Breaking RSA is Equivalent to Factoring

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CRYPTO 2008 Rump Session.

Breaking RSA Generically is Equivalent to Factoring

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Generic algorithms

- **Cannot exploit representation of elements, except for trivial properties.**
- **Used to prove lower bounds (e.g. DL, DH, DDH).**
- **Many known algorithms/reductions are generic.**
- **Often modeled as a random mapping [Shoup97].**

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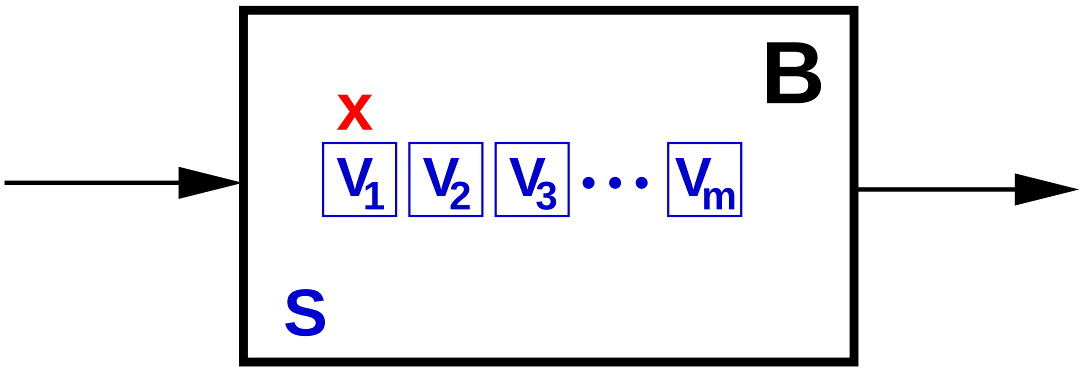
- **Often modeled as a random mapping [Shoup97].**
- **Next: simpler and more general abstract model of computation [Mau05].**

Abstract Model of Computation



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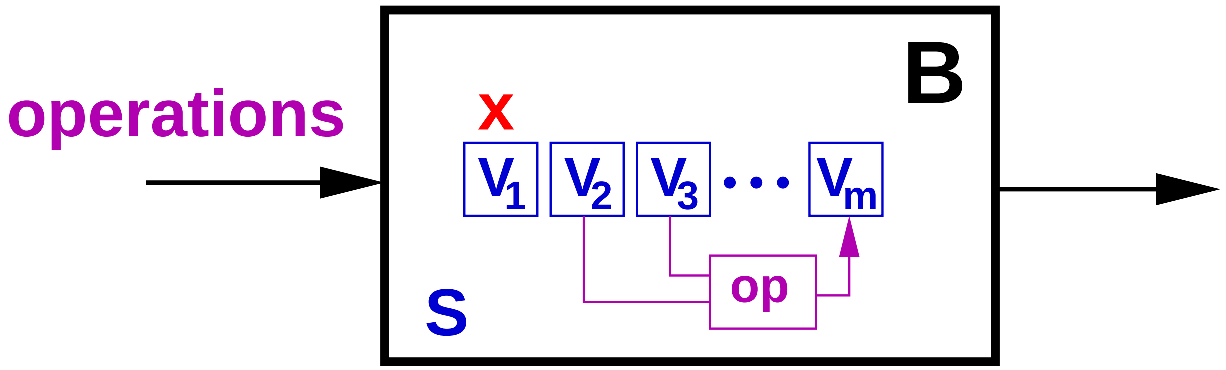

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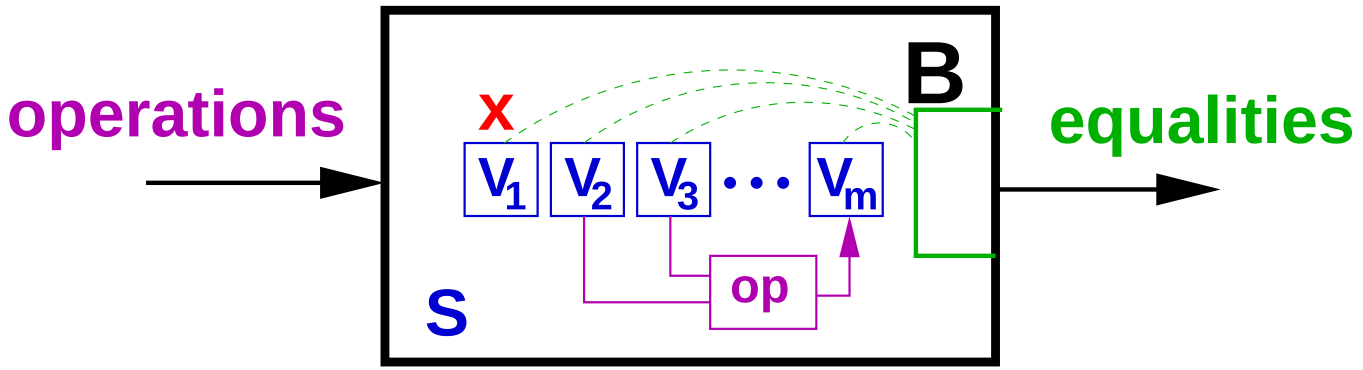

