

Two disciplines join to optimize solutions to enterprise-wide problems

Operations research and computer science merge to create optimization software *by Allison Thompson*

Imagine that you are Citroën-Peugeot, with orders for thousands of cars in hundreds of model configurations. You have to decide which of your numerous factories will produce which cars – that's an allocation problem. Then, you have to decide how to produce them most efficiently on the assembly line – that's a scheduling problem. You don't want to allocate too many car orders to one factory and too few to another – there may be a time and labor cost to switching colors in the painting machines, or you may want to paint all your red cars on Monday and all your blue cars on Tuesday.

While the fields of operations research and constraint programming have solved certain aspects of each of these types of problems, researchers are only just beginning to put the pieces together into an efficient whole. “Until recently we didn't know how to find a simultaneous optimum for this type of problem,” says **John Hooker**, professor of operations research, T. Jerome Holleran Professor of Business Ethics and Social Responsibility, and director of the Center for International Corporate Responsibility.

“What often happens in the field is a common-sense approach where central managers assign tasks to facilities, whereupon operations managers develop detailed schedules for the tasks assigned to each facility. When problems arise, they are resolved through a series of phone calls until a mutually satisfactory resolution is reached. However, an informal process of this sort is time-consuming, and, even if carried to completion, offers no guarantee of obtaining a good solution, just an acceptable one.”

The technique is to decompose the problem into its two stages, but to solve it simultaneously using the complementary strengths of the two disciplines. Hooker and his PhD students, Ionut Aron, Latife Genc and Talys Yunes, are developing a software package that will solve a wide range of enterprise-wide optimization (EWO) problems. The system is called SIMPL, which can be read as a permuted acronym for Modeling Language for Integrated Problem Solving.

“Now, we're combining mixed-integer linear programming, global optimization and constraint programming in a single system,” says Hooker. “We have found that by combining technologies and concepts from the two fields we can simplify modeling and speed up computation substantially – in some cases, 1,000 to 10,000 times faster than current technology.”

“Our dream is to make this the next generation of optimization software.”

For more information read Aron, Hooker and Yunes, “SIMPL: A System for Integrating Optimization Techniques,” at: www.tepper.cmu.edu/SIMPL. ▶

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