## Introduction:

A Data Flow Diagram (DFD) is a widely-used tool for visualizing how information flows within a system. In our current project for System Analysis and Design, we will be developing a DFD for CUET Medical Center. The DFD helps to show how data enters and exits the system, how it is modified, and where it is stored. The main goal of a DFD is to outline the system's scope and boundaries, providing a clear visual representation of the system's functionality. It also serves as a communication tool between systems analysts and all stakeholders, acting as an initial step toward redesigning the system. In DFDs, external entities are shown as rectangles, processes as circles, and data flows as arrows, with the direction of the arrow indicating the flow of information.

Context diagrams offer a high-level, simplified view of a system. They give a broad overview and help define the system's boundaries, scope, and its interaction with external components like stakeholders. DFDs can be divided into two categories: logical and physical. A physical DFD focuses on the actual business activities and operations, while a logical DFD is more concerned with the implementation details of the system. Both types of DFDs depict how information flows within a system, but a physical DFD explains "what" the system does, while a logical DFD explains "how" it works. Physical DFDs are typically easier for non-technical people to understand, whereas logical DFDs can be used to represent an existing system or showcase the design of a new one.

## Objectives:

The main objectives of this Data Flow Diagram (DFD) report for "CUET Medical Center" are as follows:

1. To develop a clear and visual model illustrating the flow of data within the organization.
2. To provide an overview of the system, showing how it interacts with external entities such as stakeholders.
3. To improve communication by presenting the data flow in a straightforward and easy-to-understand way, fostering enhanced collaboration and decision-making.
4. To identify areas where the system can be optimized for better efficiency and performance.

## System Development Life Cycle (SDLC):

SDLC stands for System Development Life Cycle, which is a structured approach used in the software industry to guide the planning, development, deployment, and maintenance of software systems. SDLC provides a systematic process for creating high-quality software by

following a series of well-defined phases and activities. This methodology ensures that software projects are well-organized, efficient, and capable of delivering reliable, robust software solutions that meet the specified requirements. It serves as a framework for managing software development from the initial idea to its final implementation and beyond.

The goal of SDLC is to create systems that progress through each clearly defined phase within set timelines and budget constraints, similar to how products are made on an assembly line. These systems must meet or exceed customer expectations and requirements. The nine phases of SDLC are:

1. System Requirements Determination.
2. System Requirements Specification.
3. Feasibility Analysis.
4. Final Specifications.
5. Hardware Study.
6. System Design.
7. System Implementation.
8. System Evaluation.
9. System Modification.

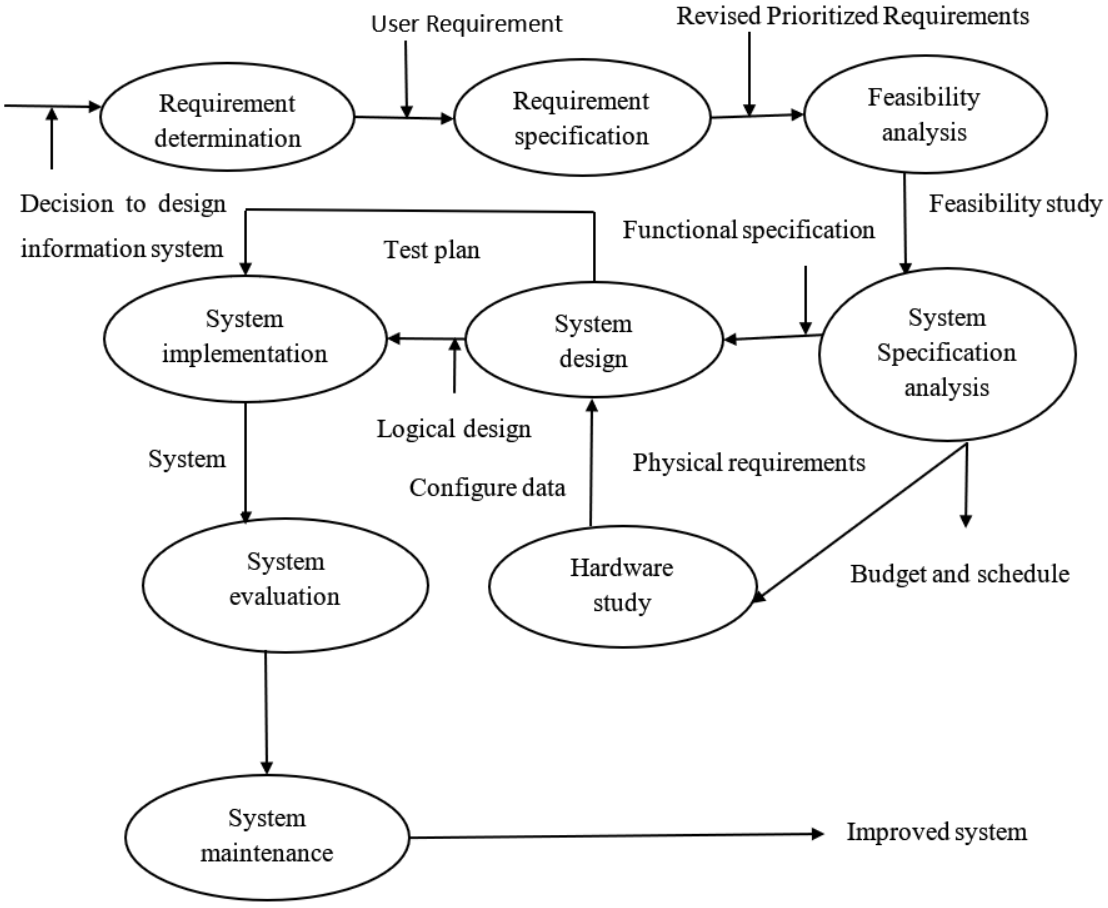


Figure 01: System Development Life Cycle

## Data Flow Diagram (DFD):

A Data Flow Diagram (DFD) is a visual tool used to map out the flow of information within a system. It illustrates how data enters the system, how it is processed, and how it exits. By outlining these interactions, DFDs help in understanding how a system handles and transforms data, making them essential in the analysis and design of information systems.

