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From the editor

Hello, and welcome to Automated Scheduling's first **Scheduling Update**. The goal of this newsletter is to have some fun while informing about the art and science of school scheduling, and providing other useful tips and tools for educators. In this issue we will offer some tips to help ensure your scheduling for 2007-2008 gets off on the right foot. There are suggestions for improving your resource

allocation and student satisfaction rate, and links to other resources including a discussion of some cutting edge concepts for school scheduling direct from Automated Scheduling's founder, Richard Hamlin.

Scheduling impacts everything in your school. Whether it's teaching loads, class sizes, or course request satisfaction, a schedule

affects your school in subtle and not so subtle ways. Getting full use out of your teachers while keeping section size as low as possible will improve teacher and student performance while limiting or reducing your staffing costs. Placing more students into the courses they request will increase student (and parent) satisfaction.

Rob Gillis

Scheduling checklist

Preparing a good master schedule, one that meets school, teacher, and student needs while preserving school resources, is more than a matter of luck. It takes careful planning and adequate time to find the best solution. Too often schools find themselves making choices because they do not have enough time to explore all the possibilities.

Here is a sample checklist to help you evaluate your own needs and prepare accordingly.

Data gathering. Is your course of studies book ready? Have you added any new courses for next year? Did any departmental/graduation/prerequisite requirements change?

Data entry. What courses did the students request? What are the requirements/stipulations of the faculty contract? What resources (buildings, rooms, equipment, etc.) have changed?

Problem definition. Can you accurately state your data and requirements in

your current software?

Generate Master Schedule. Does every section have a teacher, a room, and a meeting period?

Master Schedule/student assignments. How well does the Master Schedule meet student and faculty requirements?

Revision. Rework the problem, change teacher assignments, class sizes, # of sections, etc.

Publish final schedule and student schedules.

(See the Scheduling Timeline on page 3 for more details.)

Can you build it—Feasibility simplified

“Wouldn’t it be great to know if you can complete a workable master schedule given your current resources and constraints?!”

According to Payton Manning, he had a dream in which he died and went to Heaven. St. Peter welcomed him warmly and presented him with a modest two-bedroom bungalow just down the street from a magnificent mansion with a New England Patriots flag prominently displayed on a tall flagpole in the front yard. At his first opportunity, Peyton spoke to God about this.

“I know I never won a Super Bowl, but I was a pretty good quarterback. Why do I get this little cottage while Tom Brady gets that huge mansion,” Peyton asked God.

“Who told you that was Tom Brady’s house?,” God replied. “That’s my house.”

Have you ever had to abandon a promising master schedule because, in the end, you just could not place a section in a room when the correct teacher was available? Or, have you been frustrated when, after placing all the necessary sections into appropriate rooms at different times, you find that you don’t have a teacher available to cover one or more sections because of staffing or contract limitations? Wouldn’t it be nice to know, before going back to the drawing board, if it was even possible to complete a master schedule given the myriad restrictions imposed by facilities, personnel, and curriculum? If so, you can appreciate the usefulness of feasibility analysis.

Feasibility analysis takes a look at everything you can throw at a scheduling program. Maximum and minimum teaching loads, consecutive period restrictions, room and resource limitations, course sequencing requirements—every constraint you have is compared to your section requirements, physical resources, and personnel strength to see if, in fact, you can build a schedule that meets all your requirements without violating any constraints. Wouldn’t it be great to know the answer before you started back to the old drawing board? For more information on a better way, see this article on the latest in scheduling innovation at:

<http://autoscheduling.com/articles/Feas>



Scheduling Timeline

When	What
Fall	Analyze impact of possible structural changes to the schedule and curriculum
January	Finalize Course Bulletin & Publish Initialize the next school year in database (carrying forward data where appropriate)
February	Identify all constraints from teacher contracts, room limitations, etc. Enter constraints into scheduling software Check the data (following a checklist) Test feasibility of constraints, i.e. whether it is possible to satisfy them
March	Make any constraint adjustments needed to attain feasibility Collect and enter students' course requests Develop preliminary master schedule that meets all constraints Review preliminary schedule, and make constraint corrections
April	Optimize master schedule for students and schedule students
May	Review schedule, revise/repeat as needed
&	Publish master schedule
June	Find alternatives for unsatisfied students and reschedule them Re-balance sections Distribute "final" schedules to students
Summer	Make adjustments for new students, failures and summer school results Distributed revised schedules to students as necessary Distribute final class rosters to faculty along with any schedule changes

This sample timeline is designed to put schedules into the hands for students and faculty before the end of the preceding school year. Individual schools may need more or less time for particular aspects of the scheduling process or require other variations.

