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MADALGO seminar by Ian Munro, University of Waterloo

Integer Representation and Counting in the Bit Probe Model

We examine the problem of integer representation in near minimal number of bits so that the increment and the decrement (and indeed the addition and the subtraction) operations can be performed using few bit inspections and fewer bit changes. In particular, we prove a new lower bound of Omega(sqrt(n)) for the increment and the decrement operation, where n is the minimum number of bits required to represent the number. The model of computation we considered is the bit probe model, where the complexity measure counts only the bitwise accesses to the data structure. We present several efficient data structures to represent integer that use a logarithmic number of bit inspections and a constant number of bit changes per operation. Finally, we present an extension to our data structure to support a special form of addition and subtraction while retaining the same asymptotic bounds for the increment and the decrement operations.

Joint work with M. Ziaur Rahman