Main Elements of a DFD:

1. **Processes**
    - Depicted using circles or rounded rectangles.
    - Represent the operations or functions that process input data to produce output.
2. **Data Flows**
    - Shown as arrows.
    - Indicate the movement and direction of data between components (like processes, data stores, and external agents).
3. **Data Stores**
    - Illustrated with open-ended rectangles or two horizontal lines.
    - Represent locations where data is held for future use or processing.
4. **External Entities**
    - Drawn as rectangles.
    - Refer to users, systems, or other actors outside the system that provide input or receive output.

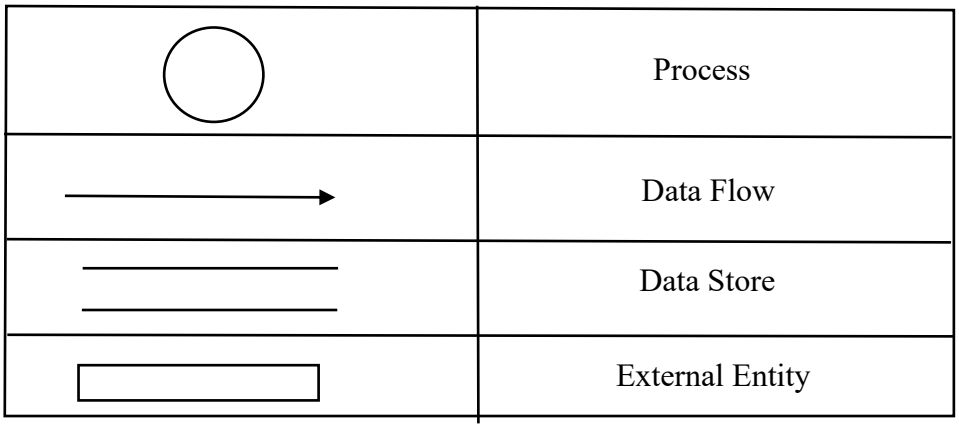


Figure 02: Symbols used in data flow diagram and their meanings

## Context Diagram:

A context diagram is a visual tool that shows the high-level interactions between a system and its external entities or factors. It provides a clear view of the system's boundaries and how it connects with other entities, such as users, external systems, or organizations. Typically, a

context diagram is represented as a single diagram and serves as the top-level view within the hierarchy of Data Flow Diagrams (DFDs). This diagram helps stakeholders understand the system's environment, visualize how data flows into and out of the system, and gain a comprehensive understanding of the system's scope and boundaries. Below is the context diagram of our system.

