The Equivalence of Strong RSA and Factoring in the Generic Ring Model of Computation

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EUROCRYPT 2010

Rump Session

The Strong RSA Assumption

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Given $n = pq$, $x \in_R \mathbb{Z}_n$, compute y, e s.t.

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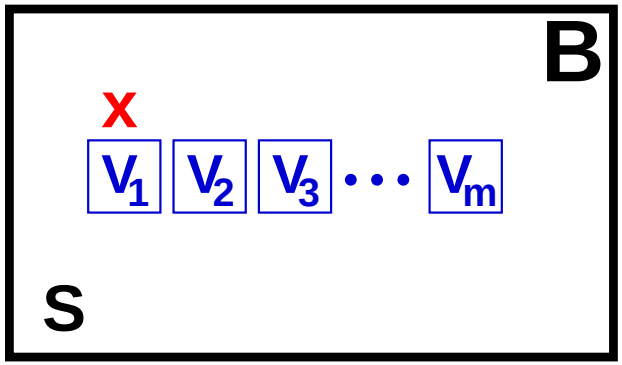
Solve Strong RSA $\stackrel{?}{\Longrightarrow}$ Factor n

The generic model of computation [Sho97, Mau05]

Used to analyze representation independent algorithms



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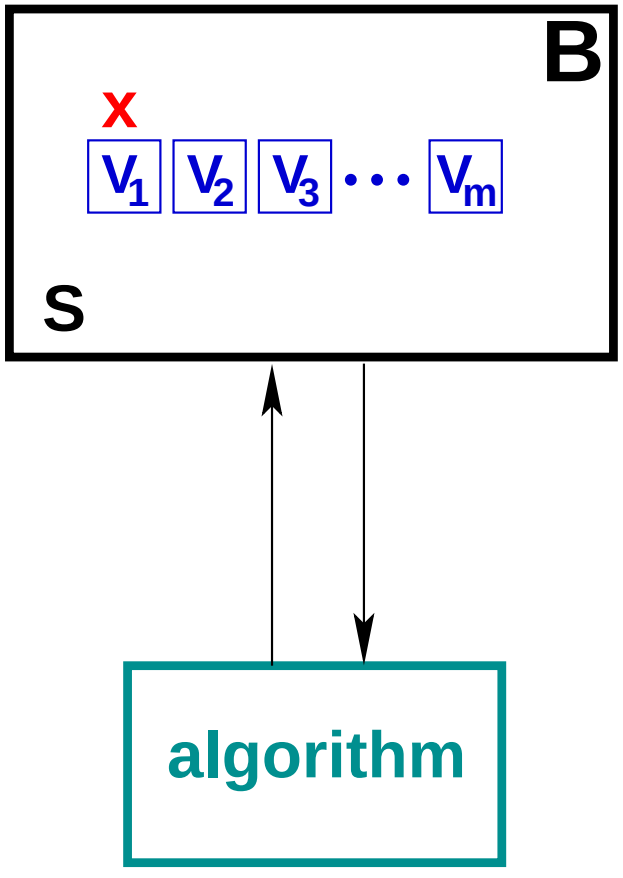

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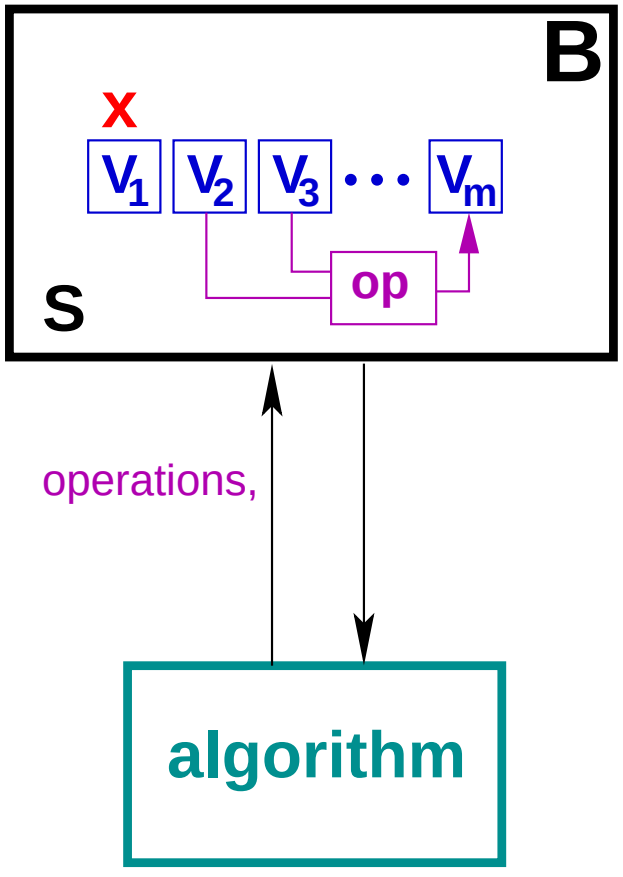

