Klinify IT Solutions:
A one-way solution for clinics

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System Analysis and Design

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1.0 Introduction

We were given this assignment to learn the step by step activity to develop the information system that suits best for the field that was provided for us to choose from. Without hesitation, we chose healthcare services as our field to develop an information system for, is because it gives us the opportunity to expand our horizons towards different fields of information system knowledge and background.

1.1 Problem Statement

Our group chose the field of healthcare services because it is one of the most important field that absolutely needs an information system. Without an information system, physical records would be used and be a hassle for doctors and nurses to fill up and go through when needed to search for previous patient records. Furthermore, to fill up the records of each patient's details and medical record manually would prone to human error, hence causing the dissatisfaction of the patient.

Information system is needed to reduce complications, it will help alleviate the problems and make the healthcare services run smoothly and help the doctors and nurses to have a systematic workflow.

1.2 Objectives

- Increase integrity and efficiency

In clinic management system, helps to secure and back-up data. This can ensure consistency of data because staff can update and delete the data easily. The management system also reduces hospital operating cost by encourage paperless.

- Improve business intelligence

Enhancing your patient's care experience to deliver better care for the patient. Identify and actively reach out to patients who are due for follow-up case

1.3 Scope

- Develop a change from manual system to computerized store management system therefore provide a better co-ordination between staff and doctor and communication between staff and patients.
- Easy to add, modify, delete and update patient's personal information and treatment records instead of changing or throwing away endless paper document.
- Easily keep data saved for example keep another copy of all the information and save it as a backup therefore if any error occurs, a backup copy of information available for the staff to keep track with.

Registry

Get Patient information and check patient details. If there is new patient create new Patient. If there is existing patient, then get appointment request details.

Finance

Manage all the payment for the treatment and medicine fees.

Staff

Manage all the appointment as create new appointment, update appointment schedule, check appointment slot and cancel appointment.

Patient

Will be the rejecter of the system.

Medicine

Will be given to the patient according to their treatment and needs.

Supplier

Will provide the medicine.

2.0 Company Description

We carried out this assignment with the end goal of learning the usage of system analysis and design in a company, in mind. We are a digital service provider company in the healthcare field called Klinify IT Solutions Sdn Bhd. Our company's purpose is providing world-class digital solutions to help clinics around the region to manage their clinical operations in a seamless and hassle-free way. Now focused on a few selected supporting clinics in Malaysia, with over 10 doctors and staffs actively using our system, with 24/7 help service.

Klinify IT Solutions is based in Malaysia itself, started up by a team of Unitarians, led by See Yu Siang and his team. The goal was simply to ease off a factor of stress that the clinic may or may not have the experience to deal with, which is IT services. We aim to be a reliable service for the clinics to rely on, with plans to expand the company to government or private hospitals and adding more features to the system.

2.1 History

As stated above the company was started by a group of students, See Yu Siang as project leader guided the team towards greatness into helping healthcare facilities that needed technical support or finance. With many discussions held through online communication software such as discord, and in gatherings to finalise a plan.