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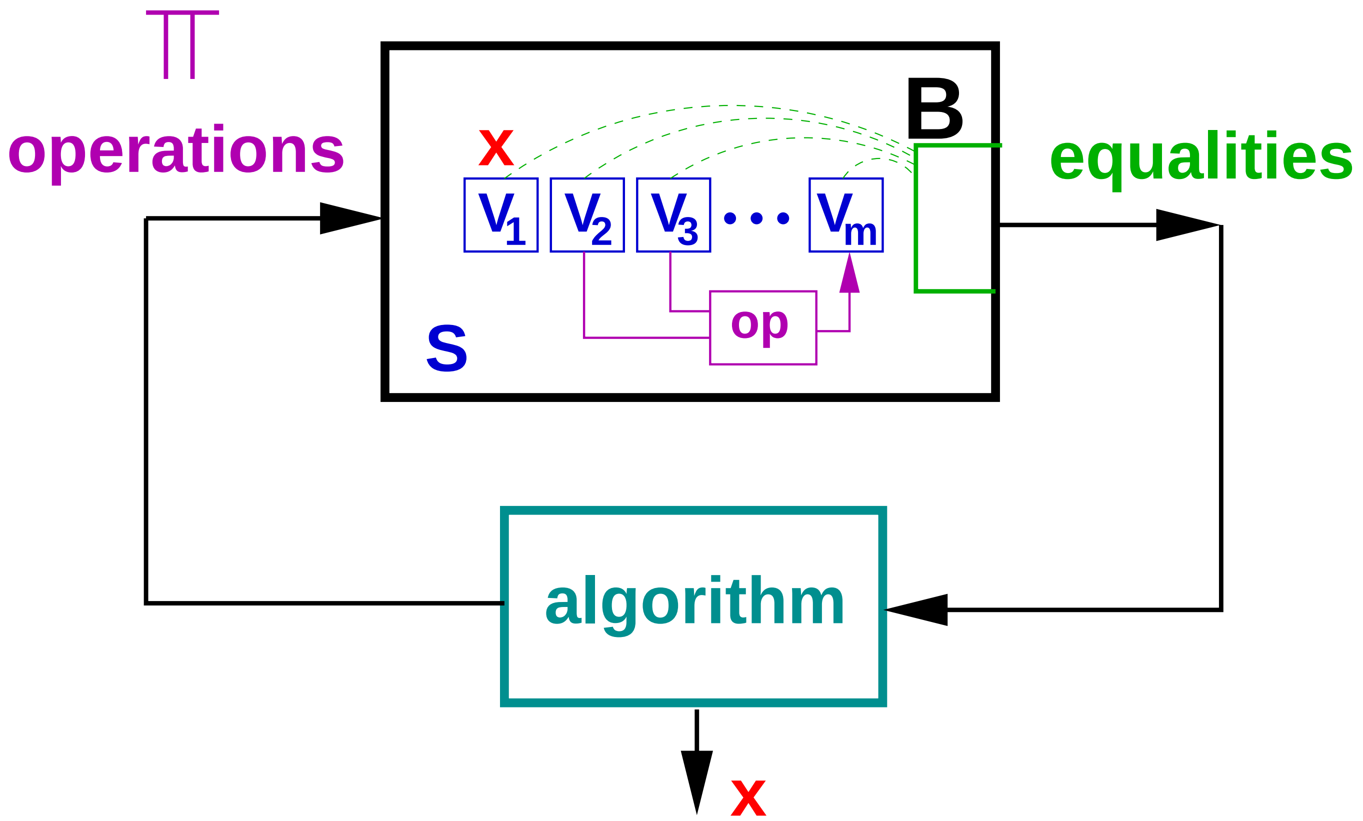

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- Possible type of operation: equality tests.
- Task of algorithm: extract x.

