

COMPUTER-AIDED STUDENTS REGISTRATION SYSTEM

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ABSTRACT

This paper aims to contribute to computerization of counseling and registration procedures in universities where students are free to choose subjects for the next semester within the limits of a study plan. A typical university student information system does not provide enough support for students counseling in their choice of subjects to register and for registration itself. This paper discusses computer data and procedures that are required for computer-aided counseling and registration service for students. The proposed procedures provide additional freedom and convenience for students in registration for subjects of a next semester. Academic staff (counselors) and administrative staff could be relieved of compulsory involvement in counseling and registration process.

KEY WORDS: database, algorithm, student registration, interactive information systems, computer-aided counseling.

INTRODUCTION

Academic performance of a university depends on a well organized and controlled registration of students for the subjects of a next semester. For a university administration it is important to know in advance which subjects and classes (groups, sections) should be opened in the next semester. Registration of students for subjects is based upon a student information system (SIS) which is an integrated part of a university information system. A SIS contains data about students, subjects offered and so on. The primary task of such a SIS is to facilitate the registration of students in the courses of a university, to make it easier for students and for the administration. Typical registration related functions of SISs are to inform students on admission policies, to inform students about specialties, study plans, course schedules and availability, to accept students applications for subjects online, to download the admission application for registration in person and so on [1,2,3,4,5 et al].

A large western university with no limits on the number of students can afford not to control the registration for subjects by students. Here a SIS just collects valid applications of students who are attracted to the university from all over the world [6,7,8 et al]. A small university with a tight budget, a limited number of students, and mainly full-time lecturers has to know in advance the subjects and the number of classes to be

opened in the next semester in order to prepare study facilities, to plan the load of its academic staff, to provide high quality teaching procedures. Expert advising of students about their optimal registration for the next semester becomes an important issue. The existing SISs do not provide sufficient support for this type of activity.

Some additional modules of a SIS should be introduced in order to facilitate registration of students in subjects in a university of the second type [9]. This paper proposes a general design of a SIS module that performs expert advising of individual students about their registration in the subjects of a next semester. Such advising is based on study plans and the study situation of a given student with the target to complete the degree studies in the shortest possible time with high quality of knowledge. After a suggested registration plan is accepted by a student it is entered into the database of a SIS.

PROBLEMS WITH STUDENTS COUNCELLING AND REGISTRATION

Typical registration and counseling procedures look as follows:

- A student composes a list of subjects for registration;
- The student discusses the list with a professor (=counselor) and gets his/her approval;
- The student gets the approval for the list from the administration;
- The application list is entered into a SIS by its administrator or through the Internet;

A typical SIS does not help much in this activity. Through the Internet it may issue an application form to be filled out by a student. It may display a list of subjects taken by the student and a specialty study plan. It may accept an application form from a student on-line [1, 2, 3, 5, et al]. A SIS does not make any suggestions (= does not counsel). The choice of subjects is entirely on a student.

In a perfect world many factors should be taken into account at the stages of subjects selection, counseling and administrative approval, such as:

- A registration list of a student should present a proper mix of compulsory and elective courses that are required by the university, the faculty and the specialty;

- The list should not exceed the maximum number of credit hours allowed for registration in one semester by the university;

- Prerequisite subjects: are they passed or being studied by the student in a current semester? If in the current semester then what are the chances that they will be passed successfully by the student?

- The student may change a specialty or a university. The previously passed subjects should be equalized (or not equalized) to the subjects of the latest study plan before registration for the next semester or in the process of registration;

- The list should aim to minimize the number of semesters the student has to study for the degree, leaving the room for high quality knowledge and minimal number of failures in subjects;

- The list should take into account the level of study success of the student, the history of subjects taken (passed and failed) by the student, the marks;

- The list should minimize the time interval that the student has to stay in the university every day (= minimize the gaps between classes);

- The registration list should aim to fill the opened classes to the optimal level, not exceeding the maximum number of students allowed in a class;

- The list should take into account specific wishes of the student to take or not to take some subjects in the next semester;

- The list should not exceed the number of credit hours that can be paid for by the student;

These are the main factors but not all. It is clear that for a counselor or an administrator it is difficult (if possible) to assess all these factors when considering a presented registration list often under the pressure of a queue (rather a crowd) of impatient students. This situation leads to premature registration of subjects and later to study process of insufficient quality. The necessity for computerized counseling and registration procedures for students is evident. Such procedures should be accessible for students through the Internet.

