The Theory of Computation

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Solution Manual

Chapter 2, Problem 2.37

Of the three, surely the easiest to reverse is the second: factoring into a power of two and an odd factor is simply shifting down until all trailing zeros have disappeared, something that can be done very efficiently on most arithmetic and logic units. The other two require the computation of a square root for reversal and are thus rather more expensive. The pairing part is a simple second-degree polynomial for our first function and our third, both easily and efficiently computed; our third function requires exponentiation, but only as a power of two, again just a shift (this time up) and thus something easily and efficiently done. Thus, of the three, the second is likely to be the fastest, while the first and third remain quite reasonable.

A formal analysis of the running time is difficult, because it depends very much on the detailed model of computation—in particular, on the cost of arithmetic and logic operations, on what is representable in one word, and on what operations are supplied by the ALU.