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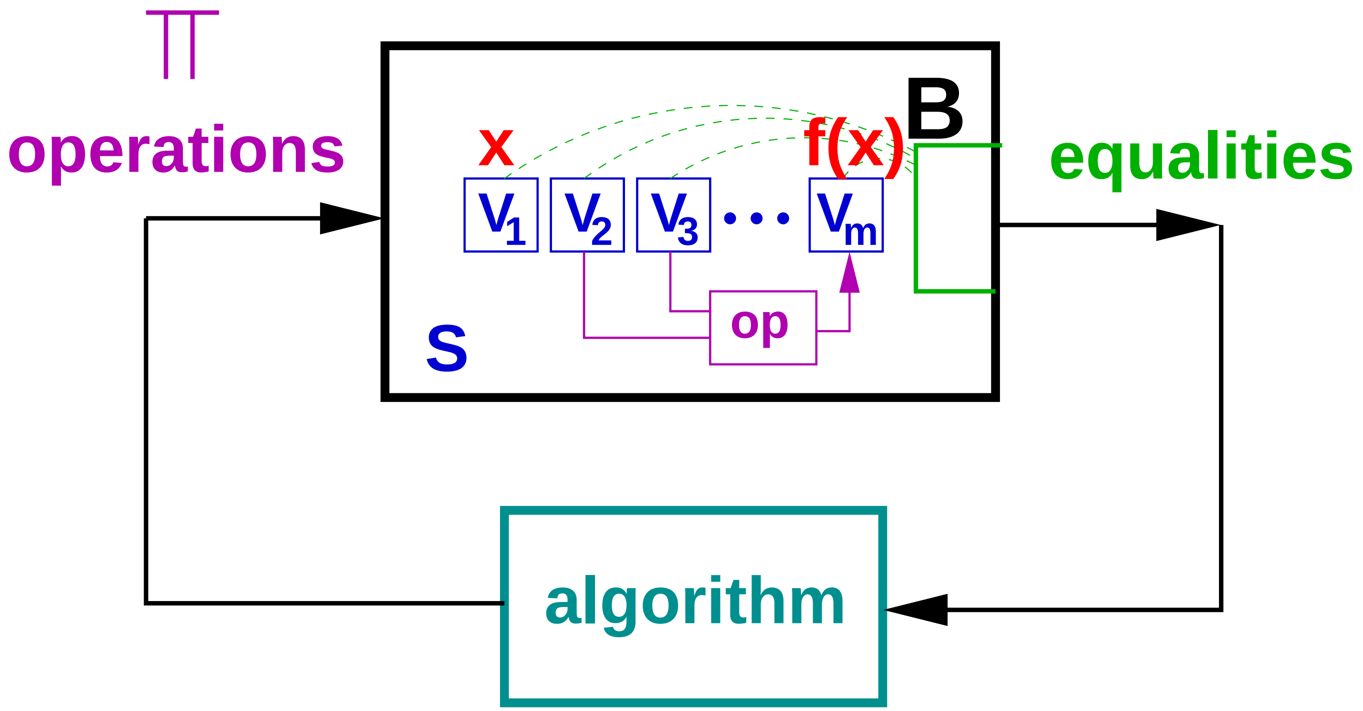