INPUT AND OUTPUT DATA OF THE MODULE

In a university SIS a unique student university number gives access to all information about the student and his/her specialty. That is why the module takes only the student university number and the number of credit hours the student plans to take (may be for financial reasons) in order to propose a registration plan for the student for the next semester.

The module produces the list of subjects to be studied by a student in the next semester within the limits of input number of credit hours. Each subject is supplied with the class number (+room and time) opened for this subject. After the student's approval the data from the registration list is entered into the university database. The produced registration list may not use the total input number of credit hours if the

student's study situation does not support safe decisions at the stage of early registration. The registration may be completed after the end of current semester.

INFORMATION USED BY THE MODULE

Information used in the module can be divided into two types:

- information common to all students of a given study specialty;
- information about an individual student;

Information common for a specialty is as follows:

- The specialty study plan with the total sum of credit hours for the degree, list of subjects in every category (university, faculty, specialty requirement, elective or supportive) with target credit hours totals;
- The advisory study plan for the specialty with lists of subjects that are advised by professors for studying by students in each semester of each study year. Such a study plan gives a perfect sequence of subjects for studying by a student starting from his/her first semester of his/her first year including the last semester of the last year. The plan shows prerequisites for each subject;
- List of subjects (+classes /max number of students /current number of students /rooms /times /lecturers /status) planned to be offered in the next semester. Possible values of the class status:
 - a. open;
 - b. closed (= full);
 - c. potential (potential may become open if there are no open classes in a given subject and the number of applicants for the potential class is large);

Comments:

- The perfect subjects sequence of an advisory study plan is rarely followed by students because of failures in some subjects, optional summer semesters, personal preferences;
- The list of subjects /classes... planned for the next semester cannot be final at the stage of early registration. Often it is finalized 1-2 weeks after the start of the next semester. Potential status of some classes in each subject makes it possible to change this list automatically or by an administrator.

These features are taken into account in the procedures of the module.

Information about an individual student required by the counseling and registration module includes the following items:

- the student university registration number;
- specialty number;

- specialty study plan number;
- list of subjects equalizations (in a case of a transfer from another university or another specialty);
- next semester registration (= current list of subjects /classes /rooms /times);
- student's individual advisory study plan with such information about each subject:
 - a. subject number;
 - b. prerequisite subject(s) number(s);
 - c. number (m) of subjects that use the given subject as a prerequisite (m is a measure of complexity and importance of the given subject);
 - d. status of the given subject:
 1. passed (+ grade);
 2. incomplete (+ total grade before the final exam);
 3. registered for the current semester (=currently studied);
 4. not ready for registration due to prerequisites not taken;
 5. spare type;
 6. subject whose prerequisite(s) are being taken in the current semester;
 7. failed (+ grade);
 8. ready for registration due to prerequisites passed;
 9. withdrawn;
 - 16, 17, 18, 19. registered for the next semester (during early registration);
- variables:
 - a. accumulated average grade before the current semester (initially = average secondary school grade);
 - b. total sum of credit hours for all types of subjects passed before the current semester / total sum of such credit hours taken in the current semester / target sum for the degree;
 - c. three total sums of credit hours for university / faculty / specialty required subjects passed before the current semester; three total sums of such credit hours taken in the current semester; three target sums for required subjects for the degree;
 - d. three total sums of credit hours for university / faculty / specialty elective subjects passed before the current semester; three total sums of such credit hours taken in the current semester; three target sums for elective subjects for the degree;
 - e. total sums of credit hours for other types of subjects (free electives, compulsory supportive etc.) passed before the current semester; total sums of such credit hours

taken in the current semester; target sums for such subjects for the degree;

- f. number of next semester registration sessions used by the student in the current semester (+ max number) to prevent the student to use the SIS as a game;
- g. number of credit hours for the next semester:
 1. advised number of hours from the advisory study plan (ha);
 2. the total number of credit hours for the semester planned by the student for registration (hp);
 3. the number of credit hours already registered by the student for the next semester during previous early registration session(s) (hr);

Comments:

- In the student's individual advisory study plan subjects with status 7, 8, 9 are ready for registration.
- Subjects with status 6 are conditionally ready for registration. During an early registration session such a subject can be chosen for registration after assessing the chances for successful completing of the prerequisite subject(s) in the current semester. If chances are low such a subject can be registered after the end of the current semester during final registration session.
- If a subject is chosen for registration its status is changed: new status = present status+10. So subjects registered for the next semester have status value ≥ 10 . If at some stage a student cancels the previous registration then the previous value of status is restored: if status value ≥ 10 then previous status = present status - 10;
- Values of variables are updated by the SIS automatically as changes occur in the student's personal records. Variables related only to a next semester are set to zero values after the end of registration period (=final start of a current semester).

