The combinatorics of memoryless computation

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An elementary problem when writing a computer program is how to swap the contents of two variables. Although the typical approach consists of using a buffer, this operation can actually be performed using XOR without memory. In this talk, we aim at generalising this approach to compute any function without memory.

We introduce a novel combinatorial framework for procedural programming languages, where programs are allowed to update only one variable at a time without the use of any additional memory. We first prove that any function of all the variables can be computed in this fashion. Furthermore, we prove that any bijection can be computed in a linear number of updates. We conclude the talk by going back to our seminal example and deriving the exact number of updates required to compute any manipulation of variables.