Adventures in Computer Science

March 5-28, 2010 in the Ars Electronica Center

Opening March 4, 2010, 7 PM, SKY LOFT

(Linz, March 4, 2010) Why can a scratched DVD still be played? How come so many digital images can be stored on a single memory card, but there are still some problems that not even the fastest computer can solve? The more than 20 experimental installations that make up "Adventures in Computer Science" will provide answers to these and many other questions. This touring exhibition was developed by the Teaching Methods in Computer Science program at the Darmstadt (Germany) University of Technology. Its appearance at the Ars Electronica Center is in cooperation with the School Board of the Province of Upper Austria and the Austrian Federal Ministry of Education, Art and Culture, and with the support of the Austrian Federal Economic Chamber's IT Offensive 2020. "Adventures in Computer Science" opens on Tuesday, March 4, 2010 at 7 PM in the Ars Electronica Center's SKY LOFT.

The Jigsaw Puzzle with the Different Colored Monkeys

Information technology measures, controls, decides, steers, recommends and communicates both visibly and invisibly. It pervades our everyday life and yet it's often so well concealed that we're not even aware of its presence. Computer processing speed increases almost by the day. Nevertheless, there are some brainteasers that just cannot be solved by a computer—the one with the different colored monkeys, for instance.

Imagine a jigsaw puzzle that consists of four equal-sized rectangular pieces. Pictured on the edges of each are halves of monkeys in four different colors. The object is to position the four pieces next to each other so that no monkey is made up of different colored halves—that is, all monkeys are one color. Statistically speaking, one needs 126 attempts to solve this problem. A computer needs all of 630 nanoseconds to figure it out. If it were given a whole second, it could solve no fewer than 1.5 million such four-piece puzzles.

So far so good. Now, if, instead of 4, the jigsaw puzzle consists of 16 pieces, the computer can solve "a mere" 100 puzzles per second. The computational effort hasn't just quadrupled; 16 times more is required. And if the jigsaw puzzle consists of 36 pieces, the processing job takes almost a year! And no wonder—the computer has to work through 4,482,556,343,409,343 possibilities. The length of time the universe has existed is how long you'd have to wait for the solution to a 10x10 puzzle! The number of permutations to be tested comes to exactly 4,265,326,330,573,335,142,293,854,240,283,428,951,958,671,066,972,613,909,968,375,819.

… non-scaling problems

A problem doesn't "scale" if solving one that's twice as large requires far more than twice as much time. This applies to sorting file cards according to insurance policy number just as it

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does to computing the shortest route from Berlin to Munich. And there are even some assignments that are so difficult that doubling the size of the task sends computational time careening into the realm of infinity. Thus, a 16-part monkey jigsaw puzzle requires more than 16,000 times as many computational steps as are needed to solve one with only four pieces. Adding just a single additional piece thus often means that the problem can't even be solved by computer because it would take an absurdly long time to get an answer!

1 Million Dollars in Prize Money for the Solution

The Clay Mathematics Institute in Cambridge, Mass. offers $1 million to the person who discovers a way for a computer to solve such a multi-part jigsaw puzzle in a shorter time. Or, alternatively, to prove mathematically that no such procedure can exist. In fact, this would represent the solution to one of seven so-called Millennium Problems.

Alternatives?

Even if most computer scientists have no hope of winning this prize money, the awareness of non-scaling problems is itself a major gain for them—in the form of their time not wasted in even attempting to solve such a problem. And just a minor revision in the terms of the assignment in this case does quite a bit for its practical solubility—that is, in the form of an approximate solution.

"Adventures in Computer Science" / Opens on Thursday, March 4, 2010, 7 PM, SKY LOFT

"Adventures in Computer Science" is all about understanding information processing. There's something for everyone: young and old, laymen (and women) as well as experts. The grand opening is on Thursday, March 4, 2010 at 7 PM. Speakers include Gerfried Stocker (Ars Electronica artistic director), Fritz Enzenhofer (School Board of the Province of Upper Austria), Christian Dorninger (Austrian Federal Ministry of Education, Art and Culture), Wilfried Seyruck (Economic Chamber of the Province of Upper Austria) and Jens Gallenbacher (Darmstadt University of Technology).

Adventures in Computer Science: http://www.abenteuer-informatik.de/
Ars Electronica Center: http://www.aec.at/news_en.php?iNewsID=1234

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