Computer Verification in Cryptography

Aim: Construction of formal/computer proofs in cryptography

Aspects:
- Cryptographic Protocol
- Functional Correctness
- Correct Implementation
- Proof of Security

Formal Proof System
- Isabelle/HOL
- Higher-Order Logic
- Interactive Proof Constructions
- Database

Algorithm

Input: $k \in \mathbb{N}$, $2 < k$ odd, $0 < x$, $\gcd(x, k) = 1$, $k - 1 = 2^z v$

Output: $b = 0$ (composite) or $b = 1$ (prime)

$\text{prim}(x, k, v, z) = b$

Computer Verification (Example)

Computer Lemma: $x, k \in \mathbb{Z}$, $k$ prime, $\gcd(x, k) = 1$, $2 < k$, $x < k$, $0 < z$, $0 < v \implies \text{prim}(x, k, v, z) = 1$;

Computer Proof → correct implemented algorithm, augmented database

Conclusion

complex, but useful approach for verification in cryptography;\(^1\)

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