PRACTICE AND THEORY OF TIMETABLING AT IBMEC-SP FACULTY: A CASE STUDY

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ABSTRACT

In this paper we show a real problem where the strategic planning is directly related to the results obtained from the classroom assignment problem. The decision to offer new courses or to expand the existent ones depends on the efficiency of this operational problem.

Keywords: classroom assignment, case study, strategic planning.

INTRODUCTION

A Faculty is an organization that has, like any other, strategic, tactical and operational planning. Haddad, C. and Lazzarini, S. developed the case study "*IBMEC SÃO PAULO IN 2006*", which deals with strategic issues for Ibmec-SP Faculty, such as: development of new courses, expand the existent courses and others. In this way, if the strategic plan decides to expand some existent course, the tactical level must be responsible for: verify the infrastructure viability, confirm the budget availability for operating expenses, and others. Finally, based on tactical plans, the operational level must deal with many daily decisions, like: assign the classes to the rooms, allocate teachers to classes, and so on.

Carter and Tovey (1992) showed how difficult the timetabling is, by identifying cases when the problem is easy and when it is difficult.

This case study deals specifically with the classroom assignment problem, deciding which class must be assign to which room, obeying the timeslots previously determined and the specific constraints.

PROBLEM DESCRIPTION

The faculty considered in this study makes use of 27 classrooms with capacities from 31 to 122 students and the scheduling for the evening courses has three stages:

Stage I – Planning: Each coordinator of each course establishes the forecasting number of students for the next year.

Stage II – Operational: With the forecast previously planned, the operational process starts, that is, the classroom assignment problem is pre-solved.

Stage III – Verification/Validation: After the first layout of the assignments (classes to rooms), the meetings between the responsible for the arrangement and directors/coordinators validate the planning.

In Stage II, given the number of demanded classes and their respective timeslots (or periods), some constraints must be satisfied in order to define the classroom assignment, such as:

1) All classes must be allocated in a room;
2) Only one class can be assigned for each room in each period;
3) A room can not be assigned for a class with a number of students higher than the capacity of the room (number of available seats);
4) The evening classes that occurs twice a week must be allocated at the same room and,
5) Because of the limited number of available rooms at the evening period, all rooms can be used for all classes.

This process (including all three stages) takes about a month to conclude. Since four years ago this assignment is carried through manually by experienced collaborators using the support of Excel spreadsheets.

STRATEGIC OBJECTIVE

According to Carter and Tovey (1992), and using all specific constraints previously presented, three strategies are proposed:

- First Strategy: *Assign the classes in rooms with enough space, that is, minimize the surplus in classrooms.*
- Second Strategy: *Assign the largest class to the largest rooms, that is, use always the largest rooms available.*

- Third Strategy: *Take the best solution of the first and the second strategies, and rearrange in order to avoid timeslots in rooms. (or, maximize the frequency of each used room).*

PRACTICAL RESULTS

Considering 27 rooms, 41 classes and 4 periods (Sunday to Thursday evenings), the three strategies were applied and compared with the practice used by the Faculty, namely Actual Planning.

In order to estimate the efficiency of the each strategy, the utilization (U) and the overall frequency (F), as Beyrouthy et. al (2006), were calculated:

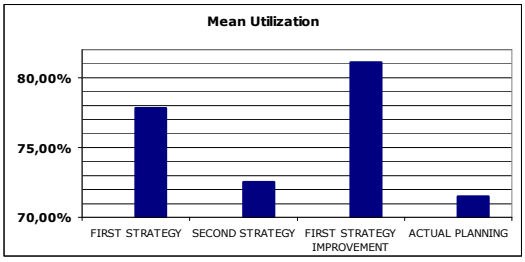

Figure 1: Mean Utilization

As Second Strategy could not be improved (there is no rearrangement that improves the solution), just the First Strategy Improvement is showed. Obviously it is predictable that the First Strategy Improvement has better or equal solutions than First Strategy. Figure 1 shows the mean utilization for the rooms using each strategy. First Strategy uses 77,8% of all offered seats, Second Strategy, First Strategy Improvement and Actual Planning uses 72,55%, 81%, 71,5%, respectively. The rooms not used in all periods are not considered in the calculus. First Strategy Improvement has the best results minimizing the remaining seats in all classes and after that rearranging the solution in order to avoid rooms used for just two periods per week.

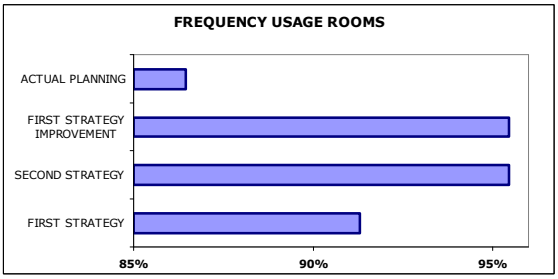

Figure 2: Frequency of usage rooms

Figure 2 shows the frequency of the usage rooms. For example, a room that is used in two periods per week has 50% of frequency usage (the availability is four periods). First Strategy provides a mean frequency of 91%, for the First Strategy Improvement and Second Strategy this number increases to 95%. The Actual Planning has a mean frequency of 86.5%.

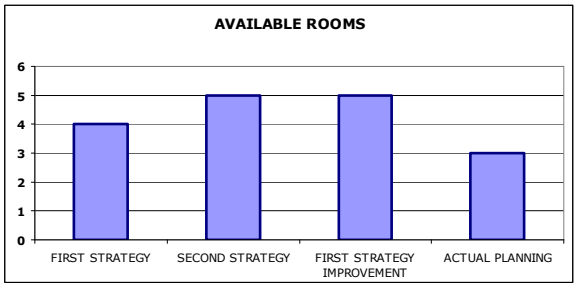

Figure 3: Number of available rooms for all periods.

Figure 3 presents the number of rooms that are available in all four periods. For example, for Second Strategy and First Strategy Improvement five rooms are not used in all periods. The availability of a room in all periods could be an advantage if a new course that requires more than two periods per week is offered or, if some existent course should be expanded, or if the costs related to cleanness, electricity are relevant in the process.

CONCLUDING REMARKS

Based on the practical results, clearly the actual planning, that is made by hand, is not inefficient but it could be improved, according to the strategy choose by the institution.

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