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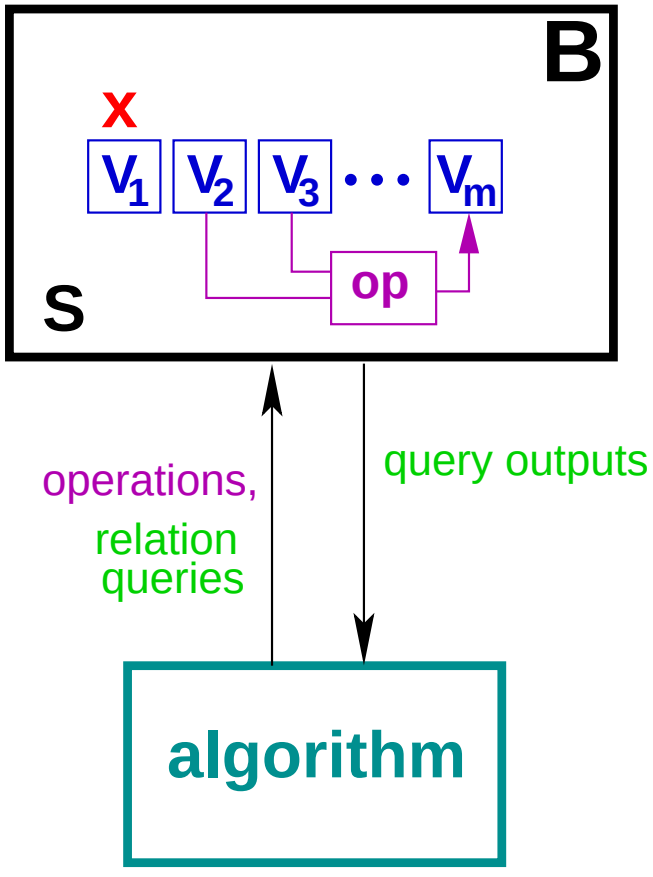
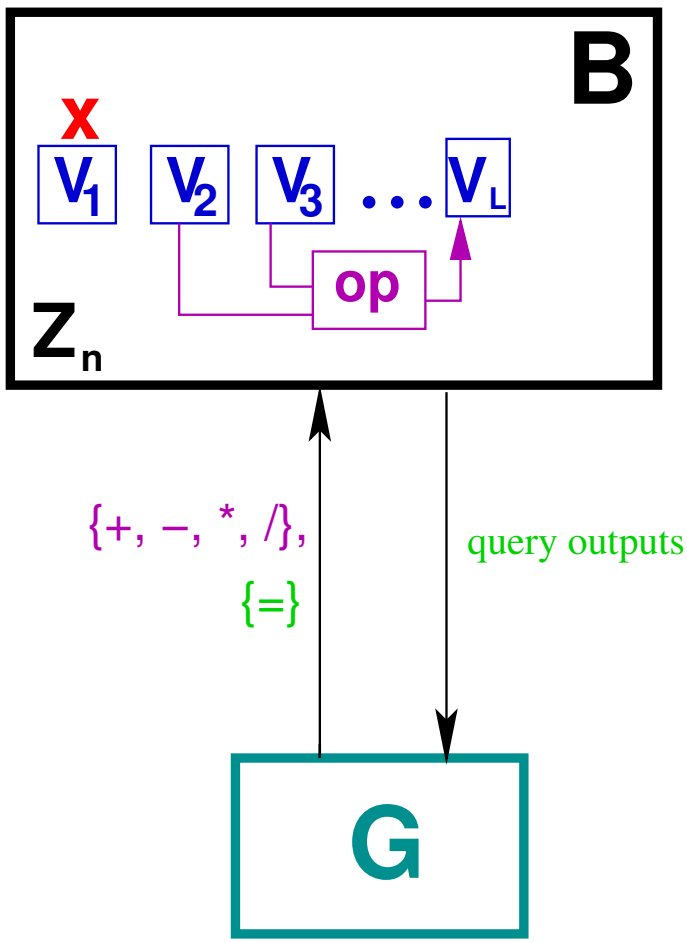
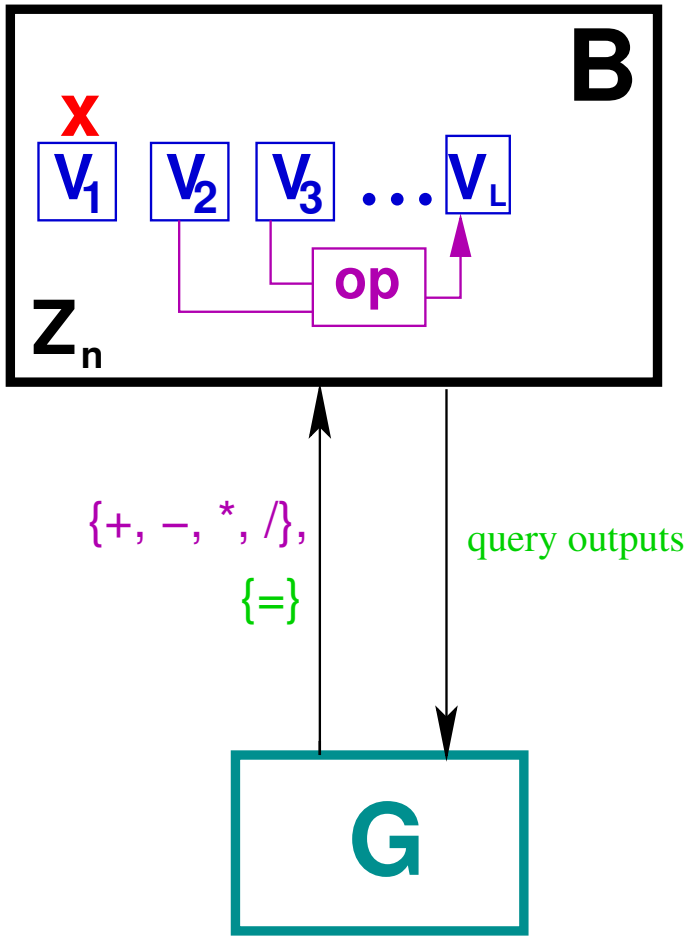