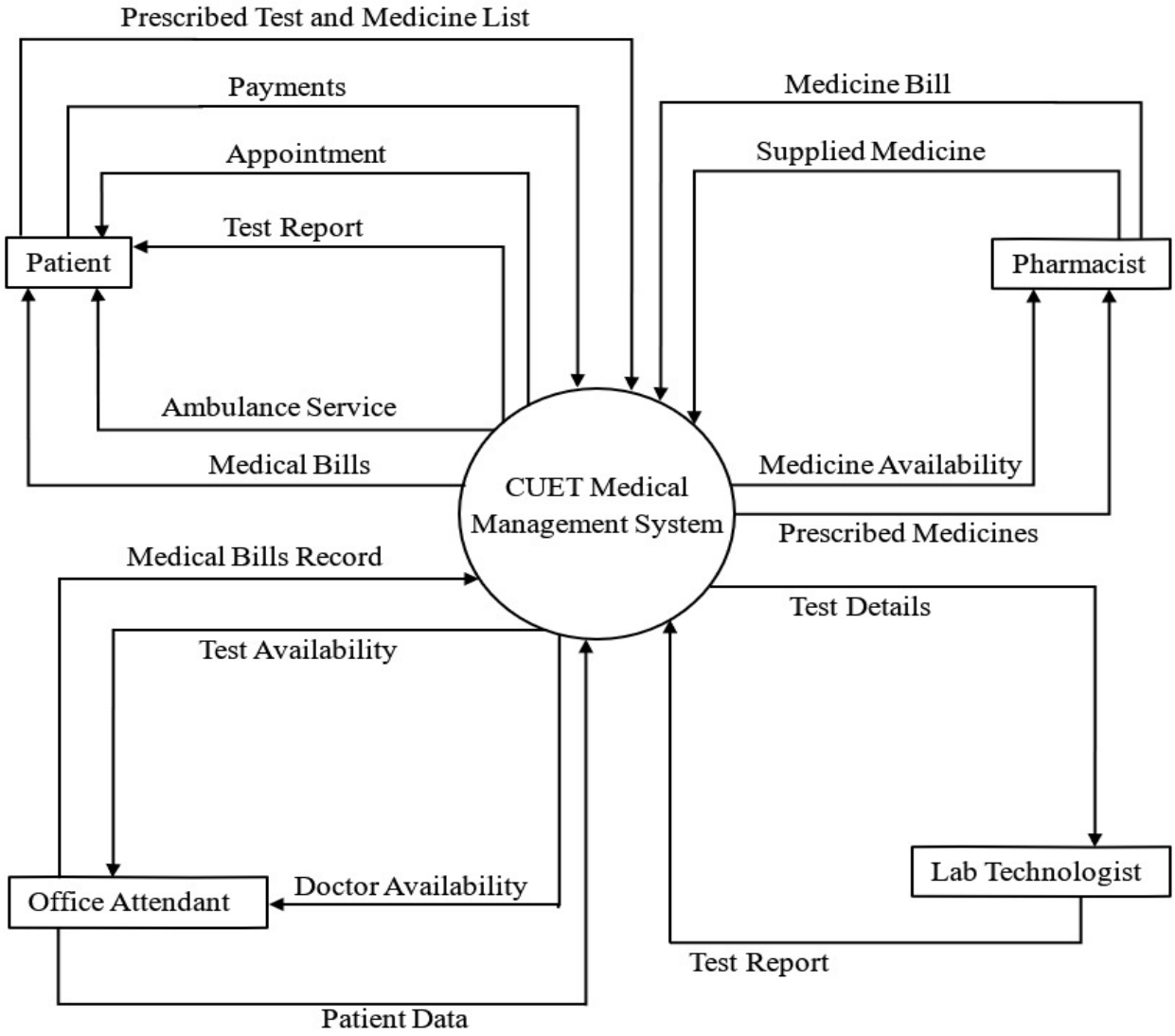


Figure 03: Context Diagram of CUET Medical System Management System

In the context diagram of CUET Medical Center Management System, we have four types of users. They are-

1. **Patient:** A patient can book an appointment of a doctor, get ambulance service, medical test reports, and the corresponding bills. A patient, who is not a student of Chittagong University of Engineering and Technology, must make payments for the mentioned services. The payments made by the patients is stored in the

system server. A patient also provides the medical test list and medicine list, prescribed by the doctor, which is later used by the office attendant, pharmacist and lab technologist.

2. **Office Attendant:** An office attendant is primarily responsible for collecting a patient's medical bills, fixing an appointment, and generating test receipt of the patient. He also inserts the patients details in the system's server. So, for performing these activities, he gets test list and doctors availability list from the system, and stores patient data and collected medical bills into the system.
3. **Pharmacist:** A pharmacist gets the prescribed medicine list and checks the medicine availability from the system. He also collects the medicine bills and gives the medicines, and finally adds these data into the system.
4. **Lab Technologist:** A lab technologist gets the medical test receipt and performs the test. Then he uploads the test report into the system.

## Logical and Physical DFD:

Data Flow Diagrams (DFDs) are divided into two categories: Logical DFD and Physical DFD. A Logical DFD focuses on outlining the types of operations performed on data and the overall system design. It shows how data flows and how processes are related, without specifying who carries out the tasks. This type of DFD helps in understanding the system's operations and the logical relationships among its components.

In contrast, a Physical DFD highlights the individuals or entities responsible for carrying out the operations within the system. It illustrates the actual flow of data and materials, providing a more detailed view of how the system functions in practice. Physical DFDs are usually created during the information-gathering phase and are useful in capturing the real-world aspects of the system. When it comes to sequence, it is often better to develop a Logical DFD before a Physical DFD to ensure that the system's physical elements are considered first.

## Logical data flow diagrams:

### 1. Logical DFD of Reception Section

This data flow diagram shows how the front desk of CUET Medical Center manages patient appointments, payments, and ambulance requests. The process begins when a patient provides their personal details and books an appointment. After checking the doctor's availability and, if available, confirms the booking and records the patient's details. After booking, an invoice is generated, and payment is collected from the patient. A bill receipt is then given to the patient, and the payment details are stored. If an ambulance is needed,

checking for available ambulances process is initiated after receiving relevant information such as the location and reason. Once an ambulance available is found, it is dispatched, and the details are recorded. All important information like doctor schedules, patient records, bookings, payments, and ambulance logs are stored in separate data stores to keep the system organized.