Some of the above discussed data may be available in a SIS currently in use. The missing data should be created specially for solving the problem under consideration.

PROCEDURES OF THE MODULE

We shall present the counseling and registration procedures using the top-down approach. A general view of the algorithm is presented on fig. 1. This algorithm reflects only the operations with data items. The network part of the procedures including security issues, creation of database tables are outside the scope of this paper.

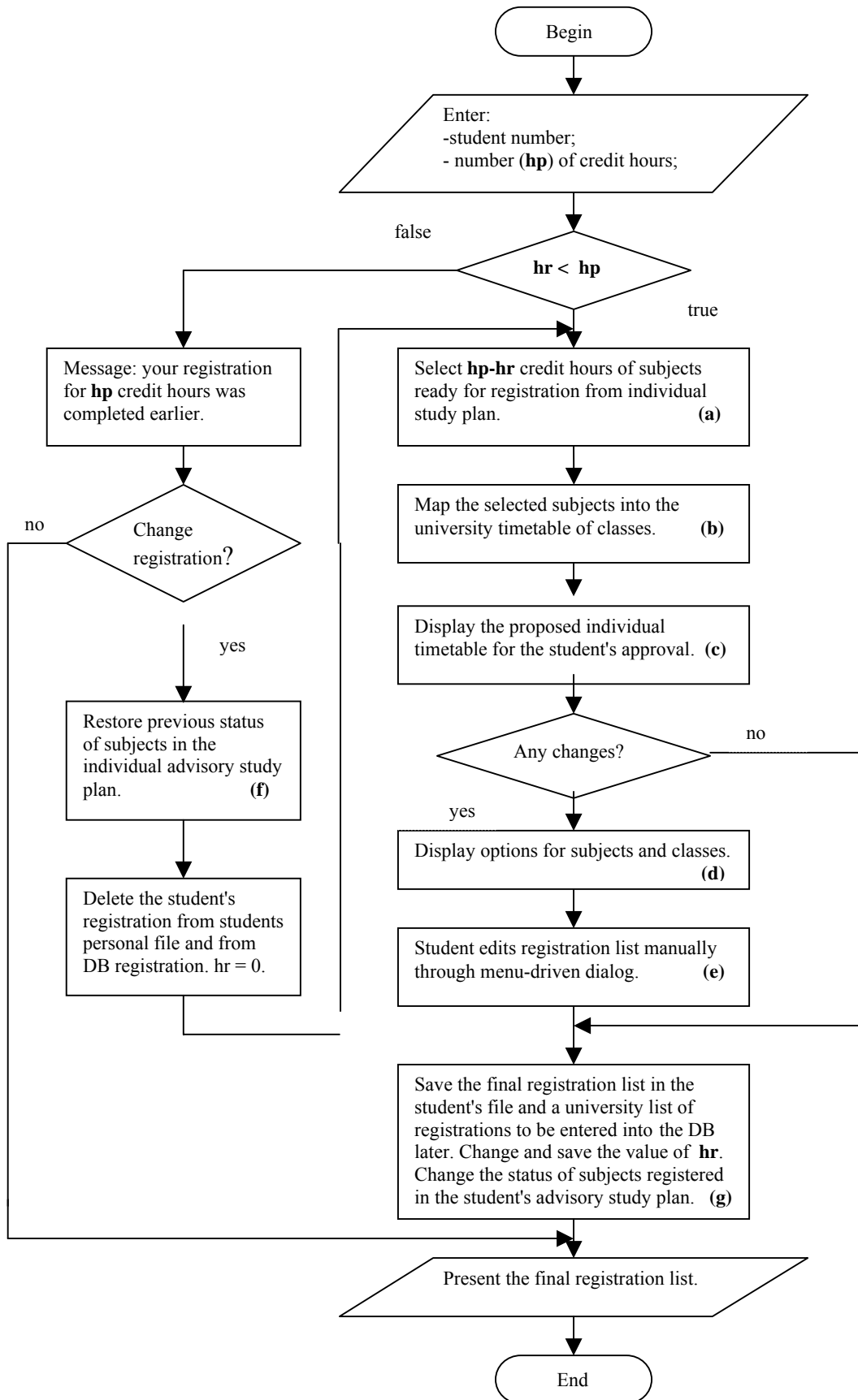


Figure 1

The algorithm on fig. 1 allows a student to make several partial early registrations, to change the planned number of credit hours for the next semester, to cancel the previous results of early registration etc. Some of the obvious steps of the algorithm (identification of a student, presenting the student the advised number of credit hours, counting the number of registration sessions used by the student and comparing to the maximum allowed number of such sessions etc.) are not included in the flowchart to make it more transparent. We shall give some further details for blocks **(a)** ÷ **(g)**.