For the ring $\mathbb{Z}_n$



For the ring $\mathbb{Z}_n$, we have from [AM09]...

For any problem $\mathcal{P}$ that G solves..



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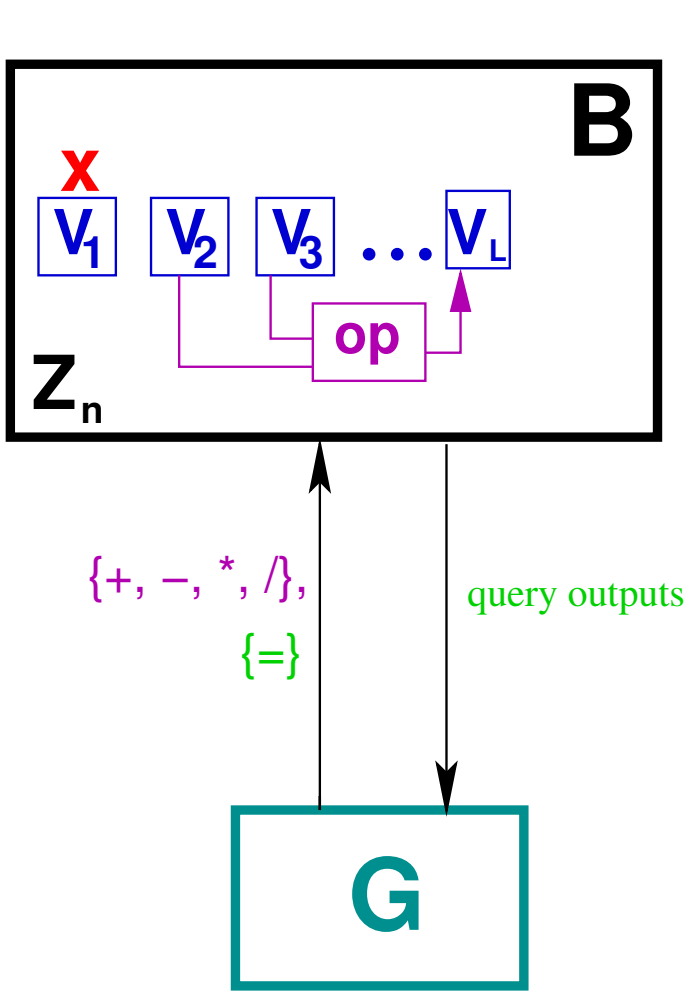
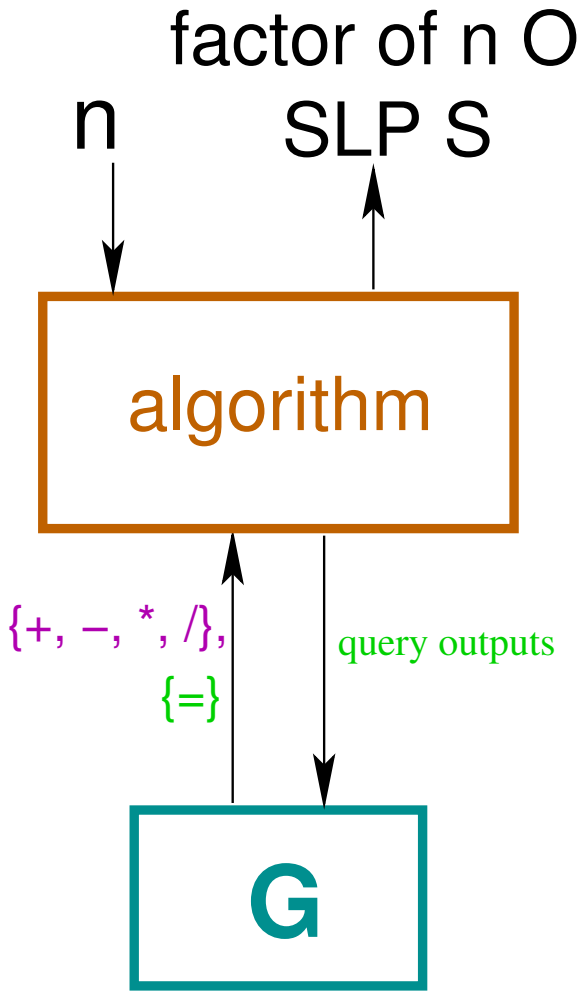
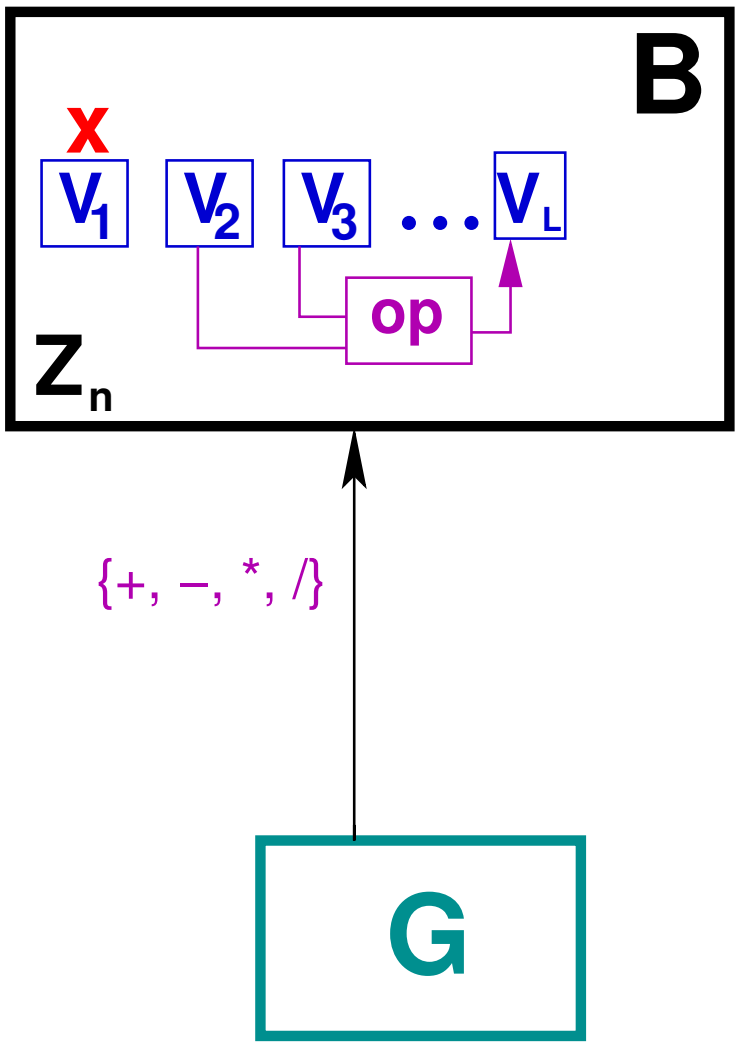
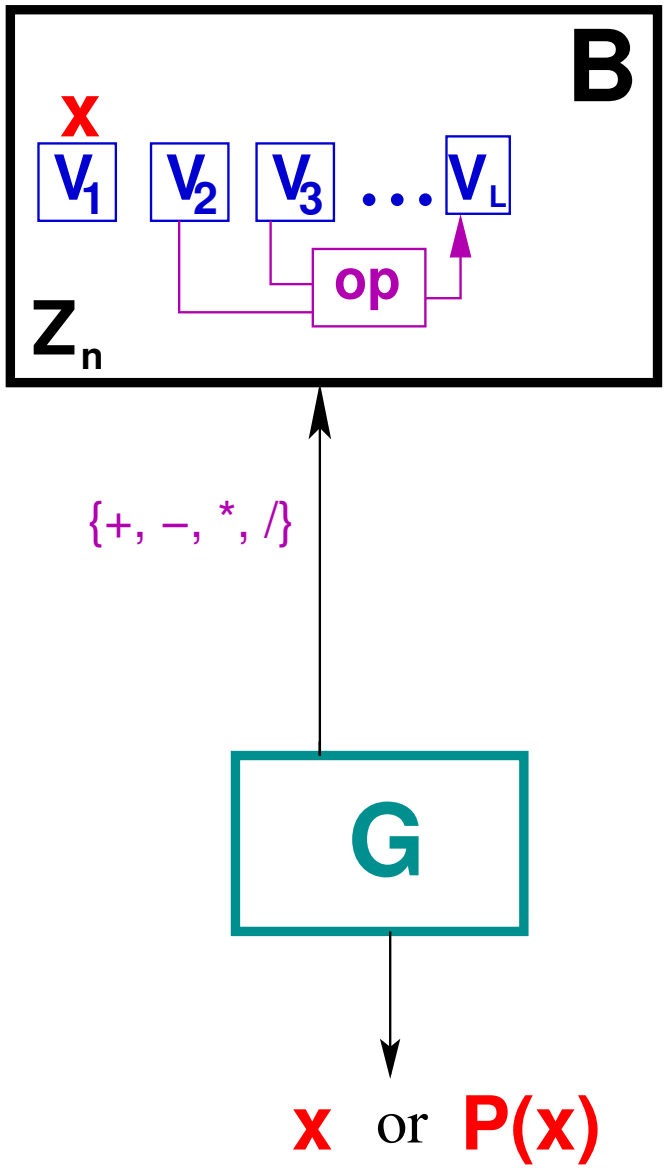