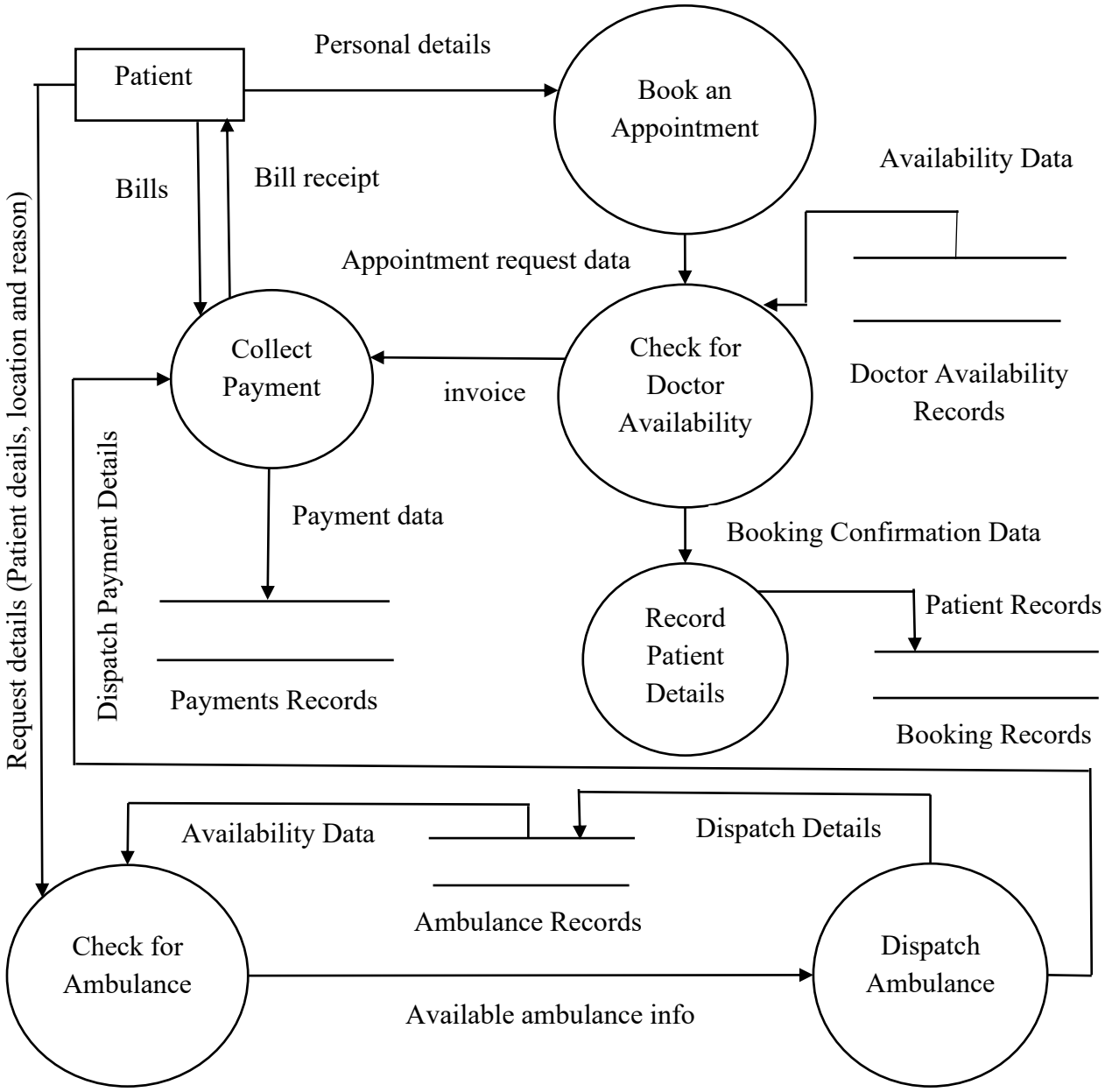


Figure 04: Logical data flow diagram of reception section

**2. Logical DFD of Medical Test Section**

The diagram illustrates the flow of a patient test system through a Logical Data Flow Diagram (DFD), detailing the process from the initial prescription to the final test result. It begins with the patient providing a prescription to initiate the test. The system then checks the test availability of the tests mentioned in the prescription and generates a test list. If

tests are available, the system updates payment records, issues bills, and generates test receipts for the patient. After payment, the test is performed, and a test report is created. The system then allows for the search and update of the test results, which are stored with the patient's details. This cyclical process enables continuous updating of test results, bills, and records, ensuring all data is properly managed throughout the procedure.

