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Abstract

Course scheduling is often a labor intensive, manual process that is governed by heuristics. UIS-SCHEDULER, a WEB enabled collaborative planning tool under development at the University of Illinois, can be used to perform asynchronous planning and course scheduling. The asynchronous environment and optimization methodology for UIS-SCHEDULER are described. This new scheduling tool is expected to save time and compress the planning cycle as a result of the reduction in the number of face-to-face meetings required during the planning process. Higher individual and group productivity and satisfaction with the scheduling process and outcomes are also expected as a result of the use of asynchronous technology.

Introduction

The process of course scheduling is often localized, cumbersome, and iterative in nature. Manual scheduling is by definition error prone and time consuming especially when one is trying to deal with a scheduling problem of any consequence.

In addition, using a "best guess approach" or heuristic model to select course offerings each semester can result in "problems" such as schedule conflicts, under scheduling of key courses, over scheduling of lecturers, and haphazard provision of special materials required by the instructors (i.e. computer technology, labs, and audio visual equipment). UIS-SCHEDULER can be used to resolve some of these problems and to develop optimal schedules of course offerings.

The WEB Enabled Groupware

Course scheduling is a collaborative effort where the needs of students, availability of faculty, classrooms, labs, and equipment must be considered by the group whose responsibility is planning the "best" schedule of course offerings. The proposed system, UIS-SCHEDULER will be embedded within Lotus NOTES, a collaborative support system (Larson-Hughes and Skalle, 1995; Kraut and Allen, 1995), where individuals can work together asynchronously.

Collaborative technologies such as UIS-SCHEDULER hold the promise of more democratic and better decision making, synergy, more objective evaluation, stimulation, and learning (Hiltz et al., 1989). Group support systems may also be able to level influence, reduce conformance pressure, domination of a group by one or two members, and information overload (Nunamaker et al., 1991).

Further, the decision to develop UIS-SCHEDULER using a WEB enabled, asynchronous groupware platform, Lotus NOTES with DOMINO as the WEB interface, was a direct result of the need for increased productivity, shorter planning cycles, and resolution of some of the problem areas listed above. The time required for face-to-face meetings will be reduced as a result of the asynchronous nature of the product (Hiltz et al., 1991; Dufner, Hiltz, and Turoff, 1994). Much work can be completed using UIS-SHEDULER

without having to attend meetings. Any team member having a standard WEB browser and access to the Internet will be able to work with UIS-SCHEDULER.

The Architecture

The architecture of the system is both client server and WEB enabled. UIS-SCHEDULER can be used as a client server application where the client software resides on the planner's own PC. UIS-SCHEDULER can also be accessed via the Internet using standard WEB browsers such as Netscape. Individual group members may choose the method of access they prefer.

To create the WEB enabled portion of the architecture the NOTES software is implemented as "middleware" with DOMINO™ as the Internet interface. For this method of access no client software is needed on the user side.

The course preferences of students and faculty will be collected asynchronously. Student and faculty participation is expected to enhance satisfaction with course offerings and the planning process itself (Sampson, Freeland and Weiss, 1995). The asynchronous collection of data will not require students to have NOTES clients since access to UIS-SCHEDULER is convenient using standard WEB browsers.

Schedule Optimization Methodology

The heart of UIS-SCHEDULER is the network flow model that will be used to optimize the course schedules (Anderson, Sweeney, and Williams, 1991). A network flow model was chosen for its ability to solve extremely large problems and for its parsimony (Mulvey, 1982).

The optimization algorithms will be designed based on the following general model:

$$\min \sum_{i=1}^{m} \sum_{j=1}^{n} c_{ij} \, x_{ij}$$

$$\text{s.t.}$$

$$\sum_{j=1}^{n} x_{ij} \leq 1 \quad i=1, 2..., m \text{ Agents}$$

$$\sum_{i=1}^{m} x_{ij} = 1 \quad j=1, 2..., n \text{ Tasks}$$

$$x_{ij} \geq 0 \quad \text{for all } i \text{ and } j$$

We can a assign a preference ranking from 0 to 10 for each course in each time slot. A network flow model can then be developed as shown in figure 1 below.
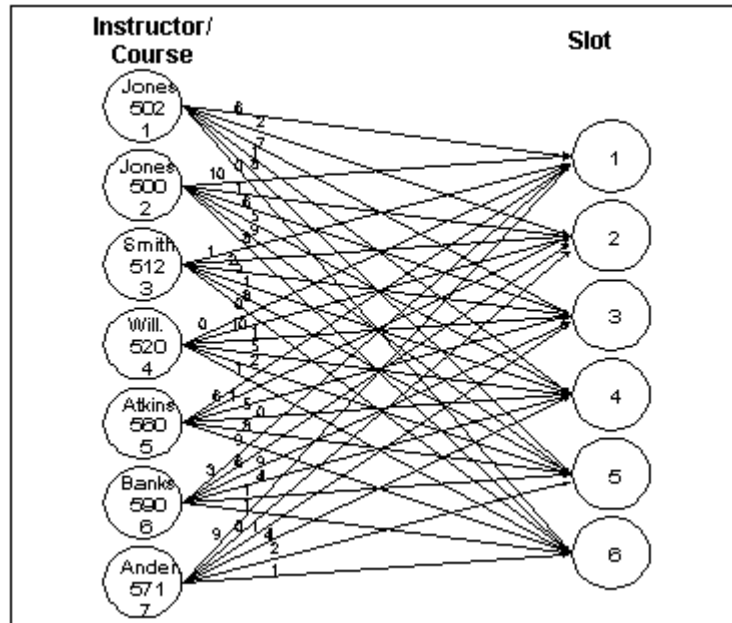
Figure 1. Network Model for Course-Slot Preferences

Conclusion

UIS_SCHEDULER will facilitate asynchronous collaborative planning efforts. Consideration can be given to the variables mentioned above to generate a more satisfying offering of courses. Students, faculty, and administration are expected to be more satisfied with schedules generated using UIS-SCHEDULER because they will have had an opportunity to participate in the planning process.

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