# **CHAPTER 3**

# **METHODOLOGY**

## INTRODUCTION

This chapter explains the methodology used in this project with the analysis of all its aspects, how the end user will interact with all the data available to him through the application, and how data flow between each of the users and the system to get the best results in terms of timetable. Then, it will address the design of the database and how it fills the database table through which the timetable is created. Finally, the interfaces of the project and how they will be designed so that both ease of use and effectiveness for the user are taken into account, with an explanation of some of them.

## Analysis

### Creating timetable

At this stage, it is analyzed how timetables are created by the university and what steps are taken to make this process as smooth as possible. After checking with the heads of departments and the secretary in the College of Engineering and Petroleum, it was found that the university's timetable is established with the following steps:

1. Determining the study subjects

Each department head determines the subjects that will be studied at each level of his department, except for the first level, where most of the subjects are the responsibility of the college secretary. These subjects are determined according to the study plan followed for each department.

1. Assign lecturers

The head of the department assigns the lecturers to each of the specified subjects according to their capabilities and requests. As previously mentioned, the subjects of the first level are determined by the college secretary, so he is also the one who determines the lecturers for them. In the absence of lecturers from the department for the subject, the head of the department or the secretary of the college may have to send a request to the head of another department to give him a lecturer capable of teaching that subject.

1. Hall distribution

At this stage, the halls are distributed to each group of all levels according to the number of students and the capacity of the hall. Here, the college uses a method to facilitate this process by defining a number of its halls for each department that takes priority over other departments. While keeping the large halls and allocating them to first-level students from all departments, these halls will be at the disposal of the college secretary. In the event of a conflict between the halls, or if the number of students exceeds the capacity of the hall, the head of the department or the secretary resorts to sending a request to one of the other departments to give him one of their halls, if it is. Available according to his needs, or to exchange if there is a group from the other section to fit in the hall.

1. Timing for lectures

At this stage, the timetable begins to form, where the department head or secretary arranges the timetable with the day for each lecture according to the following information:

* Subject
* Duration of lecture
* Lecturer
* Hall
* Group.

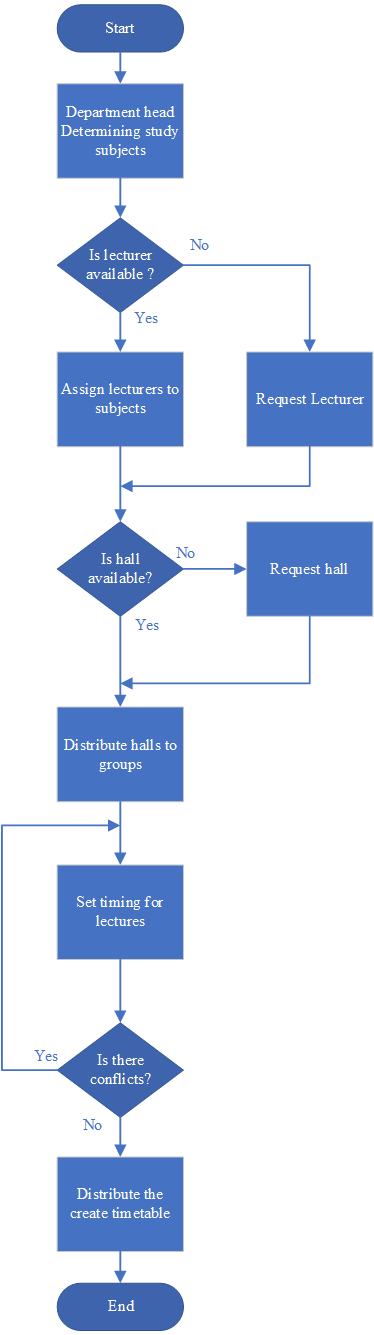
1. Checking for conflicts

The final stage of creating the schedule is to check for discrepancies between schedules created by all departments. This is done by a specific person, and in the event of a conflict, he reviews the sections in which the dispute occurred in order to try to solve the problem either by changing the timing of some lectures or changing the rooms. This process is repeated until a timetable for all departments is produced free of conflicts.

1. Distribution of the created timetables

After the timetable is created then it distributed to the college students and lecturers.

These are the steps followed in each semester by the college in creating timetables for each semester, and in the following figure a simplification of the process in order to make it easier to visualize.



The process of finding conflicts and trying to solve them is done by a specific person.

When assigning a lecturer, take into consideration his requests and capabilities

Figure Manual way to create timetable

### Creating the timetable using the genetic algorithm

After understanding how to create the timetable, here comes the role of the genetic algorithm to convert this process into an automatic process to reduce the time required to produce a timetable and be free of conflicts. The steps used to get the timetable are almost the same. The department head or college secretary has to select the subjects and lecturers for each subject, after which the algorithm starts taking this data and creates the timetable according to the constraints imposed on it. Constraints are divided into two types, hard constraints, which are used to prevent any cases of conflict, and there are also soft constraints, which are used to generate schedules according to some department preferences. Here are some constraints two follow:

Hard constraints:

* The lecturer does not teach two subjects at the same time
* The hall does not contain two groups at the same time
* The group does not take two subjects at the same time

Soft constraints:

* Set the time and day that suits the lecturer
* Don't take too much free time between lectures.
* Schedule practical subjects for the same day

So, to generate a timetable using the genetic algorithm as mentioned earlier, the first few steps are the same as those in the manual method with the difference that the genetic algorithm starts to take the lead after it has the data needed to create the best timetable, and it follow these steps:

1. Determine the study subjects. (manually)
2. Assign the lecturers. (manually)
3. The algorithm distributes the hall and manage the timing for the lectures.
4. The generated timetable is distributed to the college students and lecturers.

These are the steps used to create the timetable using genetic algorithm and to get a good understanding of the concept of it and visualist see the figure.

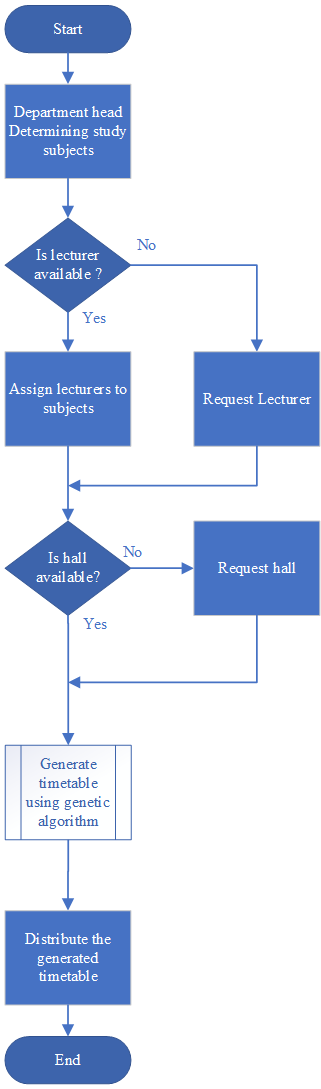


Figure flowchart to generate the timetable using the genetic algorithm

### Users of the system and their use case

From the analysis, you find that the genetic algorithm needs users who give it the necessary data to generate the timetables, and these users are the ones who control the results that the algorithm will give, and they are:

* Admin of the system.
* Head for the department.
* College secretary.

#### Admin of the system

The system administrator will be responsible for operating the schedule generation system within the college campus and will also be assigned to perform some other tasks. Here is his use case:

|  |  |
| --- | --- |
| Use case 1 | Add users |
| Flow |  |