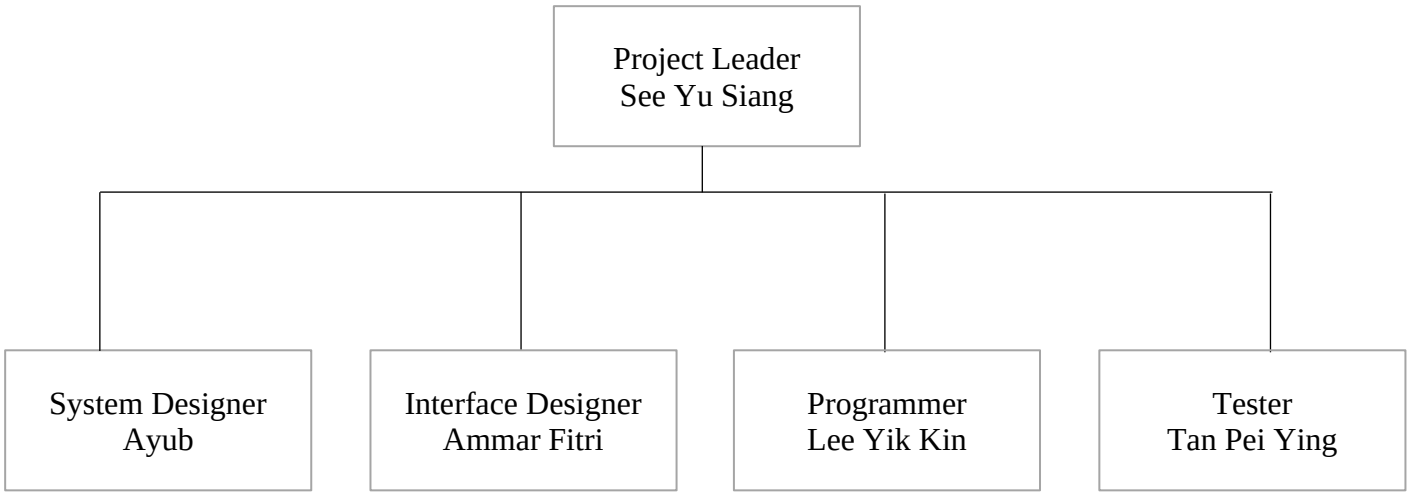
2.2 Mission

- To ease the workflow of doctors
- Easier to access & manage patient data

2.3 Vision

- To be the leading digital service company for clinics and hospitals all over Malaysia

2.4 Klinify's Organizational Chart



3.0 Gantt Chart

Months / Project Phases	1 (5/9)	2 (12/9)	3 (19/9)	4 (26/9)	5 (3/10)	6 (10/10)	7 (17/10)	8 (24/10)	9 (31/10)	10 (7/11)	11 (14/11)	12 (21/11)
Planning												
Design												
Coding												
Testing												
Delivery												

4.0 Project Overview

This project aims to help clinics that have complications with understanding latest technology, loads of paperwork to be done by hand or lack the budget to get a system to do so. Our system is to provide clinics to have a systematic and smooth system that will assist them in their daily activities and management. The system must alleviate tasks and make operations less tedious for staffs and doctors. The system also needs to be simple enough for the staffs and doctors to learn as the time it takes to learn the system will impact their own work thus, having a system that is easy to learn will be beneficial for them.

Nowadays, some clinics are still sticking with their traditional ways of handling patient data and the management of the clinic by hand, which may cause numerous blunders due to human errors such as typos or laziness. The environment as such would cause a hassle for the clinic manager and working staffs, to handle every paperwork and patient's records with their bare hands, it would be time-consuming and tiring for a person to do so. This is where our system is implemented to help and reduce these workloads as much as possible, with its features such as to add or modify patient records, and its simplicity to arrange patient schedules to appointed on duty doctors, the system is set to satisfy its objectives that are to increase the integrity, efficiency and business intelligence of the clinic.

Additionally, for our team to fully implement the system to operate well, we have planned and scheduled every step of the development cycle to near perfect and having contingency plans in case of any mishaps. The schedule of each development stages is managed by the project leader, and every defect or misinformation is to be quickly resolved and moved on to further developments. Although, despite the lack of insight about the clinical environment, it is a constraint for the project since the team has no knowledge on how a specific clinic would operate their regular procedures or activities, but is seen as a challenge to be overcome as more research will be done to satisfy our targeted users.

Our system will fulfil the requirements that are needed to achieve a well-balanced system that will aid in making the clinic's management with no problems and complications. The system will also be made with ease of use in mind and that it will not take as much time to learn the system so that it will not interrupt the workflow of the staffs and doctors.

4.1 Recommendation

The main recommendation of the system will be focused on ease of use. This is because clinics are always busy with their daily activities that learning a new system will take a huge toll on their workflow and might jeopardize their tasks. The new system ensures that the time taken to learn the system will not be as much and will even save time once implemented and learned.

Next, the system will focus on detailed information yet simplistic designs for easier and comforting use by the staff and doctors. This is because looking at a page full of words might be troublesome and tiring for them to look at. With the new system, we intend to put in as many useful information as possible for the users while also having a non-complicated design to ease the browsing experience of the user.

5.0 System Description

5.1 Alternatives

The alternative system configuration proposed is MySQL, being that it is an open-source relational database management system that fits our plan, but it would be extra work for the team and the users. On our side, the work of programming and designing is to be doubled since we would have to manually program and design our interface via Java, PhP, and C++ for the system to work with the database and have a simple interface to navigate. On the user's side, it is required to have XAMPP installed on their work devices and have smooth Internet Connection for the system to function at its fullest.

5.2 System Description

The team of Klinify IT Solutions has proudly announced that the system would be named as Klinify 1.5 as it represents the first version of the system and the 5 team members that created it, hence '1.5'.

