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Datenstrukturen & Algorithmen Exercise Sheet P4 AS 16

Hand-in: Before Thursday, 20th October 2016 10:00 via the online judge (source code only).

Exercise P4.1 *Example task: Array maximum.*

Given $n \geq 1$ positive integers a_0 to a_{n-1} as an array A, find the maximum of these numbers.

Input The input consists of several integers on one line separated by spaces. The first integer is n, the length of the array, followed by n integers a_0 to a_{n-1}.

Output The output cosists of a single integer, the maximum of A.

Grading This task is not graded. Submit your `Main.java` at `https://judge.inf.ethz.ch/team/websubmit.php?cid=18985&problem=DA_P4.1`, enroll password is "`quicksort`".

Example

Input:

```
5 3 42 1 5 11
```

Output:

```
42
```

Notes For this exercise, we provide a working program as an Eclipse project archive on the lecture website[1]. The archive also contains more tests – you can copy&paste the data into your running program. The main goal of this exercise is to learn to work with the judge. You are encouraged to experiment with syntax errors, wrong output etc.

Please turn over.

[1] Lecture webpage: `http://www.cadmo.ethz.ch/education/lectures/HS16/DA/index.html`

Exercise P4.2 *Maximum-sum subarray.*

Given $n \geq 1$ integers a_0 to a_{n-1} as an array A, find the maximum-sum subarray of A and output its sum.

A *subarray* of A is a consecutive part of the array $(a_i, a_{i+1}, \ldots a_{i+l-1})$ starting at some index $0 \leq i < n$ and with length $0 \leq l < n - i$. Among all the subarrays of A (one for every choice of i and l), the *maximum-sum subarray* is the subarray with the highest sum. Note that an empty subarray (with $l = 0$) is also allowed and has sum 0.

Input The input consists of several integers on one line separated by spaces. The first integer is n, the length of the array, followed by n integers a_0 to a_{n-1}.

Output The output should contain one line with the sum of the maximum-sum subarray as a single integer.

Grading Your can get up to 2 bonus points, one bonus point for every 100 points you get in the judge (rounded down). Your program should work in time $O(n^2)$ (or faster) and be reasonably efficient to pass the tests in time.

Submit your `Main.java` at `https://judge.inf.ethz.ch/team/websubmit.php?cid=18985&problem=DA_P4.2`, enroll password is "`quicksort`".

Examples

Input 1 (same as in the lecture):

```
9 7 -11 15 110 -23 -3 127 -12 1
```

Output 1 (subarray with $i = 2$ and $l = 5$ is optimal):

```
226
```

Input 2 (all numbers negative):

```
3 -1 -2 -3
```

Output 2 (empty subarray is optimal):

```
0
```

Notes For this exercise, we provide a program template as an Eclipse project archive on the lecture website, which will load the input array A for you. The archive also contains more tests for you convenience – you can copy&paste the data into your running program.