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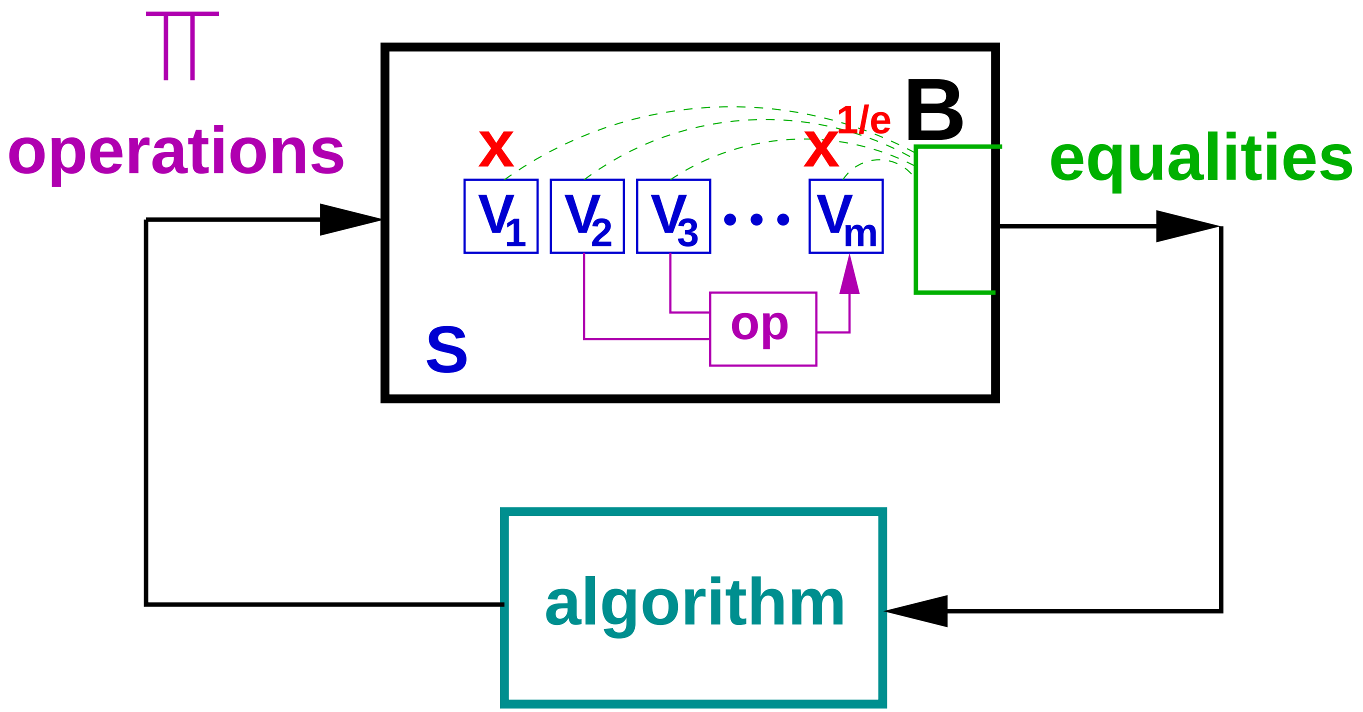
- B allows to perform internal operations.
- Possible type of operation: equality tests.
- Task of algorithm: achieve V_m= f(x) for some f.

Breaking RSA Generically



$$\mathbf{S} = Z_n$$

$$\mathbf{f(x)} = \sqrt[e]{\mathbf{x}}$$

$$\Pi = \{+\,,\,-\,,\,*\,,\,/\,,\,(\cdot)^{-1}\,,\,\mathbf{eq?}\}$$

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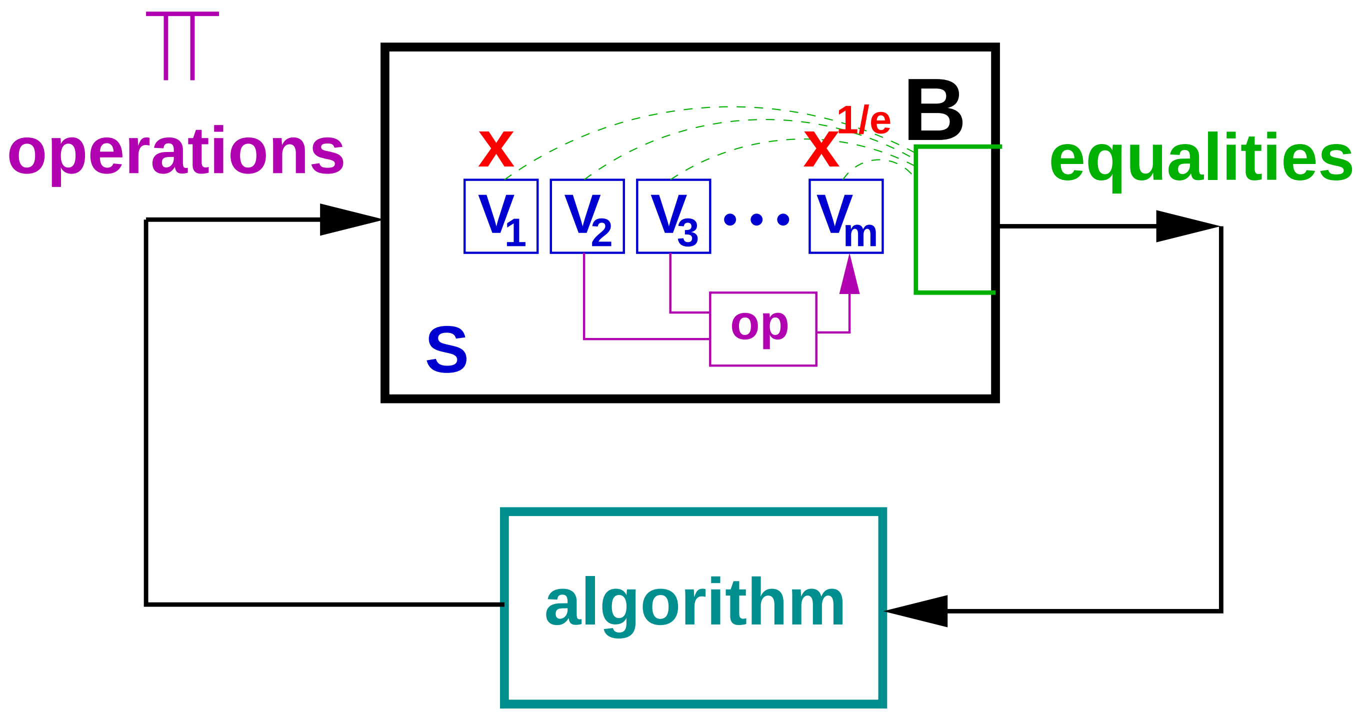