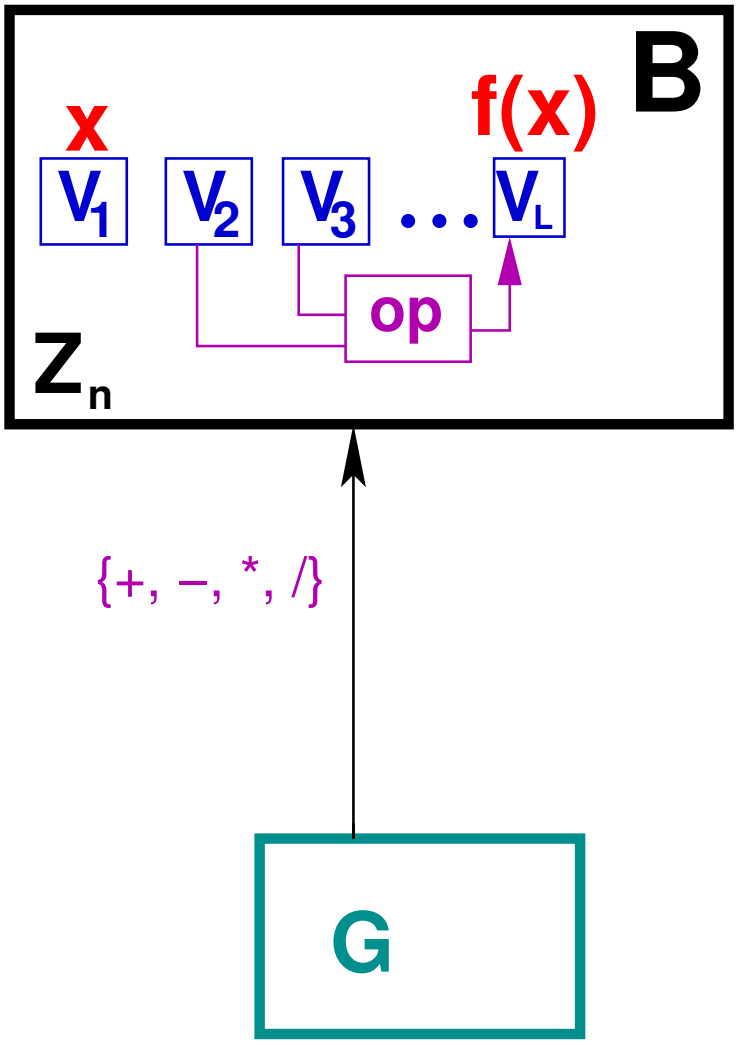
Thus assuming factoring *n* is hard, we can restrict attention to Straight Line Programs



Extraction/Decision Problems Uninteresting

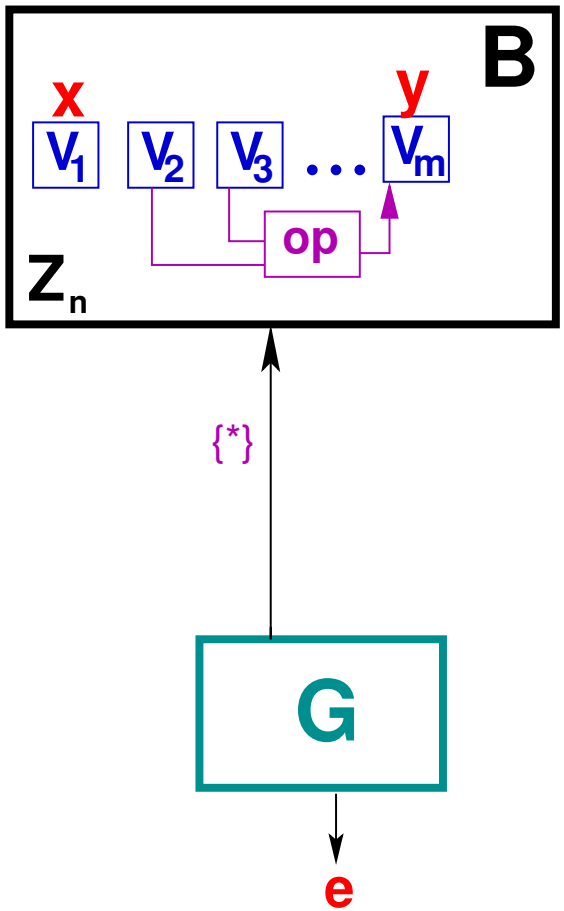


Computation Problems More Interesting



Earlier Attempt at Strong RSA in the Generic Model [DK02]

