generate report - then responds to the view report request. Basically, the report contains the book's transaction records. It is generated based on the report type summary, exception, and detail.



## STEP 2 - DRAW LEVEL 0 DFD

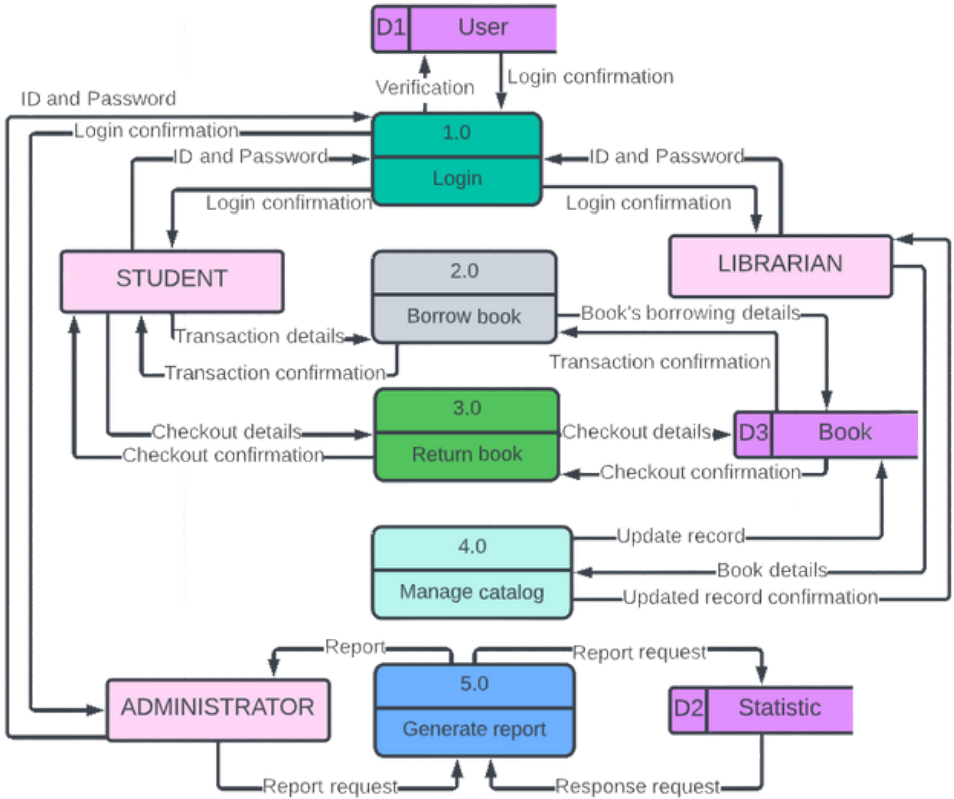


