Dynamic strings

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References and Reading

[1] Chapter 3 and Sections 6.2, 6.4 of: Navarro, Gonzalo. Compact data structures: A practical approach. Cambridge University Press, 2016.

Exercises

1 Dynamic structures A *searchable partial sum with inserts* (SPSI) is a data structure supporting, in addition to the usual `access`, `sum`, and `search` queries, also an `insert` query defined as follows. Letting A be the array of n integers underlying the partial sum structure, $insert(A, i, x)$ turns A into $A[1..i-1]xA[i..n]$.

1.1 Design a SPSI structure supporting efficient queries and taking asymptotically the same space of the worst-case entropy of A.

1.2 Use the SPSI of Exercise 1.1 to design a compact string (i.e. $O(n \log \sigma)$ bits of space) supporting `insert` operations (i.e. insert a character at some position i), in addition to the usual `access`, `rank`, and `select`.

1.3 Combine the solutions of Exercises 1.1 and 1.2 to design a run-length compressed string (see week 5) supporting `insert` operations in addition to the usual `access`, `rank`, and `select`. Note that run-length compression must be preserved after inserting a character.