Strong RSA: Given x, find y, e such that $y^e = x \mod n$



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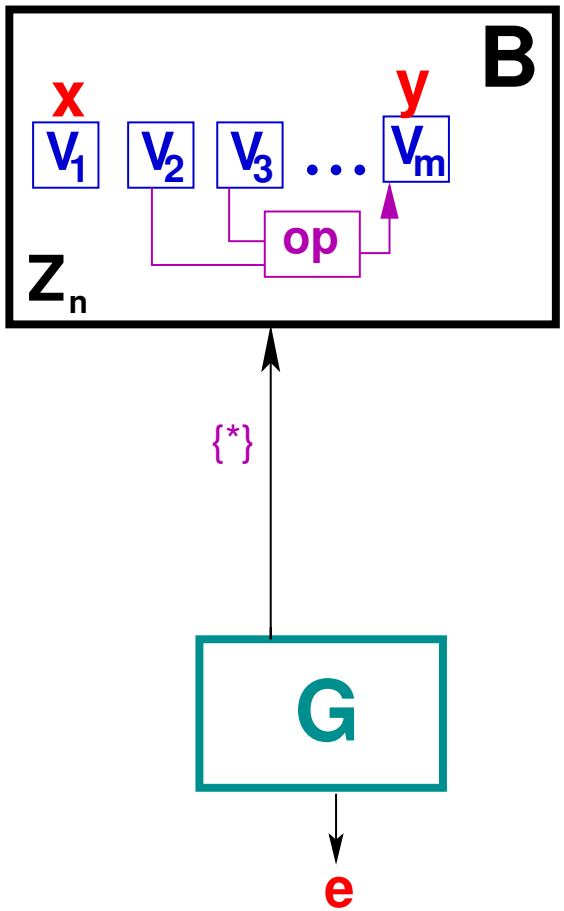
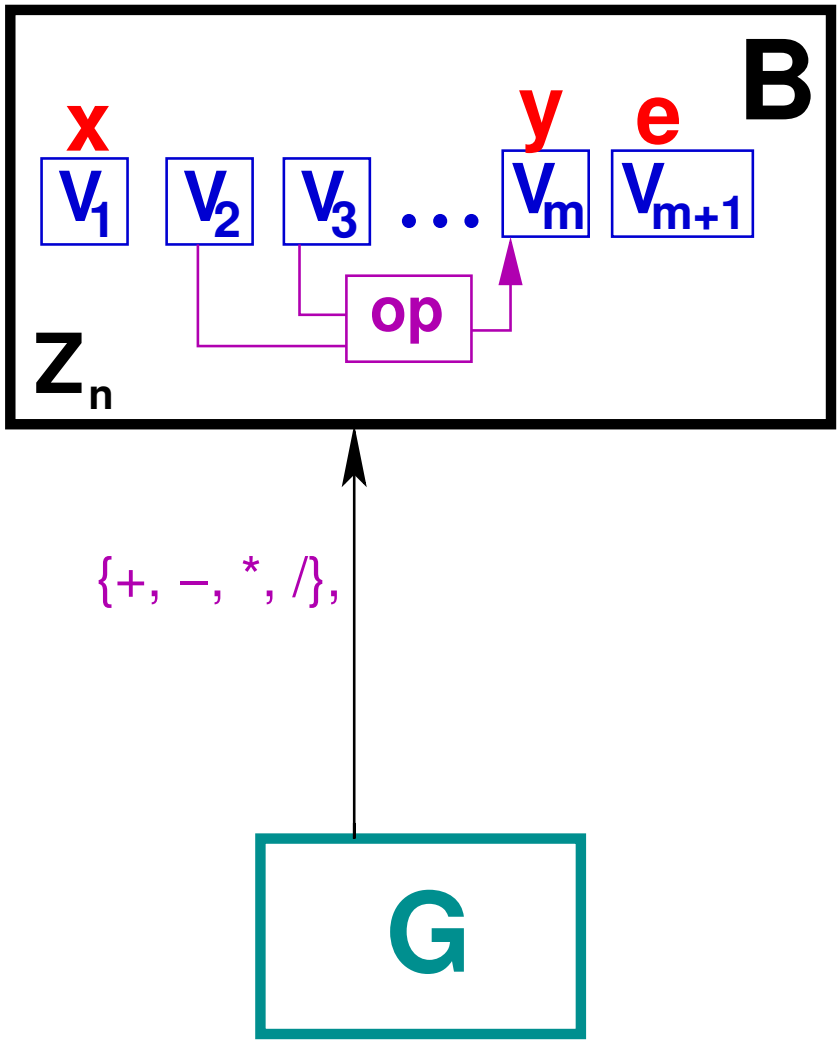