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Previous results: [Brown05], [Leander/Rupp06],

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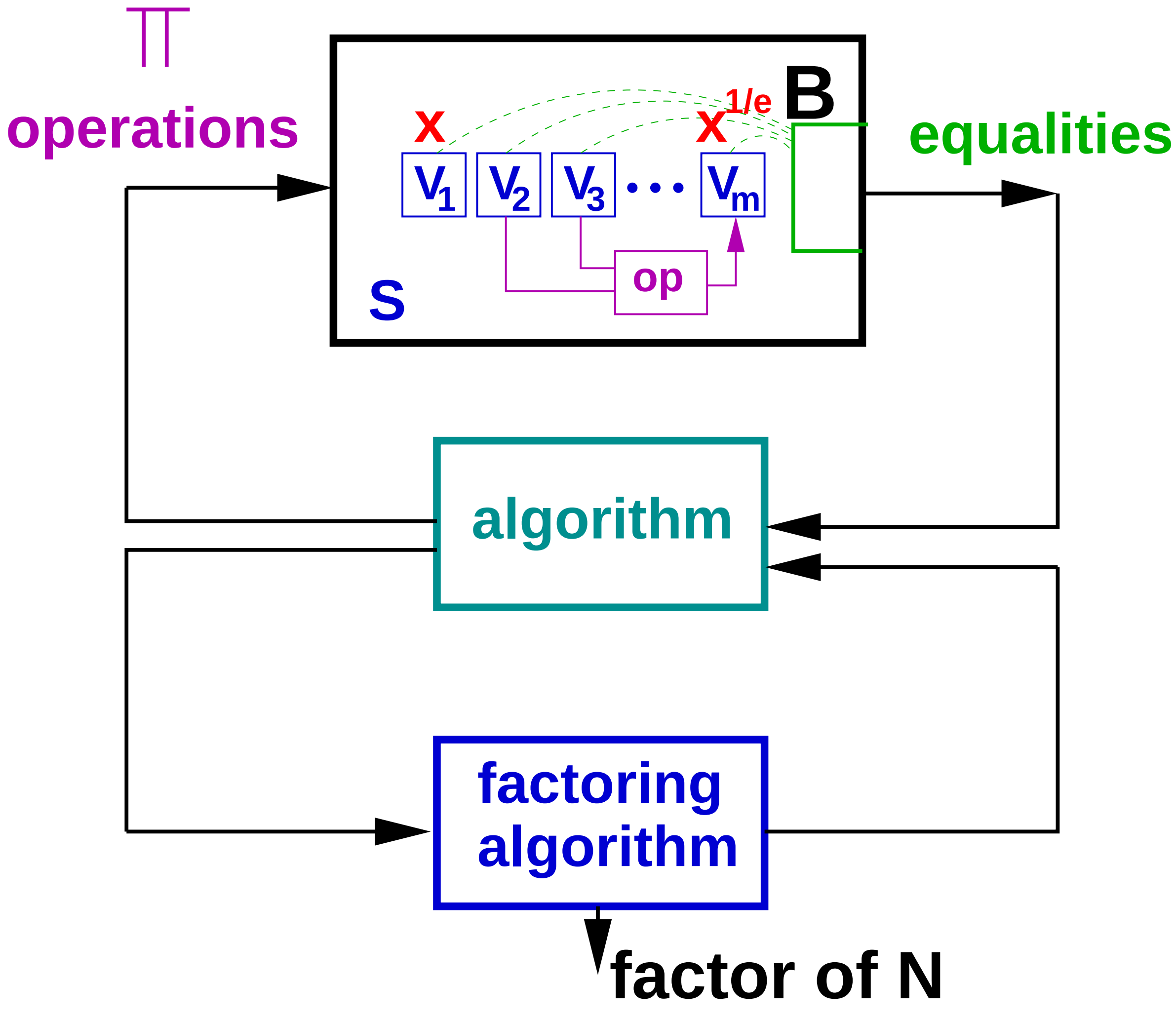

