

Wolfram's 2,3 Turing Machine Is Universal!

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http://www.wolframscience.com/prizes/tm23/solution_news.html

News Release

Wolfram's 2,3 Turing Machine Is Universal!

October 24, 2007—Wolfram Research and Stephen Wolfram today announced that 20-year-old Alex Smith of Birmingham, UK has won the US \$25,000 Wolfram 2,3 Turing Machine Research Prize.

In his 2002 book *A New Kind of Science*, Stephen Wolfram hypothesized that a particular abstract Turing machine might be the simplest system of its type capable of acting as a universal computer.

In May 2007, the Wolfram 2,3 Turing Machine Research Prize was established to be awarded to the first person or group to prove either that Wolfram's Turing machine is universal, or that it is not.

Alex Smith was able to demonstrate—with a 40-page proof—that Wolfram's Turing machine is in fact universal.

This result ends a half-century quest to find the simplest universal Turing machine.

It demonstrates that a remarkably simple system can perform any computation that can be done by any computer.

It also provides important further evidence for Wolfram's general Principle of Computational Equivalence—a central hypothesis developed in *A New Kind of Science*.

"I had no idea how long it would take for the prize to be won," said Stephen Wolfram. "It could have taken a year, a decade, or a century. I'm thrilled it was so quick. It's an impressive piece of work."

The immediate implications of the result are primarily scientific.

But potential future implications include the possibility of using Wolfram's 2,3 Turing machine to construct a computer operating at a molecular scale.

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"I saw the prize problem primarily as a puzzle," said Alex Smith. "At first, I didn't think the Turing machine would be universal. But then I found a way to show that it is."

Smith is an undergraduate studying electronic and computer engineering at the University of Birmingham, UK. He grew up in Birmingham, and was an alternate for the UK International Mathematical Olympiad team.

Smith's proof will be published in the journal *Complex Systems*.

An official prize ceremony is being planned for November at Bletchley Park, UK, the site of Alan Turing's wartime work.

The prize was adjudicated by a distinguished committee consisting of Lenore Blum, Greg Chaitin, Martin Davis, Ron Graham, Yuri Matiyasevich, Marvin Minsky, Dana Scott, and Stephen Wolfram.

For additional information, see the original media release announcing the prize, or the prize website.

For Stephen Wolfram's personal reaction to the prize, see his blog post.

The prize is part of Wolfram Research's ongoing commitment to the support of scientific research and education. In addition to its acclaimed Mathematica software system, Wolfram Research is also responsible for MathWorld, the world's #1 mathematics information website, as well as the new Wolfram Demonstrations Project. Wolfram Research also sponsors the prestigious annual NKS Summer School and the Wolfram Science Conference.