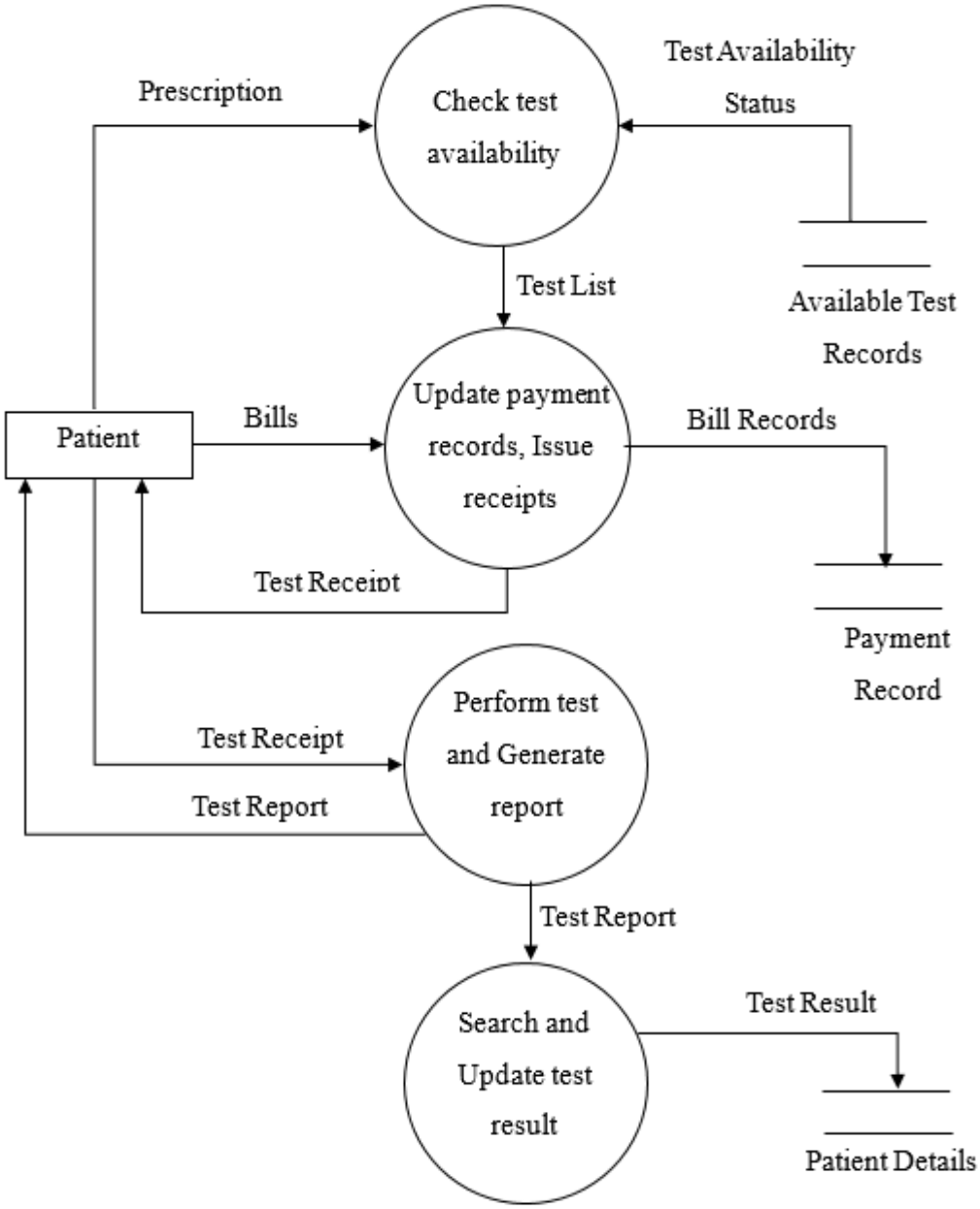


Figure 05: Logical DFD of Medical Test Section

### 3. Logical DFD of Medicine Management

The Logical Data Flow Diagram (DFD) of the Medicine Management outlines three core processes: Check availability and cost, Generate and collect bills, and Update stock and payment. The system interacts with a single external entity, the Patient, and utilizes two key data repositories: the Bill repository and the Medicine repository. The workflow begins

when a patient presents a prescription, which is then processed to verify medicine availability. Once confirmed, medicine bill is generated and given to the patient. After collecting the bills from the patient medicine stock is updated in Medicine repository and securely stores all payment records in the Bill repository for future reference and reporting and the medicine is dispensed to the user. This structured flow ensures efficient medicine dispensing, accurate financial tracking, and real-time inventory management.

