

Use DLP to build a fixed length collision resistant hash function

Collisions for the hash function H are distinct inputs x and y such that $H(x) = H(y)$. A function H is collision resistant if it is infeasible for any probabilistic polynomial-time algorithm to find a collision in H . A family of functions indexed by s is given by

$$H^s(x) = H(s, x)$$

A hash function is a pair of algorithms (Gen, H) where $\text{Gen}(1^n)$ outputs the index s (for choosing H^s). If H^s is defined only for inputs x of a certain length, we say it is a fixed length hash function.

A hash function (Gen, H) is collision resistant if for all probabilistic polynomial time adversaries A :

$$\Pr[\text{Output of Hash-game} = 1] \leq \text{negl}(n)$$

Based on DLP, two values can be hashed as

$$y = (g^{x_1} \cdot h^{x_2}) \bmod P$$

Where g, h are primes in the \mathbb{Z}_p group and through this two values are hashed into a single value. In other words, the function hashes $2n$ bits to n bits.