Klinify 1.5 is a digital-based clinic management solution that helps clinics to go digital, without interrupting their work processes. It is a database management system (DBMS) that is mainly built focused through Microsoft's own software, Microsoft Access.

See Yu Siang, head of Klinify IT Solutions said that the system is supposedly a game-changer for the healthcare industry that exists right now. Klinify 1.5 will slowly bring aid to clinics all around Malaysia to migrate their old ways writing records on paper to electronic records using personal computer or work devices. Hence, making the digitization of medical information much more efficient, allowing doctors & staffs more time to spend with patients, as it reduces their regulatory burden while ensuring that they have access to the patients' medical records whenever they are needed.

The use of Klinify 1.5 is fairly simple, with its minimalistic UI design and basic functions, it is much easier for its users to adapt and learn. Doctors and nurses can easily access new/old records of patients by logging in with their registered IDs and passwords, the functions that are available are simply, add new records, edit records, delete records and search records. There would be forms and windows popping up for some of the actions that has been made by the user, either to show duplicate data being implemented or to warn the user that a record is being deleted.

Each action will be recorded into the system so that the clinic may keep track of its record history for their clinic evaluation while they can send the history to us for future enhancements aimed to better the system for our users.

Additionally, the system also allows the clinic to manage their patient scheduled appointments, by letting them emend or add new appointments accordingly with the on-duty doctors. So that appointments would not be written down on paper and it would not be mixed up by human error for example, time clashing, redundant appointments or patient losing the appointment papers.

6.0 Feasibility Assessment

6.1 Economic Analysis

In economic feasibility, cost benefit analysis is done in which the expected costs and benefits are evaluated. Economic analysis is used for evaluating the effectiveness of the proposed system. Being that it is tangible, it is measured in Malaysia Currency and categorized in several categories:

1. **Cost of reduction and avoidance.**

Reduce the cost of staff turnover and overtime labour. The system can import patient records and fill out intake form for future uses instead of requiring more admin manually entering all the information. By using the scheduling application, staff can integrate data on past shifts and fulfil current patient needs. Therefore, prevents the situation of unexpected patient volume spike thus, not needing to allocate more temporary hires.

2. **Error Reduction**

Optimize the supply chain for value-based care for example, inventory tracking and eliminating waste. Staff can always check back the previous medical treatment of old patients to ensure the right treatment has been provided and also to prevent any mishaps or errors.

3. **Increase speed of activity**

Advanced appointment bookings and reminders can be digitized not only to increase efficiency but also increase the speed of activity. Reducing the patient's waiting time allowing doctors to provide patient care immediately following the patient's schedule.

4. **Improvement of management planning and control**

The system allows staffs and doctors to monitor the total number of appointments easily, so that their management can arrange their work schedule (available time slot) and at the same time update the staffs monthly work schedule, improving the workflow in the clinic.

5. **Increased Feasibility**

Appointment arranging and patient's record modifying, these two major strong points have already let the clinics operate conveniently. Given that their daily admin work only needs to go through the system.

Cost Benefit Analysis

Cost benefit analysis helps to identify financial benefit, risk and cost associated with the system. In this topic, 2 main benefits are improved which are performance and minimized processing costs. Further cost and benefit are categorized as:

1. **Tangible/ Intangible**

Tangible cost for example hardware cost, salary for system developer, software cost, employee salary, training and support cost. Intangible cost such as customer satisfaction, improved company status.

2. **Direct/ Indirect**

If the proposed system can handle more than 25% transaction compare to the present system, then it is direct benefits. Indirect cost such as insurance, maintenance, electric bills.

3. **Fixed/Variable**

Depreciation of hardware can consider as fixed cost.

Steps to develop a Cost and Benefit Analysis

1. Estimate the development cost, operating cost and benefits.
2. Determine the life of the system
3. When benefits start to accrue?
4. When system become obsolete?
5. Determine interest rate (Realistic low risk investment rate)

Cost for the proposed system (figures in MYR thousands)

Year / Cost Category	1	2	3	4	5
Hardware	30				
Software	30				
Personnel	10	12	14	16	18
Maintenance	0	2	3	4	5
Cost a year end	70	24	17	20	23
Cumulative costs	70	94	111	131	154

Year / Benefits	1	2	3	4	5
From finished report	15	15	15	15	15
Increase in sales	25	35	45	55	65
Benefits at end year	40	50	60	70	80
Cumulative benefits.	40	90	150	220	300