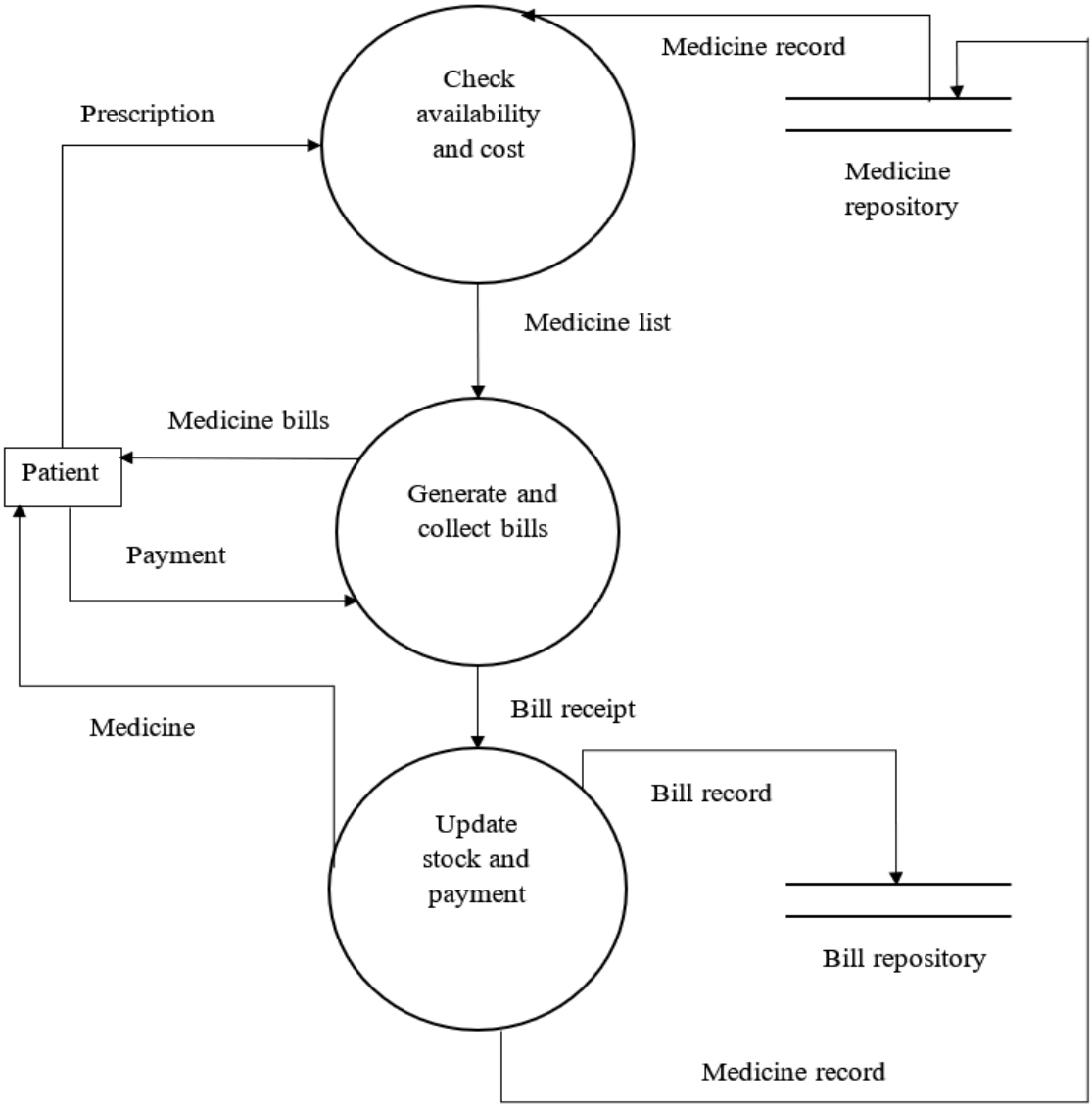


Figure 06: Logical DFD of Medicine Management

## Physical Data Flow Diagrams:

### 1. Physical DFD of Reception Section

This data flow diagram describes the operations of the Reception Section at CUET Medical Center, focusing on appointment booking, payment processing, and ambulance scheduling. The process begins when a patient provides personal details to the system.

Within the system, the office attendant checks doctor availability, confirms the appointment, and records the patient's information.

Once the appointment is confirmed, a bill is generated, payment is collected by the office attendant, and a receipt is issued to the patient. The payment data is stored in the appropriate records.

If an ambulance is required, the patient submits a request through the system. The office attendant then checks ambulance availability and dispatches an ambulance if available.

All essential data including doctor schedules, patient records, bookings, payments, and ambulance dispatch information is stored in dedicated data repositories to ensure efficient and organized management.

