

# Mandatory exercise: Compression

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**1 Random access to a grammar-compressed string.** Let  $S$  be a string of length  $N$  compressed by a Straight Line Program  $\mathcal{G}$ . The height  $h$  of  $\mathcal{G}$  is the length of the longest path from the root of  $\mathcal{G}$  to a terminal node.

The query `DECODECHAR( $i$ )` returns the character at position  $i$  in the string  $S$ . Explain how to support the query `DECODECHAR( $i$ )` in  $O(h)$  time using  $O(n)$  space and preprocessing time, where  $n$  is the size of  $\mathcal{G}$ . That is, describe a data structure, how to construct it, and how to support the query with the data structure.