Profit= Benefits- Cost

300,000-154,000 = MYR 146,000

Since we are gaining, the system is feasible

6.2 Technical Analysis

COMPONENT REQUIREMENTS

Computer and Processor
Windows OS: 1.6 gigahertz (GHz) or faster, 2-core. 2.0 GHz or greater recommended for Skype for Business macOS: Intel processor
Memory
Windows OS: 4 GB RAM; 2 GB RAM (32-bit) macOS: 4 GB RAM
Hard Disk
Windows OS: 4 GB of available disk space macOS: 10 GB of available disk space; HFS+ hard disk format (also known as macOS Extended) or APFS Updates may require additional storage over time.
Display
Windows OS: 1280 x 768 screen resolution macOS: 1280 x 800 screen resolution
Graphics
Windows OS: Graphics hardware acceleration requires DirectX 9 or later, with WDDM 2.0 or higher for Windows 10 (or WDDM 1.3 or higher for Windows 10 Fall Creators Update). macOS: No graphics requirements.
Operating System
Windows OS: Windows 10 SAC, Windows 10 LTSB 2016, Windows 10 LTSB 2015, Windows 8.1, Windows 7 Service Pack 1*, Windows Server 2016, Windows Server 2012 R2, Windows Server 2012, or Windows Server 2008 R2. macOS: Any recent macOS
Browser
The current version of Microsoft Edge, Internet Explorer, Safari, Chrome, or Firefox.
.NET version
Windows OS: Some features may require .NET 3.5 or 4.6 and higher to also be installed.
Other
Internet functionality requires an internet connection. Requires for online update for certain software and hardware. Fees may apply.

Technical Risk Factors

Technical risk violation may be one of the most severe cause of failure for a system. Improper application of theory upon engineering the system and inaccurate requirement analysis may exaggerate complex phenomena that is grounded in technological aspect. Maintainability, extendibility and reliability are other technical risk that may appear later in the system development stage. The overall risk rating of the project is relatively low due to the availability of existing resources, easy-to-learn/use system building tool (Microsoft Access) and low hardware and software requirements. Below listed are a few risk factor and description assigned.

Risk Factor	**Description**
Project Size	Number of members on the project team Project duration time
Project Structure	Inability to acquire necessary hardware / software. Hardware or software errors and incompatibilities. (New and old system) Amount of user information in system development effort
Development Group	Familiarity with target hardware, software development environment, tools and operating system Familiarity with proposed application area Familiarity with building similar systems of similar size

6.3 Operational Analysis

Operational Feasibility Studies

Determine whether the proposed system can fulfil the objective that have been identified during problem definition phase.

Process

The current system for the clinics will grant the staffs, doctors and the clinic manager the ability to update all the medical data, patients' information and the patients' appointments schedule very easily and quickly. Since it is a 24/7 update system, it will be very convenient for them to track the schedule changes anytime, anywhere even if they are on leave. The system for the clinic database which is only accessible by the clinic manager, staff and doctors with their own username and password being added in the system, makes it so much easier booking patients through the system which also would help to reduce redundancy of data between staff and doctors compared to endless paperwork.

Evaluation

The system will mainly be beneficial for the staff and physician that are on duty. The system will display all the patient's personal details, appointment bookings, doctor appointed, and previous treatment records, all that information are capable to stay up to date 24/7. It also helps the patients to call in for bookings in advance, instead of waiting at the clinic or call in for a cancellation. Furthermore, there will be a reminder for the admin staffs on upcoming appointment dues, so they can call or text the patient as a reminder of their upcoming appointment. This ensures the patients to believe in the efficiency of the clinic.

Implementation

The system helps from resources both inside and out. When it comes to the clinic manager, they must manage a lot of the medical data entry. The system will help their work more efficient and run a business which is clinical operation paperless. The system is able to link up all of the partnered clinics in a single easy to use system. The system also ensures the security of the patients' records therefore it builds up the trust and the good relationship between the doctors and patients. It also saves the nurse's time by reducing paperwork and allows the doctor to give better care to their patients.

Resistance

When we talk about the resistance of our system, the staff and doctors will be more durable to work with a system that can be used to reduce their work time. It enables them to work efficiently with the ability to view, edit and submit the report of appointments. With access of a calendar showing all the appointments and time slots that are available or taken, it helps the staff to handle the patients without any traffic difficulty since the data is all stored in our database system.