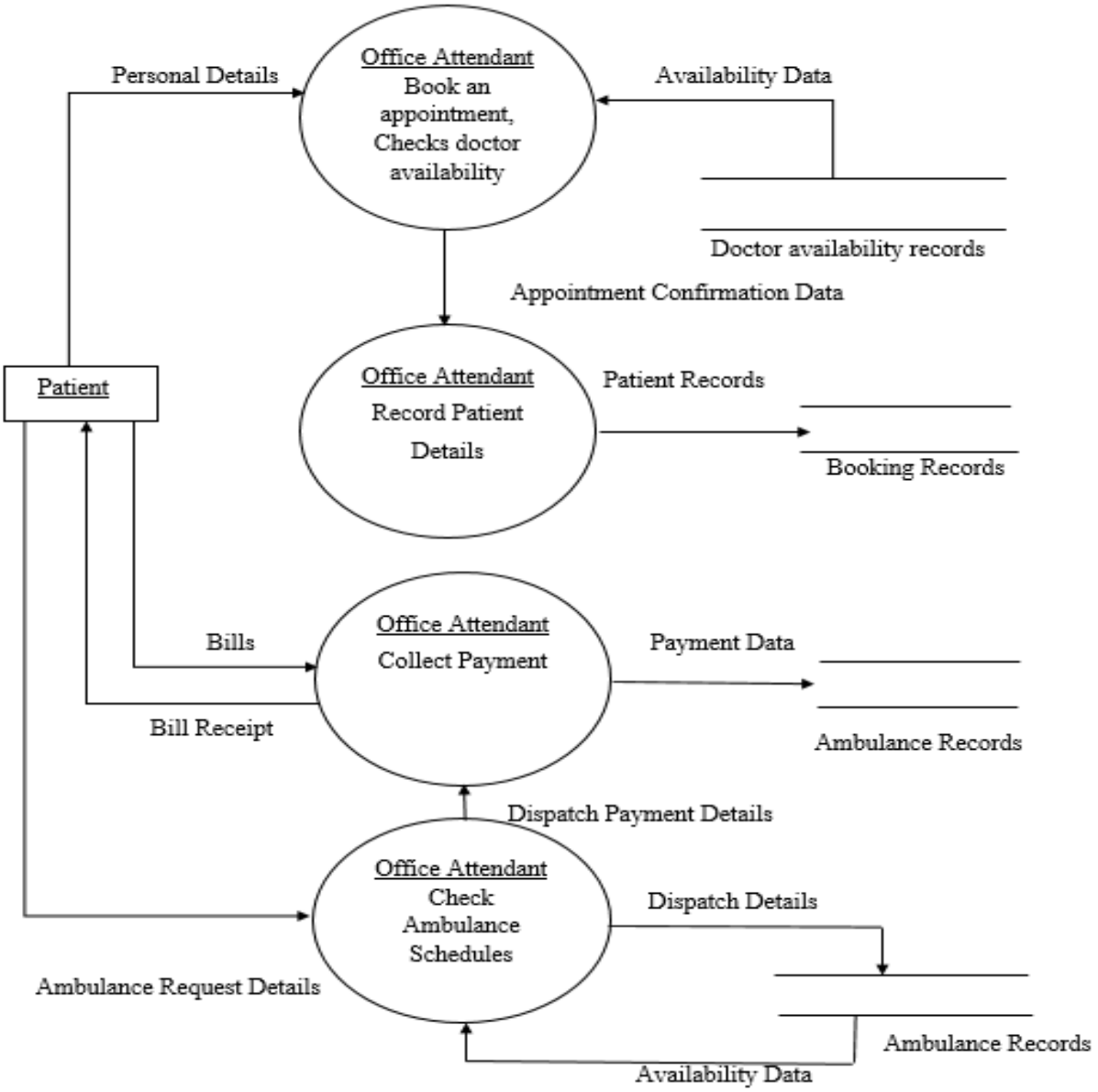


Figure 07: Physical DFD of Reception Section

## 2. Physical DFD of Medical Test Section

The Physical Data Flow Diagram (DFD) shows the steps involved in the patient's medical test process, focusing on the interactions between the patient, office attendant, and lab technologist. Initially, the patient submits a prescription to the office attendant, who checks if the requested test is available. If the test is not available, the office attendant issues a referral to the patient, directing them to get the test done at another facility. If the test is available, the office attendant collects the required payment from the patient, updates the Payment Records, and provides a Test Receipt to the patient. This receipt acts as proof of payment and is required by the lab technologist to perform the test. Once the patient provides the Test Receipt, the lab technologist verifies it before conducting the test. After performing the test, the lab technologist generates a Test Report, updates it with the patient's details in the system, and provides a copy to the patient. This process ensures all steps are properly documented, and the patient's medical test is conducted accurately.

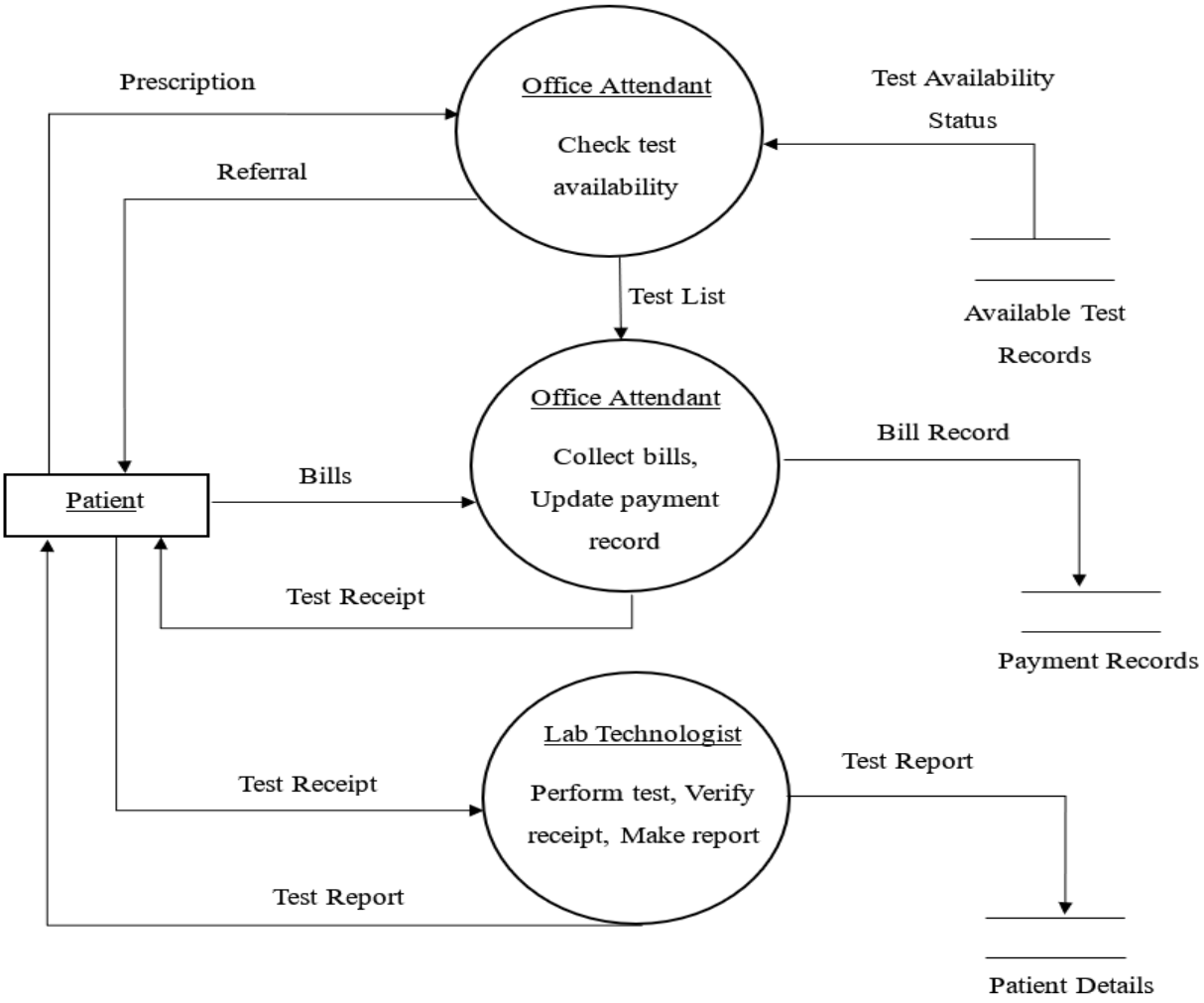


Figure 08: Physical DFD of Medical Test Section

### 3. Physical DFD of Medicine Management

The Physical Data Flow Diagram (DFD) for the Medicine Management captures the operational workflow involving the Pharmacist, who executes three key processes: Check availability and cost, Generate and collect bills, and Update stock and payment. The system interacts with a single external entity—the Patient—and relies on two critical data storage components: the Medicine repository and the Bill repository.