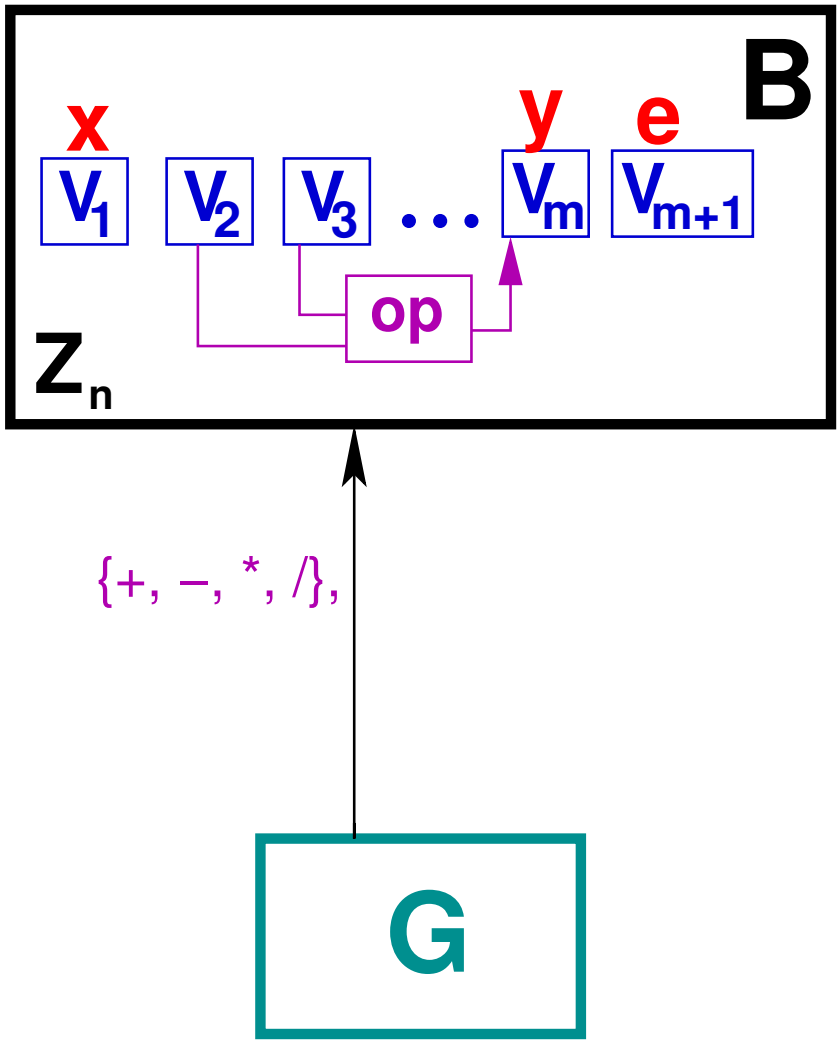
Not much different from RSA

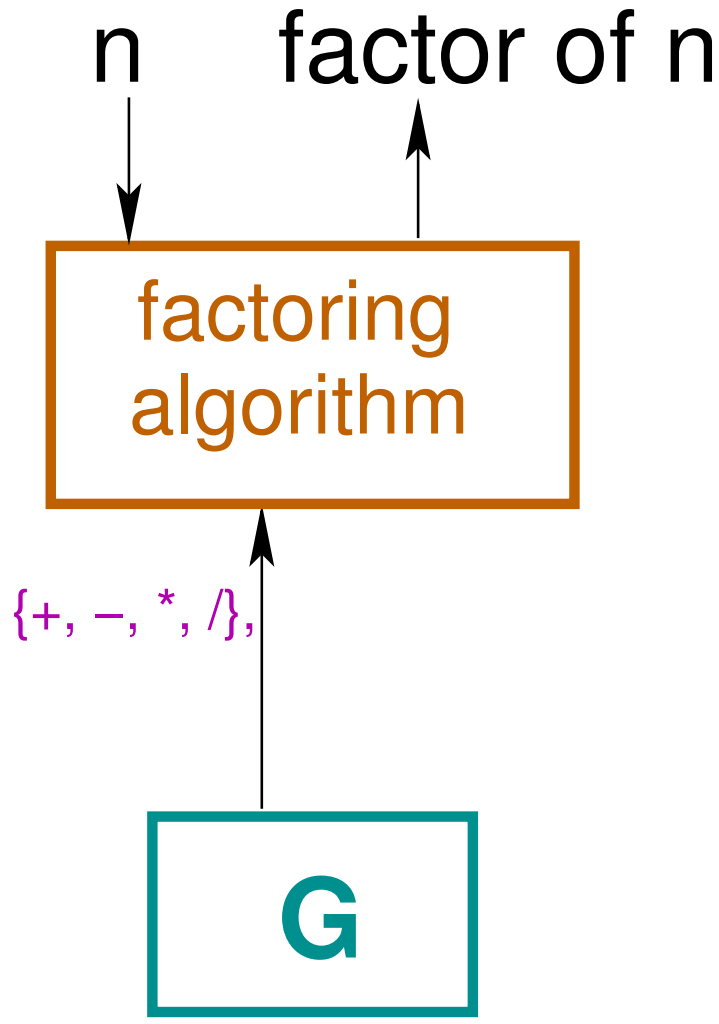
How to model Strong RSA in the generic model?

Here is how!