Figure 3.3

**QUESTION 1**

**Explain in your words the interaction of entities, process and data store in the above Level 0 DFD.**

**SCAN FOR ANSWER**



## STEP 3 - DRAW LOWER DIAGRAM DFD

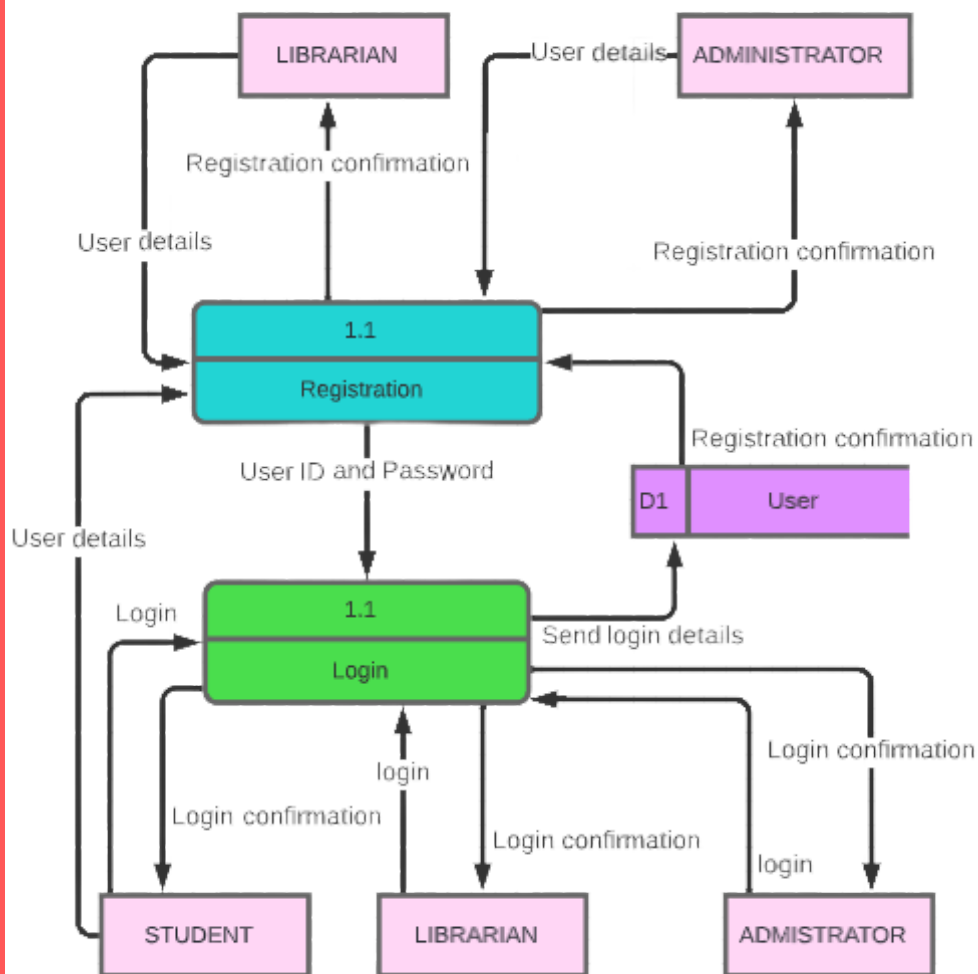
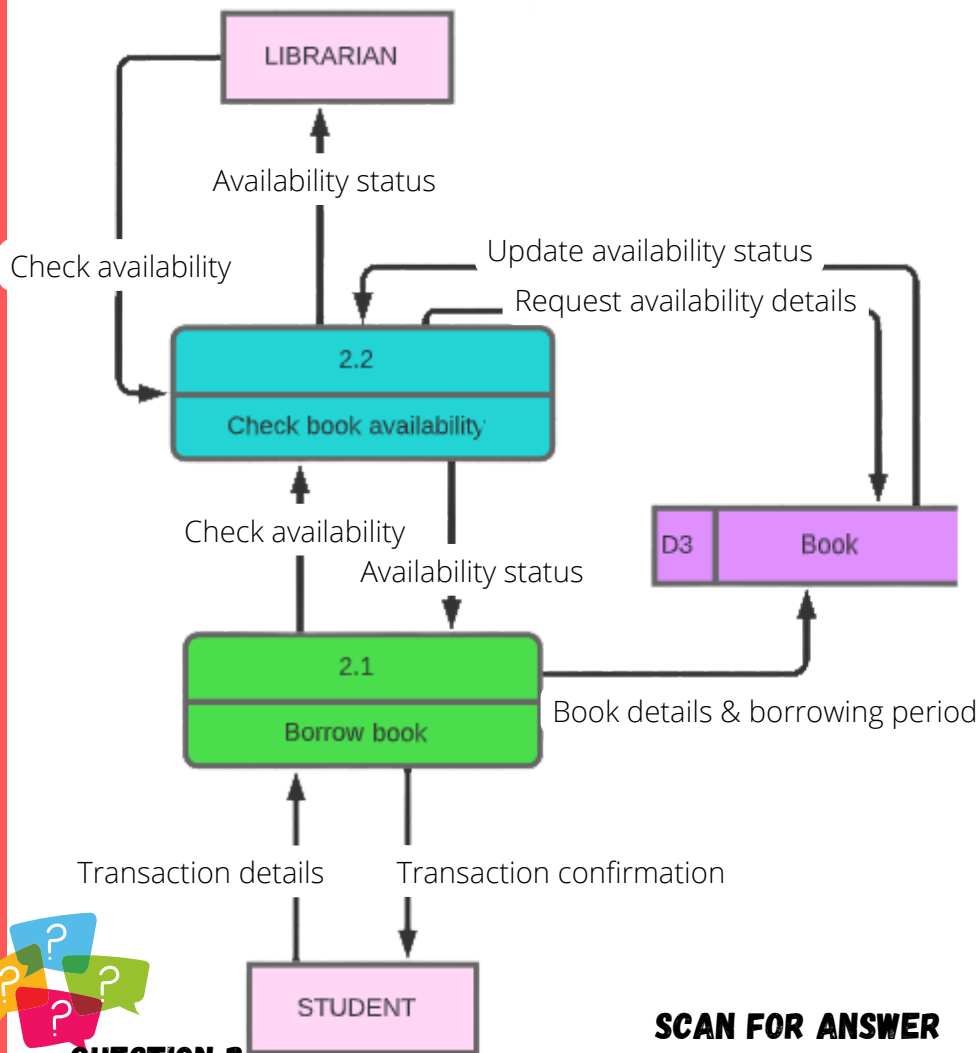