Scheduling Seminar

In February, Automated Scheduling will hold a free professional seminar in various locations around New York State on the subject of creating more effective schedules by better automating the scheduling process. This seminar is specifically designed for school administrators as well as others involved in the scheduling process.

- February 9th - Long Island
- February 12th - Rochester
- February 14th - Albany

For more information, please visit :

autoscheduling.com/seminars

History by the Decade

- Around the year 1000, scientists suspect that the sun was particularly bright for a period of time that is called the Medieval Optimum. Average global temperatures were about one or two degrees higher than they are today.
- Potatoes, native to the Andes, were first planted in Germany in 1621.
- The Louisiana Purchase was completed December 20th, 1803 as the territory was formally transferred from France to the United States during ceremonies in New Orleans. The Louisiana Purchase effectively doubled the size of the existing U.S. With 827,987 square miles in the deal, the price translated to about three cents per acre.

These and many thousands of other fascinating and not-so-fascinating facts can be found online at www.decades.com. It has to be one of the most ambitious history timelines ever. It's a great resource for teaching history, finding essay topics, or just reading for fun.

Good enough, still room for improvement, or time to start over?

Does this situation sound familiar? You settled on a master schedule, filled the sections with students, massaged the section placements to place a few more students, and you still have not reached your goal. You need to make a choice: accept the schedule in its current state, continue to fine tune the schedule, or start over. And your deadline is approaching.

How do you decide which path to take?

Most schools rely on experience, judgment, and frustration to guide their decision making process. However, there is a way to

determine if there is room for improvement given your current set of requirements and constraints. It is called optimization, and it requires an objective function. An objective function is a mathematical representation of the quality or desirability of your school's schedule. Once expressed mathematically, two schedules can be compared by comparing their respective objective function values. The one with the greater value for the objective function is the better schedule, given the value you place on each of the inputs.

Optimizing completely places an upper bound on the maximum value for the function. If the current value of the objective function is less than the upper bound, you likely still have room for improvement. If the two are equal, you have gone as far as you can go with current set of inputs and constraints.

In cases where it is too difficult to obtain a great bound, diminishing returns can signal when to stop. At some point, more time will not yield a significant improvement. Whether the result is very close to the optimum, depends on the quality of your algorithm.

"You need to make a choice: accept the schedule in its current state, continue to fine tune the schedule, or start over. And your deadline is approaching."

Please, see the article entitled *The Mathematical Approach to Academic Scheduling: The Objective Function* at <http://autoscheduling.com/articles/ObjFunc> for a detailed explanation of how this works.

You probably know that the number of possible ways to play out a chess game is too big a number to contemplate. Let us say, to keep it simple, that it is much more than a trillion trillions. Just counting to a mere trillion would take about 200,000 years, if you count quickly and do not take any breaks. A trillion crisp new dollar bills would make a stack 80,000 miles high. So how mind-boggling is it that a typical school schedule has many times (in fact, many trillions of times) the permutations of the game of chess? And you want to do it without the computational help of a computer?

Nearly all of the computer chess programs developed in the 80s and 90s could be beaten by human players, sometimes even by players who were not all that good. Over time, programs got better and better. Today you have to be a Master to beat some of the programs that are commercially available. And there is at least one program, IBM's Deep Blue, which can beat a Grand Master. In any software category, there are powerful programs and others that are not so good. There may be some that are downright bad.

If you decide to look for help with scheduling, talk to others who have used the products or services you are considering. Take a look at what has been written about the prospective solutions. Examine the scheduling process being proposed and ask yourself if it seems up to the task of finding the best solutions among trillions upon trillions upon trillions of combinations, and then decide.

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A note from the publisher

*I hope you enjoyed this inaugural issue of **Scheduling Update**. To receive future issues you must request the free subscription at: <http://www.autoscheduling.com/newsletter>*

Thanks to Robert Gillis for editing this newsletter. He is knowledgeable about academic scheduling and has experience scheduling with various software as well as manual scheduling. He has degrees in education, business and engineering from Harvard, the University of Missouri, and M.I.T., respectively. My thanks also go to Dan Evans for his invaluable contributions to this issue.

It is our goal to bring you a publication that is useful. If you have any comments or questions about the newsletter, please email editor@autoscheduling.com.