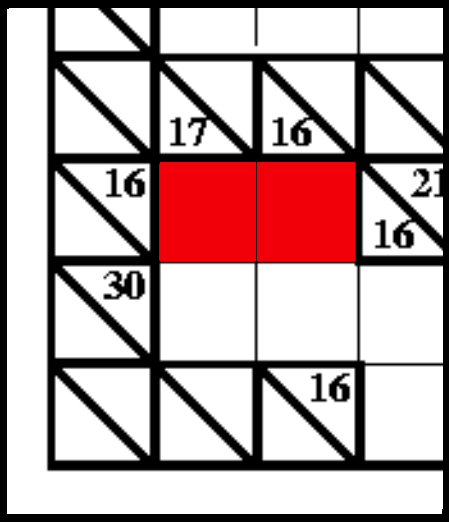
Kakuro, Sudoku and Computer Science

To be a good computer scientist you have to enjoy problem solving. That is what it's all about: working out the best way to do things. You also have to be able to think in a logical way: be a bit of a Vulcan. But what does that mean? It just means being able to think precisely, extracting all the knowledge possible from a situation just by pure reasoning. It's about being able to say what is definitely the case given what is already known...and it's fun to do. That's why there is a Sudoku craze going on as I write. Sudoku are just pure logical thinking puzzles (most of which are generated by computers of course). Personally I like Kakuro better: similar to Sudoku, but with a crossword format.

What is a Kakuro?

A Kakuro is a crossword-like grid, but where each square has to be filled in with a digit from 1 to 9 rather than a letter. Each horizontal or vertical block of digits must add up to the number given to the left or above, respectively. All the digits in each such block must be different. That part is similar to Sudoku, though unlike Sudoku, numbers can be repeated on a line as long as they are in different blocks. Also, unlike Sudoku, you aren't given any starting numbers, just a blank grid.

Where does logic come into it? Take the following fragment:



There is a horizontal block of two cells that must add up to 16. Ways that could be done using digits 1 to 9 are 9+7, 8+8 or 7+9. But it can't be 8+8 as that needs two 8s in a block which is not allowed so we are left with just two possibilities: 9+7 or 7+9. Now look at the vertical blocks. One of them consists of two cells that add up to 17. That can only be 9+8 or 8+9. That doesn't seem to have got us very far as we still don't know any numbers for sure. But now think about the top left hand corner. We know from across that it is definitely 9 or 7 and from down that it is definitely 9 or 8. That means it must be 9 as that is the only way to satisfy both restrictions.

Here is a full Kakuro to try.

Check you got it right on the cs4fn website (www.dcs.qmul.ac.uk/cs4fn/) when you are done.

Being able to think logically is important because computer programming is about coming up with precise solutions that even a dumb computer can follow. To do that you have to make sure all the possibilities have been covered. Reasoning very much like in a Kakuro is needed to convince yourself and others that a program does do what it is supposed to. An ongoing challenge is in developing programs that can do that kind of reasoning and so be able to tell us whether other programs are correct or not.

For more logic puzzles go to the cs4fn webzine (www.dcs.qmul.ac.uk/cs4fn/).