Strategies

Since our new system is created, it will be convenient for both employees of the clinic and patients. The system helps to manage the booking of multiple resources from the same calendar for example the doctors on duty and a time slot at the same time. An appointment reminder is sent out to the patients that are clearly from the clinic with the reference of the patient's name. The system also helps managing patient records making it easy for the employees of the clinic to search up the patient's past visits.

Adapt & Review

The system is designed and made user-friendly for the clinic's staff to use, patients would call in for an appointment, then the staff may key in the appointment into the system with their timeslots and patient's record (X-RAY files may be included), so the doctor on duty would easily follow the timeslots. The system has log system that records every changes in the clinic's database, which cannot be overridden by anyone in order to prevent sabotage by the clinic's staff or any outsiders.

7.0 System Analysis

7.1 System Requirements

Functional Requirements

- The system supports patient appointments and able to modify them. The staffs or doctors can modify or remove the appointment.
- The system supports adding, modifying or deleting new users or doctors into the system
- The system also supports patient records to be added, modified or removed by staffs or doctors.
- The system provides a calendar so the Admin can edit or update the appointment schedules for the patients, while authorized staffs may view the appointments of patients.

Non-Functional Requirements

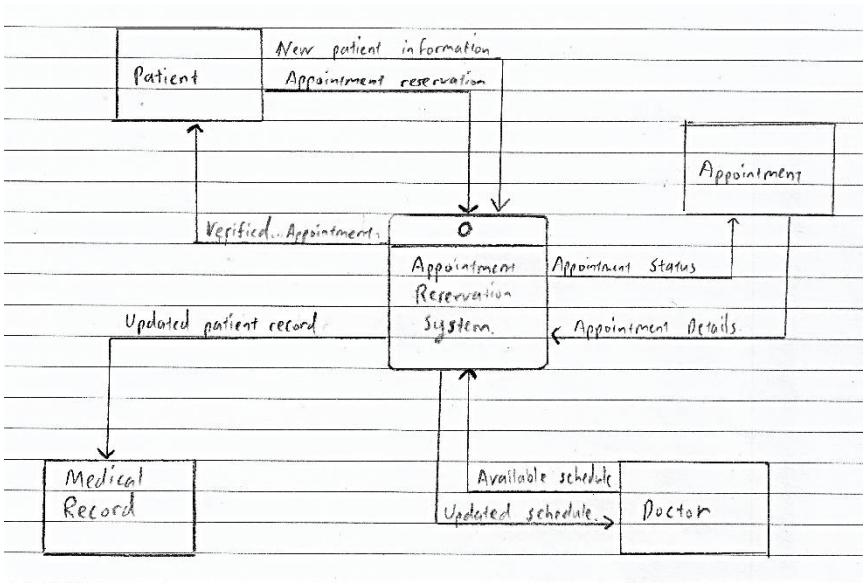
- The system should support all types of operating systems.
- System should be easy to use and navigate through.
- Only authorized user can modify data in the database/records.

