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8. **INTRODUCTION**

This project is designed to optimize the class schedule for Fall 2021 for the Entomology Department at Mavericks University. We were given the necessary data for this task in the form of an excel file. This excel file contained information that included the course names and credit hours, the classrooms available, the professors and their workload for the coming semester, and much more. Included within the excel was also a preference list that we needed to use to generate a list of preferences for each professor according to their qualifications. We as a group was also tasked with the development and implementation of two unique rules that would shape the outcome. All data was handling was performed through Python with no changes to the original data. This project was completed with the idea that any department would be able to use the code to solve their assignment problems so long as they provide their data in the same structure.

The remainder of the report is as follows. Section 2 describes the information relevant to the class schedule of Fall 2021 for the Entomology Department at Mavericks University. Section 3 discusses the relevant assumptions made while addressing the problem. Section 4 explains the mathematical model created to solve the issue. Section 5 provides the computer implementation as well as a detailed explanation of our implementation. Section 6 will discuss the results of the implementation. Finally, Section 7 concludes the report, provides a recommendation and presents the topics for potential work.

1. **PROJECT INFORMATION**

This section presents the relevant information of the project. By analyzing the data provided within the excel file, we can find sections labeled: Colleges and Departments, Course Catalog, Professors, Qualification, Courses Offered Fall 2021, and Classrooms. The section labeled Colleges and Departments contains the college, college code, department, and department code. The next section contained all relevant information regarding the courses in the College of Agriculture. It contained the course number, course name, and credit hours per course. Credit hours are important because it lists how often a course is presented a week. For reference, one credit hour is worth fifty minutes. The next section, Professors, showcases the faculty member’s names as well as the workload in credit hours for each respective member. It is important to note that some faculty members have a workload of one, therefore are not teaching. Qualification is the next section and is important because it lists each respective professor’s qualification for every course available in the college of agriculture. Every professor is given a qualification of either one (meaning they are qualified) or zero (meaning they are unqualified). This section will be used to complete the task of creating a preference list. The following section showcases similar information to the Colleges and Departments section except that it only provides the courses offered in the Fall 2021 semester. This section of the excel file also shows how many sections each course provides. The last section provides each classroom that is available for use as well as the capacity for each respective room.

1. **ASSUMPTIONS**

A minimal number of assumptions were made before the completion of this project. This is because of the limited amount of grey area involved in the creation of the model. Grey area meaning room for the team to change the outcome.

The first assumption that was made was that students would be classified as paying customers. This means that the final product, the course schedule, would be a completed product before being released. Therefore, a very limited amount, if any, of the data would change. Thus, the submitted model would still be useful.

The second assumption that was made was that

1. **MATHEMATICAL MODEL**

In every mathematical model, there exist four separate sections. These four sections include the parameters, the decision variable(s), the constraint(s), and the objective function. The parameters can be thought of as the information listed within the question or project information. In the case of this specific project, the parameters were all the data listed within the excel file. The decision variable describes the quantities that the decision-makers would like to determine. These can be referred to as the unknowns of a mathematical model. Constraints are inequalities or equalities defining the limitations on decisions. These can be thought of as what can and cannot be done when the data is put through the model. Lastly, the objective function evaluates some quantitative criterion of immediate importance such as cost, profit, or yield. This is where the model determines what it ultimately wants to do.

Only one decision variable was created for this project. This decision variable can be referred to as “Xfcsrp”. X denotes the final product whereas each of the indices represents specific factors. F represents the professors/faculty members, C presents the courses being taught, S represents the course session, R represents the classroom that is being utilized, B represents the period(s) being used, With this decision variable, the model can clearly show who is teaching what course in which classroom at what time and on what day.

Table 1: Notation for Class Scheduling Model

**Sets**

Faculty members, indexed by

Courses offered, indexed by

Sessions of a course, indexed by

Classrooms, indexed by

Sequence of periods per day, indexed by

**Parameters**

Course preference of each faculty member randomly generated

The total workload of each faculty member randomly generated

Duration in minutes of one credit hour

Duration in minutes of one period

Number of credits of class c

Number of times a class meeting each week

**Decision Variables**

The next portion of the model is the constraints. There are seven constraints in total, four of which directly impact the feasibility of the model and two of which the team has created per the project requirements.

The first constraint enables it so that the faculty members whose semester workloads are zero, are not utilized in assigning courses. Wf represents the workload for every respective faculty member. The mathematical equation is as follows:

,

where

The second constraint covers the need for each course to be taught for the number of periods needed to satisfy the course credit hours on the days it is offered. In simpler terms, this constraint makes it so the course is taught with enough time to fulfill the credit hours. represents the number of credits of class and , a constant represents the duration in minutes of one credit hour. In this project, . represents the number of times class meets each week. , a constant represents the duration of each period. . The mathematical equation is as follows:

where

The third constraint establishes the rule that for every day a course is assigned, it will last the same amount of time. This is meant to make it so classes do not occur two hours one day and one hour another. **The mathematical equation is as follows:**

The fourth constraint works in hand with the third in that for every day the course is assigned, it is assigned on the same period of that day. This is to further make sure that a class will occur at the same time every day that it is assigned. **The mathematical equation is as follows:**

The fifth constraint establishes the rule that a course can only be assigned to a room if the max enrollment of the class is less than the max capacity of the room. This is done to ensure that there is maximum utilization of the classes. **The mathematical equation is as follows:**

The last portion of the model is the objective function. The ultimate goal of the model is to maximize the preference list and output a feasible course semester schedule.

The objective function equation is as follows:

1. **COMPUTER IMPLEMENTATION**
   1. **USE SCREENSHOTS OF THE CODE, GO THROUGH AND EXPLAIN EACH CHUNK**
2. **RESULTS**
   1. **EXPLAIN THE FINAL RESULT, PRETTY SIMPLE, INCLUDE PICS**
3. **CONCLUSION**

This report showcased a feasible course semester schedule intended to optimize the preference list. The parameters consisted of the department and course information, professor qualifications, and credit hours. The report shows the need for the implementation of this model to easily solve the scheduling problems for the departments within Mavericks University.

Regarding future work, this model can be used within the many departments of Maverick University so long as the data is presented in a similar structure. This model is intended to be used for multiple departments across multiple semesters.