

Spreadsheets that use logic instead of math may revolutionize data management, scientists say

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What tool has uses for both the U.S. Army and the Stanford Computer Science Department? Logical spreadsheets—data management systems that use logic instead of math—allow easier manipulation of data, an idea that could have profound implications in fields ranging from hotel management to insurance sales.

"There are many cases where traditional spreadsheets are just not sufficient," says Associate Professor Michael Genesereth, whose group in the Computer Science Department is developing this new method of data management. "Why not have a spreadsheet that looks just like a regular spreadsheet except it has the ability to encode and use logical formulas? That's what you can't do with Excel in any way today."

Microsoft Excel, the most popular and widely used traditional spreadsheet, is the closest competitor to a logical spreadsheet. While Excel is useful, situations exist when it is beneficial to have logical expressions supplant mathematical formulae.

Under the guidance of Genesereth, doctoral candidate Michael Kassoff has been investigating the concept of logical spreadsheets since coming to Stanford in 2001. "They use symbols instead of numbers, and what that allows you to do is to talk about not just numerical expressions, like if you're doing taxes, but you can also talk about things in the world, places and events," Kassoff explains.

Genesereth gives the example of trying to use a logical spreadsheet to plan a meal. "You enter the main course, and let the spreadsheet suggest greens and carbohydrates that are gastronomically compatible and satisfy nutritional requirements," he says. "Or you can do it in the other order." Traditional spreadsheets fail in such applications because they are more rigid and cannot represent logical constraints.

The need to move beyond the limits of traditional spreadsheets, identified by Genesereth more than 10 years ago, gave rise to the idea of logical spreadsheets. Along with other members of the Stanford Logic Group, a multidisciplinary research team of about a dozen, Genesereth and Kassoff set out to develop a program that could tackle these challenges.

One puzzling issue has been how to preserve and rectify temporary inconsistencies. Kassoff specializes in managing inconsistencies in computational logic. If the system comes across two or more contradictory statements, it will take the following approach: "Allow you to have those problems, alert you to the problems, and allow you to fix them on your own."

The group is currently awaiting approval on a patent for their ideas about handling inconsistencies in spreadsheets.

After a few years of straightening out other technical difficulties and user-interface problems, the team came up with a prototype called PrediCalc, which they presented in a 2005 paper published in VLDB, an international journal on very large databases.

Funding for the team's logical spreadsheet project comes from the Stanford Logic Group and SAP.

Although Stanford is a forerunner in this field, it is not the only group

exploring logical spreadsheets. With funding from DARPA, the Defense Advanced Research Projects Agency, four small companies also are working on commercial applications for the spreadsheets. The Department of Defense would like to use the technology for organizing troop deployment and training, according to Kassoff.

The Stanford Logic Group focuses on other usages, such as scheduling classes or events. "For example, for your course schedule as an undergrad you have requirements to fill," says Kassoff. "So think of your course plan as a spreadsheet and the requirements—three math classes and only 21 units in a quarter—as constraints. You fill out the form and it tells you if there are any problems."

Currently, administrators manage the scheduling of rooms in the Gates Building using logical spreadsheets. Starting next fall, Genesereth hopes that the Computer Science Department will be run using logical spreadsheets. He has named this effort the Digital Department Project and calls it the "poster child" application for logical spreadsheets.

The group is looking for other flagship applications as well. Genesereth hopes that eventually logical spreadsheets will find use in forms that are easily accessible through the web. In fact, he hopes these websheets will be the norm. "Frankly, it should have an impact on every website that has a form of some sort that you have to fill out," he asserts. "All online forms could all be websheets. There's no reason for them not to be."

Says Genesereth: "This technology could be very explosive when it finally does make its way into practical use."

Source: by Chelsea Anne Young, Stanford University

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