

Data Structures - Assignment no. 10, May 31, 2006

Remarks:

- Please write your exercises in pen, or in clearly visible pencil. Please write very clearly.
- For every question where you are required to write pseudo-code, also explain your solution in words.

1. Show how to preprocess an array A of size n , such that the data structure supports the operation $SUM(i, j)$. This operation computes $A[i] + A[i + 1] + \dots + A[j - 1] + A[j]$. The preprocessing time should be $O(n)$, the space usage of the data structure should be $O(n)$, and the query time should be $O(1)$.

Hint: the solution is really simple! (once you find the trick). Think about a Prefix-Sum array – an array B where in location k the number written is $A[1] + A[2] + \dots + A[k]$.

2. Give a solution to the Range Minima Problem with space usage $O(n)$, preprocessing time $O(n)$, and query-time $O(\log n)$.

Reminder: In the Range Minima Problem you need to preprocess an array A of size n , such that the data structure supports the operation $RM(i, j)$. This operation computes $MIN(A[i], A[i + 1], \dots, A[j])$.

3. Let s be a string of length n and let T be its suffix tree.

- (a) What is the maximum possible height of T as a function of n ? (give the answer up to a constant). Give an example, you don't have to prove that it is optimal.
- (b) What is the minimum possible height of T as a function of n ? (give the answer up to a constant). Give an example, you don't have to prove that it is optimal.

4. Given two strings s_1, s_2 , both of length n , and given an integer k , show an algorithm that finds the longest string s that appears at least k times in s_1 and at least k times in s_2 .

Hint: First think of how to find all of the longest strings that appear in s_1 at least k times.