Block **(a)** selects **hp** – **hr** credit hours among the subjects open for registration (subject status = 6, 7, 8, 9) in a student's individual advisory study plan. Two selection strategies are possible. If **hp** is close to a maximum advised value then the necessary number of open subjects is selected sequentially starting from the first open subject. If **hp** is small then only important, difficult subjects are selected among open subjects. Such subjects are prerequisites for several other subjects. The flowchart of block **(a)** is presented on fig. 2.

Block **(b)** attempts to find an open class (+ time, room) for every subject of the student's provisional registration list in the faculty timetable for the next semester within the start and end hours specified by the student. Its flowchart is presented on fig. 3.

Block **(c)** displays each subject of the student's provisional registration list linked to some open classes (+ time and room). If some subject failed to be mapped into some class (due to narrow time limits or absence of open classes for this subject) then it is displayed with the message: "An open class was not found for this subject within the given time limits".

Block **(d)** displays two groups of classes of the next semester:

- For each subject from the student's provisional registration list, all classes are presented with status = open or potential. For every potential class the number of students is given who applied for permission to register in it (= these are pending applications);
- All classes with status open or potential are presented for such subjects:
 - a. A subject has status = 6,7,8,9 in the student's individual advisory study plan;
 - b. The subject is absent in the student's provisional registration list;
 - c. The subject does not belong to the group of subjects in the specialty study plan where the target sum of credit hours has already been reached by the student.

Block **(e)** assists a student in finding interactively a class for an unmapped subject of the provisional

registration plan in the first group of displayed classes. The student may search among the classes outside the time limits or among the potential classes with largest number of applicants. (A potential class can be chosen in hope that it will be converted into open later, due to a large number of pending applications for the class. If the hope does not materialize then the student can register for another subject later.)

If the student cannot find a satisfactory class for an unmapped subject in the first group of displayed classes then the subject is replaced by some acceptable subject (+class /maximum number /current number /room /time /lecturer) from the second group.

Block **(f)** executes only if the student decides to cancel the previous registration and to register from the very beginning. In the student's individual advisory study plan the block finds every subject with the status > 10 and returns the previous status: current status –10.

Block **(g)** makes final updates of the student's personal file and database registration files:

- adds the newly registered subjects/rooms/times to the list of previous early registration in the student's personal file;
- adds the newly registered subjects (+classes /rooms /times /student name /student university number /registration time and date) to the list of faculty registration. (The data from the list may be entered into the database later when the server is less busy);
- adds the number of credit hours for the newly registered subjects to the previous value of **hr** (number of credit hours for the subjects that are already registered for the next semester);
- changes and saves the status of each newly registered subject in the student's individual advisory study plan: existing status value + 10;
- increments and saves the number of registration sessions used by the student;

Comments on the algorithm:

- When block **(g)** on fig. 1 begins its execution, the provisional student's registration list turns into a permanent list. But still it is possible to change the list during the next on-line registration session;
- Most of the blocks of the algorithm are straightforward. But some of the blocks need further details. For example, block **(1)** on fig. 3. can be implemented using some heuristic procedure for a given simplified case of timetabling or a standard timetabling procedure [10, 11, 12 et al.].