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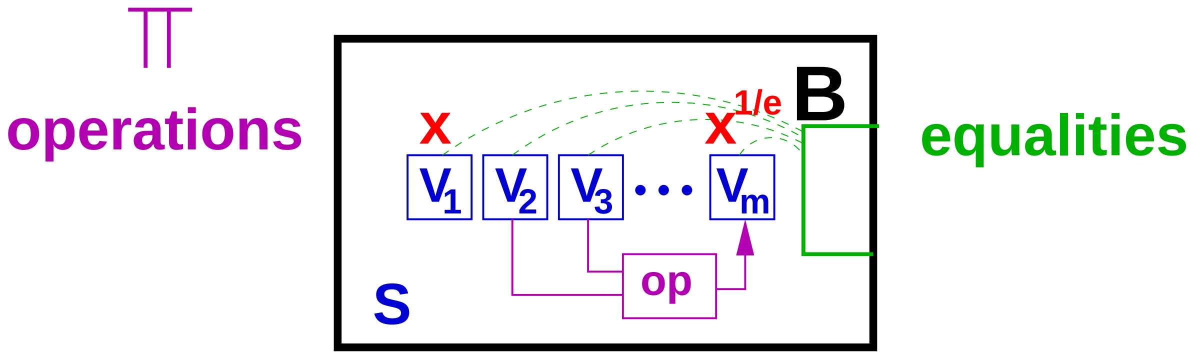

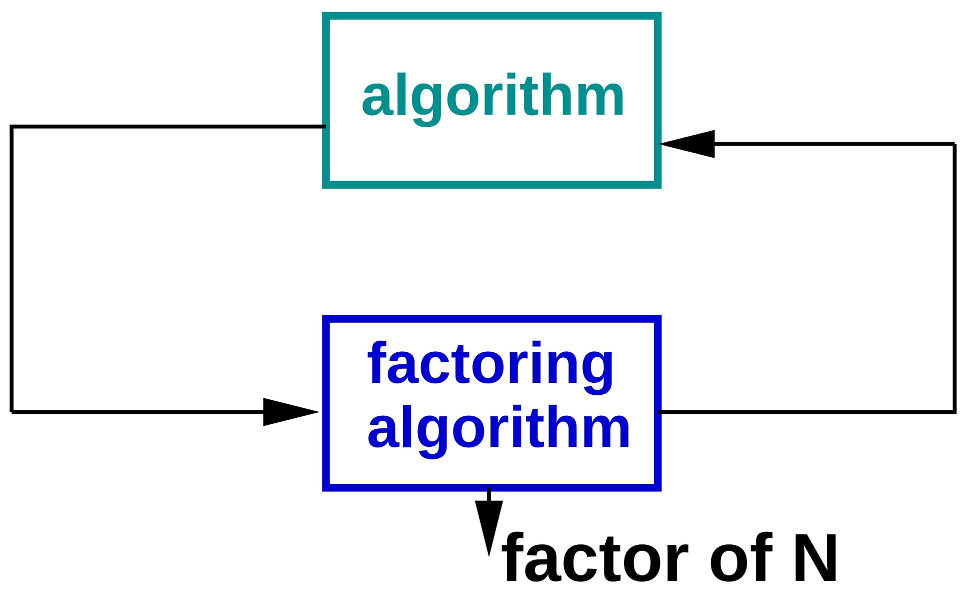

Paper on e-print, but contains an error!

Fixed version (more involved) will soon be on-line.