**SPREADSHEET MODEL**

The model was then simplified by tailoring the study track for the Decision Analytics students taking financial engineering track. The courses are selected according to the program requirements. The full requirements of completion of the program are consists of school requirements which are the engineering foundations, major requirements which are the cores of Industrial Engineering and Decision Analytics (IEDA) and major electives which are the specialized study on the chosen area. In addition, there are required common core courses from the university.

Since HKUST students in the school of engineering join a department in their second year, we only included the major cores and ignoring some engineering foundations such as calculus by assuming the students have finished those courses compulsorily in their first year. Only some common core courses are selected for demonstration because of the limited computing power of Excel solver. The final year projects and final year thesis are not included in our model because of its special requirements.

Figure 1 shows the details of all the chosen course. The courses are simply split into four categories. According to the requirements, the ones with yellow background have no alternatives, and ones with green background or blue background are those left freedom of selections. The credits of each course are given, and also the data that is whether offered in Fall or Spring term. The orange area in this table shows whether the course is offered in that semester. Intuitively, 1 means true and 0 otherwise. For example, (MATH2011, YR1F) is 1, meaning course MATH2011 is offered during the fall semester of the first-year study. It is assumed that the specific time slots is not considered since it is not sure whether the timeslot is fixed as the past data is not found, and empirically there are plenty sections can eliminate such time confliction.

Figure 2 is where all decision variables are placed. As stated, we are only making plan for the study path after joining IEDA. All decision variables here are binary, having value 1 means this specific course is chosen. For example, in this table, if (MATH2011, YR2F) is 1, meaning the student will enroll and study MATH2011 in the fall term of the second-year study. In addition, the courses with selection freedom are added with preference values that are entered by students. The term chosen in number orders are recorded. The preference level and term chosen in number order is used in later study. There is also entries for recommendation from coordinator, which is set to 1 if the course is suggested to take as late as possible, and -1 for as early as possible.

Graphical user interface, application, table, Excel

Description automatically generated

Figure 1.

Table

Description automatically generated

Figure 2.

Table

Description automatically generated

Figure 3.

In Figure 3, more requirements are added. The middle part implements the constrain that every course can only be taken once unless the student has failed, but plan making primarily assumes no failing. On the right part, the categorical requirements are set. This area sets the constrains according to the requirements, that are all non-selectable courses must be taken once, one economics course out of the two should be taken, and 5 courses out of the 6 major electives should be taken. In this specific demonstration model, only 3 common core courses are selected and 2 of them should be taken.

On top of these course requirement, there are also constrains on each term, that is every term the student should take at most 18 credits, and at least 12 credits. Since in this demonstration, the prior objective is to minimize the latest term, the lower bound requirement is then trivial and not included. The detail is show in Figure 4.

Figure 5 shows the most complicated constrain to implement, that is the prerequisites. Notice that there is a course of which one prerequisite course is an elective course, if using ordinary term number comparison, it is possible that for this course, the prerequisite is not selected to take and the term number will be 0, by the course can be chosen by the solver according to the simple comparison. Thus to avoid such problem and to avoid non-linearity, the data is fetched and processed according to the formular shown in the modelling part.

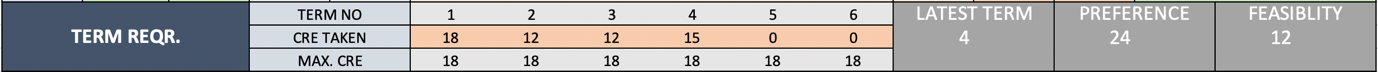


Figure 4.

Table

Description automatically generated

Figure 5.

A screenshot of a computer

Description automatically generated with low confidence

Figure 6.

Figure 6 shows all the calculated objective value, and the total objective value. In this specific case, minimizing the latest term had the top priority, thus the , this equation is free to alter to meet different demand. For example, the coefficient of can be set to 1 to increase its priority, and the final results will change accordingly.

Graphical user interface, text, application

Description automatically generated

Figure 7.

Graphical user interface, application, table, Excel

Description automatically generated

Figure 8.

Finally, insert all the constrains accordingly into the solver like in Figure 7, and the result for this specific case is shown in Figure 8. The result will be different for cases with different entered preference, recommendations and the defined priorities among the three objectives.