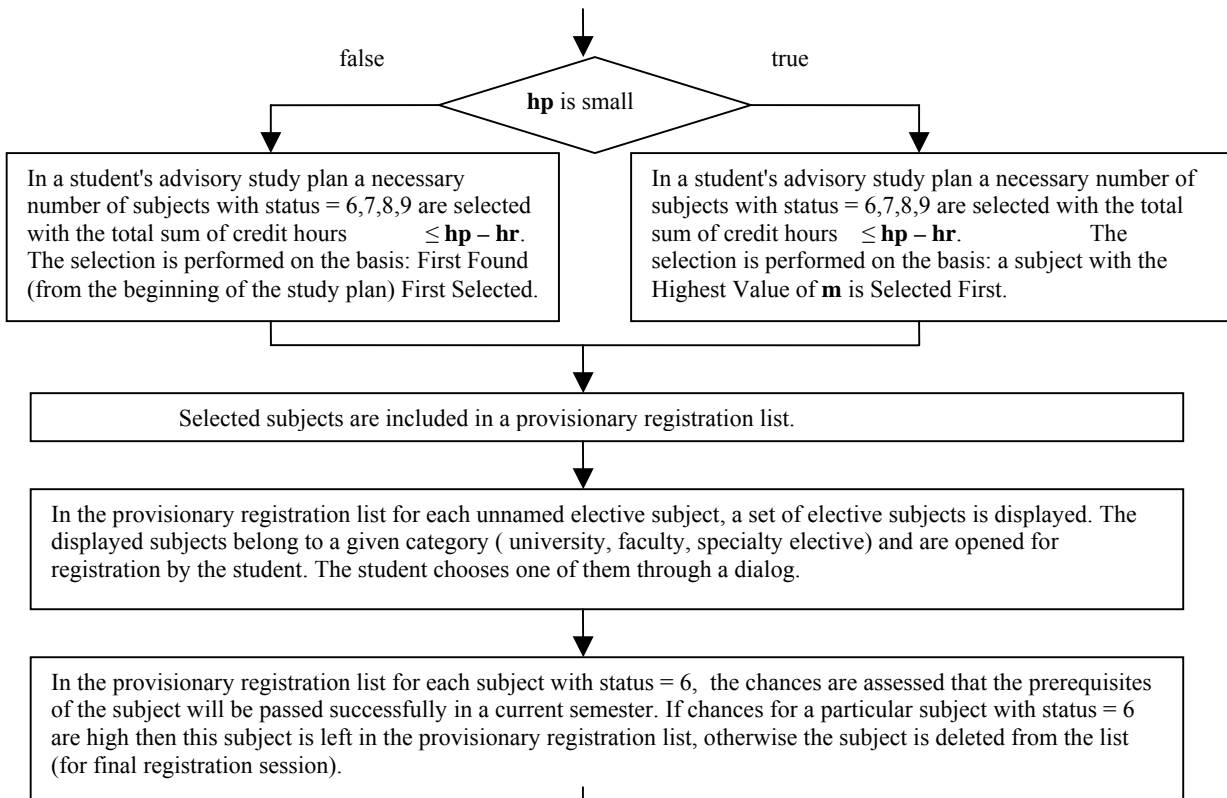


Figure 2

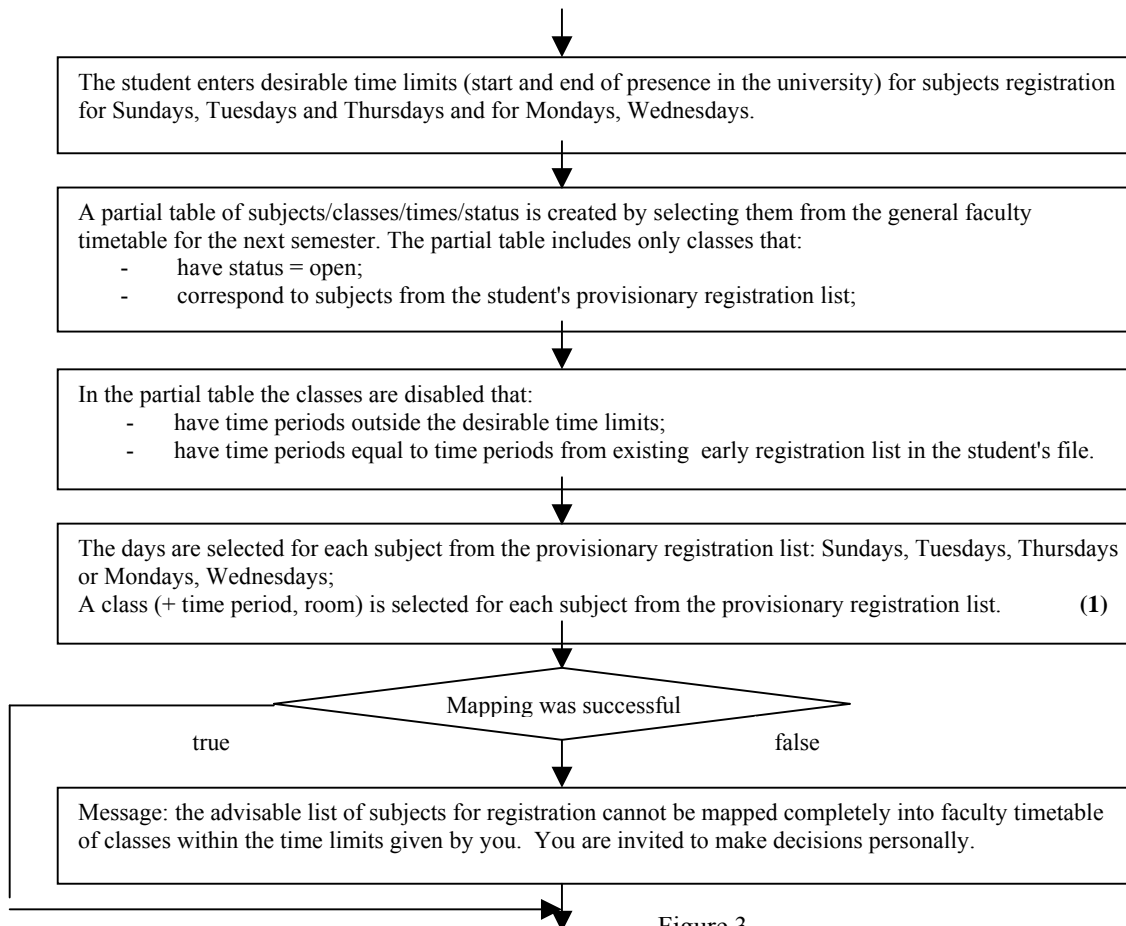


Figure 3

The proposed data and procedures have some advantages over existing cases:

- They allow to choose automatically the subjects that should be studied by a student in the next semester (= eliminating the need in counseling or administrative approval);
- They make it possible to avoid early registration into subjects with prerequisites that are unlikely to be passed successfully. Such subjects are registered after the final exams;
- Subjects for registration are linked to classes (opened or potential) automatically or in a dialog with a student using only options feasible for a given student;
- A student can have several registration sessions. It is possible to cancel or change previous registrations;
- Good students have privileges in registration. They have high chances to pass prerequisites in a current semester, so they can make early registration for all subjects when all classes are opened;
- If a current number of students in a class reaches its maximum number then the class is closed automatically. It can be opened again if administration increases the maximum number of students allowed in the class;
- Potential status of some classes allows to open additional classes in the university timetable if necessary (automatically or by administrative decision);

The proposed procedures are not free of disadvantages, such as:

- The work load on a SIS, server, SIS administration may increase considerably;
- The database must comply with high standards. It should be updated permanently preserving integrity and consistency.

CONCLUSION

