

Meeting: 1007, Santa Barbara, California, SS 10A, Special Session on Complexity of Computation and Algorithms

1007-03-23 **Cristian S. Calude*** (cristian@cs.auckland.ac.nz), Department of Computer Science,
University of Auckland, PB 92019 Auckland, New Zealand. *Complexity, Provability and
Incompleteness*. Preliminary report.

In this talk we report some results, jointly obtained with H. Juergensen, regarding Chaitin's heuristic principle: 'the theorems of a finitely-specified theory cannot be significantly more complex than the theory itself'. We show that this principle is valid for an appropriate measure of complexity. We show that the measure is invariant under the change of the Goedel numbering. For this measure, the theorems of a finitely-specified, sound, consistent theory strong enough to formalize arithmetic which is arithmetically sound (like Zermelo-Fraenkel set theory with choice or Peano Arithmetic) have bounded complexity, hence every sentence of the theory which is significantly more complex than the theory is unprovable. Previous results showing that incompleteness is not accidental, but ubiquitous are here reinforced in probabilistic terms: the probability that a true sentence of length n is provable in the theory tends to zero when n tends to infinity, while the probability that a sentence of length n is true is strictly positive. The talk will conclude with a few open problems. (Received December 03, 2004)