Our Result





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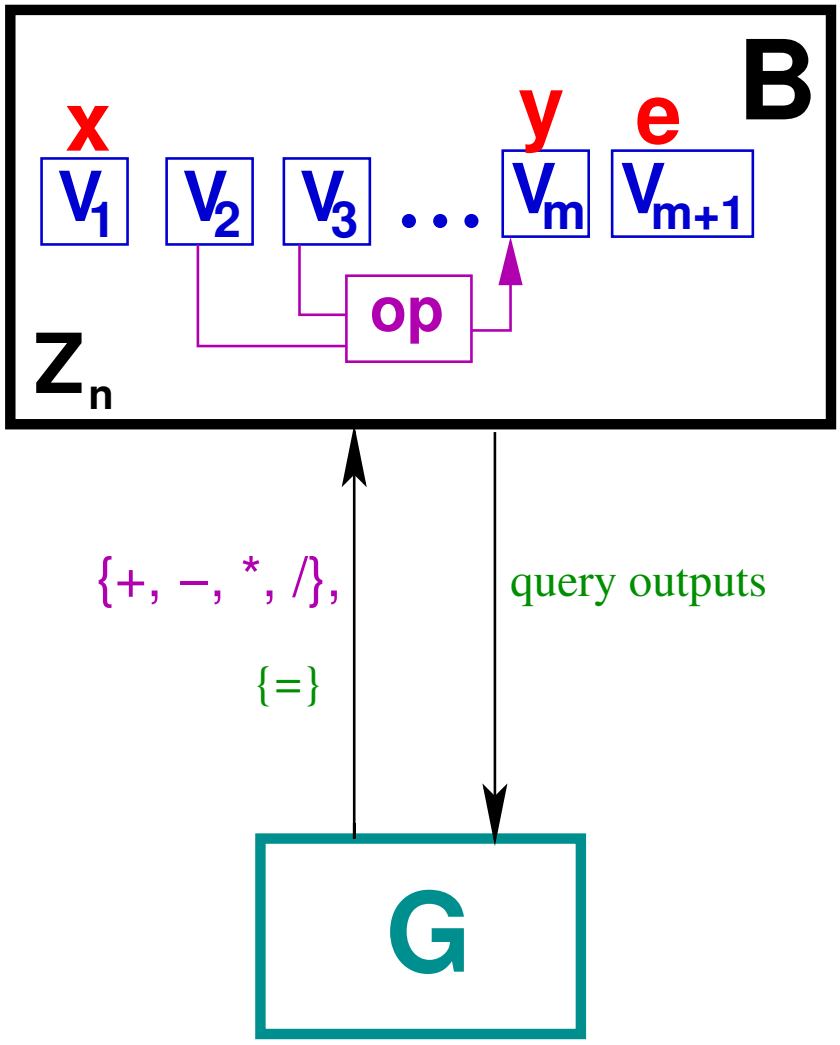
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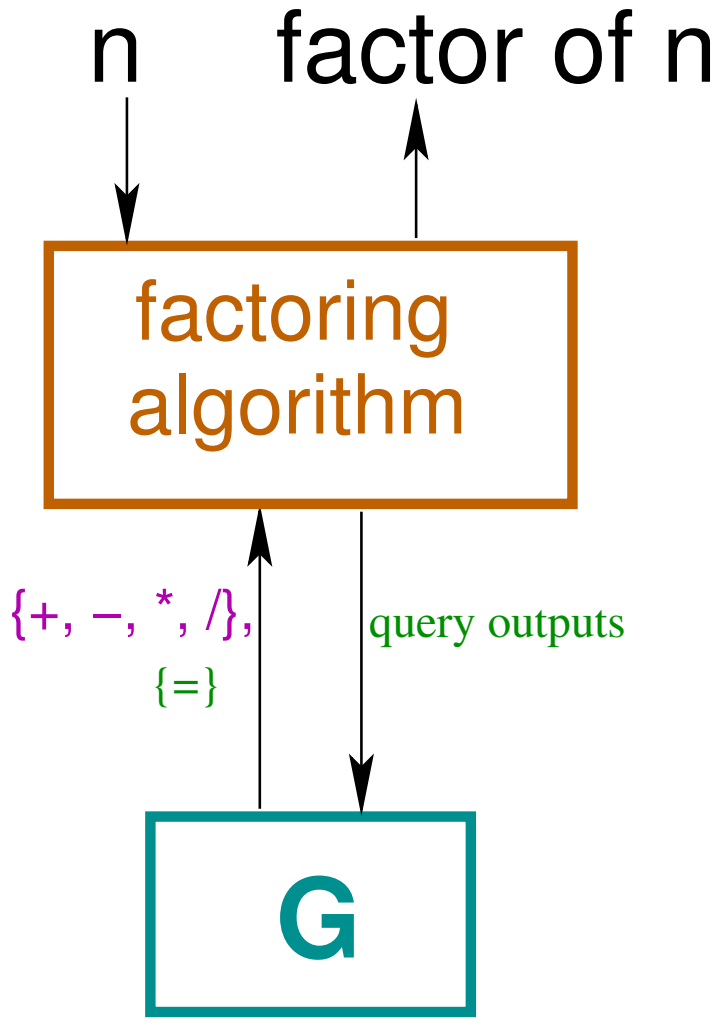
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