Automated timetabling and registration procedures are a necessary condition for a smooth, orderly academic process in a modern university. This paper is an attempt to contribute to the solution of this problem. Its aim was to find out what kind of data and procedures are required in order to computerize the counseling and registration procedures for students. The proposed module of a SIS gives students more freedom and convenience in registration. It improves the quality of registration, excludes involvement of faculty members in this process, though it requires a database and network hardware of high quality.

REFERENCES (the internet information dates to 25/02/2005):

1. <http://www.bu.edu/reg> (SIS of Boston university, USA);
2. <http://oibs.metu.edu.tr> (SIS of Middle East Technical University, Turkey);
3. <http://www.utdallas.edu> (SIS of university of Texas, USA);
4. <http://www.acs.utah.edu/student/> (SIS of university of Utah, USA);
5. <http://www.just.edu.jo/reg> (SIS of the University of Science and Technology, Jordan);
6. <http://sisweb.uccavis.edu> (SIS of university of California, USA);
7. <http://registar.mit.edu> (SIS of MIT, USA);
8. <http://epgy.stanford.edu> (SIS of Stanford university, USA)
9. A. F. Ossyka, M. A. Musbah, O. S. Al Hamouz, Student Information System Enhancement, *Jordan Journal of Applied Science. Natural Sciences*, 6(1), 2004, p.p. 65-80.
10. <http://www.ttable.com> (software package TTABLE);
11. <http://timetabler.com/tt4windows.html> (software package TimeTabler4 for Windows);
12. J. C. Beck, A. J. Davenport, M. S. Fox, The ODO Project Towards a Unified Basis for Constraint-Directed Scheduling, *International Journal of Scheduling*, 1(1), 1998, p.p. 89-125.