

Exercise 2.72.

Consider the encoding procedure that you designed in exercise 2.68. What is the order of growth in the number of steps needed to encode a symbol? Be sure to include the number of steps needed to search the symbol list at each node encountered. To answer this question in general is difficult. Consider the special case where the relative frequencies of the n symbols are as described in exercise 2.71, and give the order of growth (as a function of n) of the number of steps needed to encode the most frequent and least frequent symbols in the alphabet.

Answer.

We have seen in exercise 2.71 that it takes up merely one step to encode the most frequent symbol, where as accessing the least frequent symbol requires $N - 1$ steps, where N denotes the number of symbols in the alphabet. Suppose the size of the most frequent and least frequent symbols we have to encode are both n .

For the most frequent symbols of amount n , each one takes one step to encode, so the number of steps it required has an order of growth $\Theta(n)$. On the other hand, since each element in the set of least frequent symbols takes $N - 1$ steps to encode. Therefore, the number of steps needed to encode the most frequent symbols of size n grows as $\Theta(n^2)$.

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