Figure 3.4

## STEP 3 - DRAW LOWER DIAGRAM DFD



## QUESTION 2

**Draw Lower Level Diagram DFDs for:**  
 (a) Return Book,  
 (b) Manage Catalog  
 and  
 (c) Generate Report

Figure 3.5

SCAN FOR ANSWER



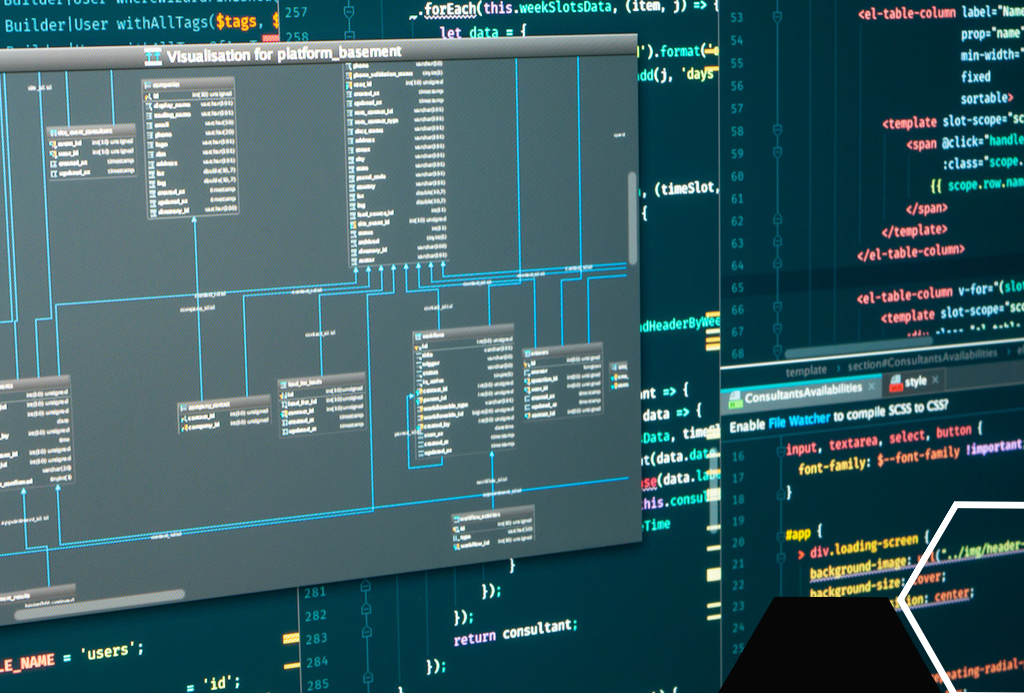
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