

We want to show that: „Every symbol from a given alphabet can be represented as a bitstring. This representation is one-to-one and only scales logarithmically in alphabet size.“ Consider an alphabet  $A$  with  $n$  symbols where each symbol  $a_0, a_1, \dots, a_{n-1}$  can be represented by a unique integer. Because we can use the index of an element as its integer counterpart, at least one such representation exists

We can uniquely represent an integer  $c$  as a bitstring  $b$  through the following algorithm: Zero all bits in  $b$ . Find the largest  $x$  such that  $2^x$  divides  $c$ . Set  $b_x$  to one and set  $c$  to  $c - 2^x$ . Continue until  $c$  is zero. The length of such a bitstring is determined by the  $x$  of the first iteration, so the first  $x$  such that  $2^x \mid c$ . The length of the resulting bitstring will thus be  $\lfloor \log_2(c) \rfloor$ , hence the logarithmic scaling in the size of the alphabet, 2.