Target Users

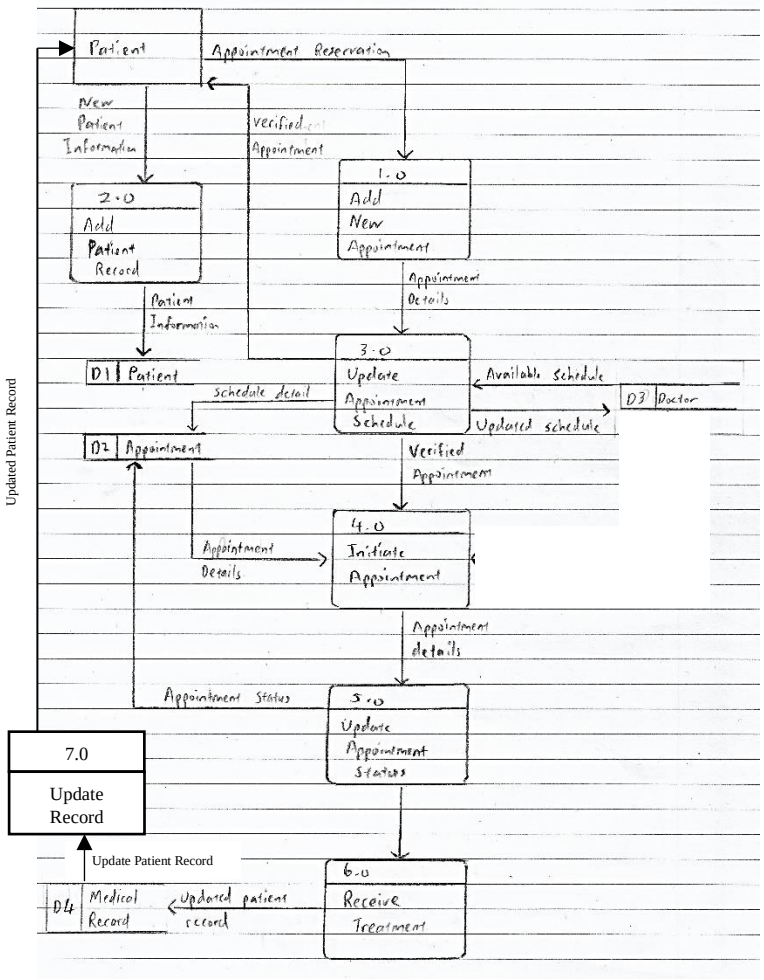
First off, our target users are clinic doctors and staffs that we will partner with, for better helpline service before fully expanding to further horizons. They will be using the system regularly on a daily basis. Next, there are going to be one specific type of user, such as an Admin or the general user as we speak. The admin has the access to control and view every action of the system being used and has the authority to make changes of patient records and patient appointments also being able to make modifications to the doctor's information or add users. The main use of the system is to lessen the burden of clinical staffs and doctors by easing the process of making appointments for patients and, adding or updating patient records. The expectations of the new system will be a bit high since it is a new system that will either replace their old system or be a new addition in their workplace, so expectations of easing their job scopes will be high but they would have to learn the system in order to meet their true expectations from the system. The new system will help the tasks done by the staff and doctors to be more efficient by simplifying the addition or updates on patient records and making it easier to book in patients' appointments. With just these few modifications, it will smoothen the workflow for the staffs, and be more time effective for doctors toward appointments. The users will have to accept the system willingly because it is made to help them in their work, although some may be new to the system but in time, they will surely realize that it is beneficial to them.

7.2 Data Flow Diagram (DFD)

Context Diagram

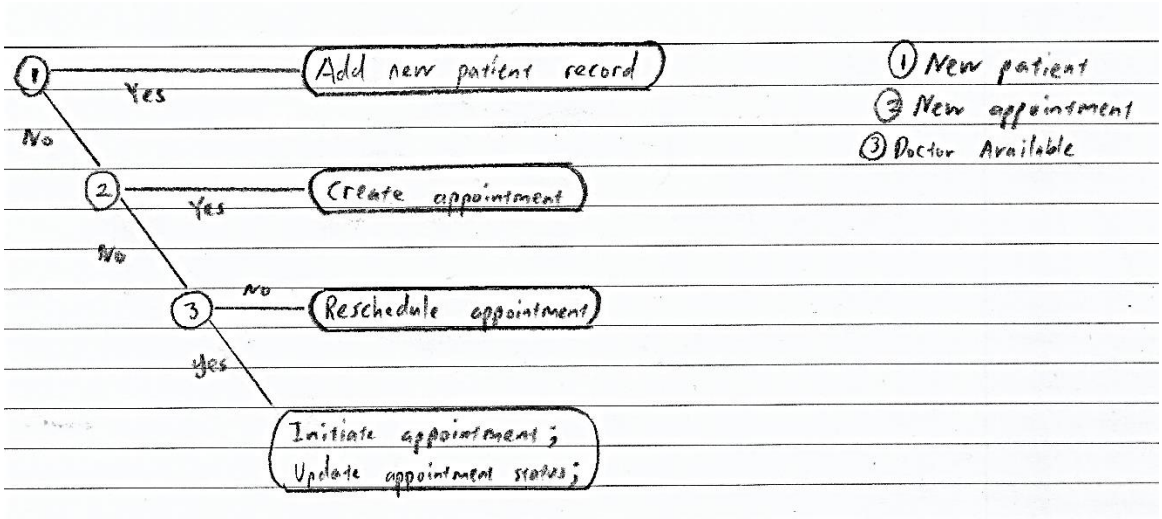


Level-0 Data Flow Diagram



7.3 Logic Modelling

Decision Tree: Appointment Reservation



7.4 Data Modelling

Entity-Relationship Diagram