The process initiates when a patient submits a prescription. The pharmacist first verifies medicine availability in the system. Upon confirmation, bill is generated for payment. Following the transaction, the system automatically updates the medicine stock in Medicine repository to maintain accurate inventory levels and dispense medicines. Simultaneously, all payment details are securely recorded in the Bill repository for audit trails and reporting purposes. This streamlined workflow ensures efficient medicine distribution, precise financial documentation, and real-time stock management, enhancing overall operational reliability.

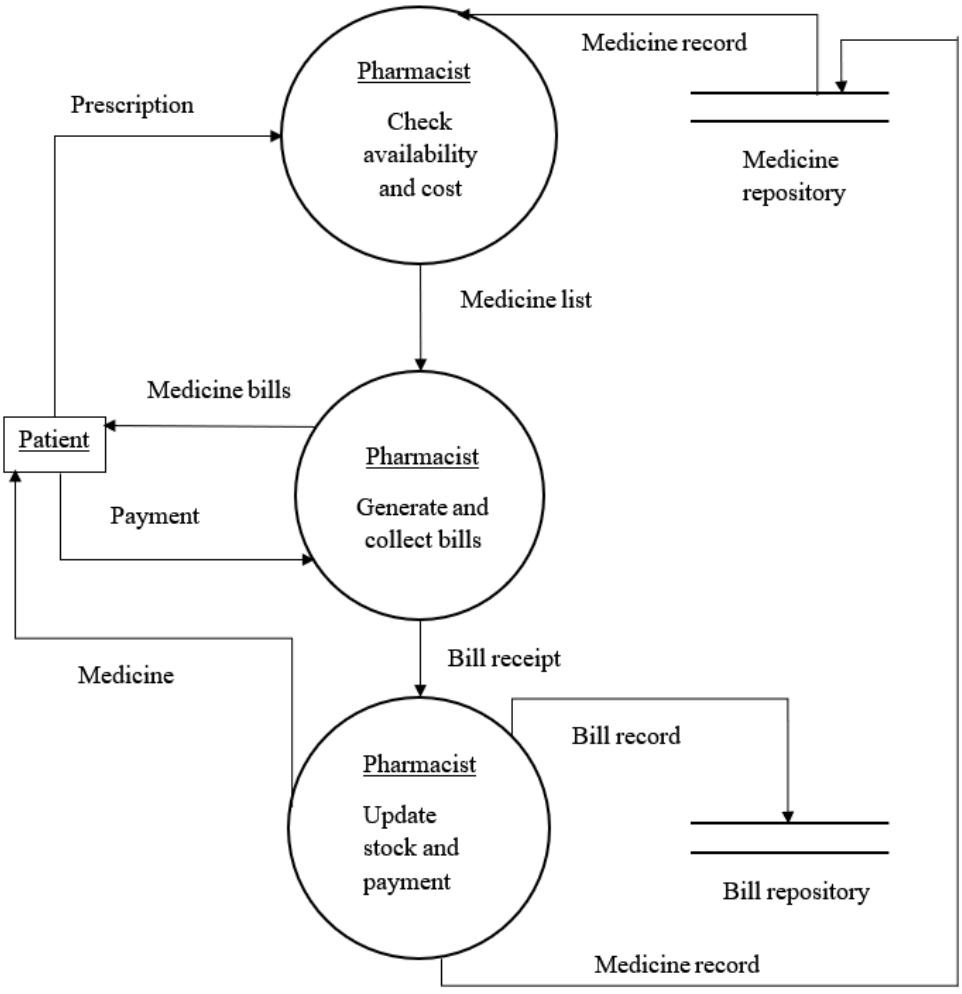


Figure 09: Physical DFD of Medicine Management

## Validating The Data Flow Diagrams:

**Rules for drawing DFD**:

- Each process should have at least one input and an output.
- Each data stored should have at least one data flow in and one data flow out.
- Data stored in a system must go through a process.
- All processes in a DFD go to another process or a data store.
- Data can flow from
  - external entity to process
  - process to external entity
  - process to store and back
  - process to process
- Data cannot flow from
  - external entity to store
  - store to external entity
  - store to store
  - external entity to external entity

## Process Description:

### 1. Appointment Booking

Patients can request appointments, which are managed by the office attendant based on doctor availability. The system keeps track of patient details, time slots, and confirms the booking accordingly.

### 2. Ambulance Request Handling

When an ambulance is required, the system allows the office attendant to record the request and dispatch the ambulance based on availability. The patient's location and emergency details are stored for tracking.

### 3. Medical Test Management

If a patient requires diagnostic tests, the office attendant checks the test availability. If not available, a referral is issued to an external facility. The system logs test requests and their completion status.

### 4. Medicine Dispensation

Prescribed medicines are issued to patients from the medicine stock. The office attendant records the transaction, ensuring that the patient's medicine history is maintained.

**5. Medicine Stock Tracking**

The system monitors the inventory of medicines. It logs stock levels, tracks which medicines are dispensed.

**6. Doctor Availability Check**

Before confirming any appointment, the office attendant checks if a doctor is on duty, based on the roster. The system helps in identifying available doctors for a given time or day.

## Conclusion:

In this report, we have given the overview of the CUET Medical Center first showcasing the interaction between external entities such as- Patient, Office Attendant, Pharmacist and Lab Technologist with the system. Then we have provided both logical and physical data flow diagrams of each section that helps to show what is happening and how it is happening and who is responsible for these activities.