University of Cape Town ~ Department of Computer Science
Computer Science 3003S Theory of Algorithms ~ 2014

# Practical Test 2 Session 1 Question 2

Time: 120 minutes

## Problem Description

A lumber yard has a stock of N long wooden planks with lengths $L_1$, ..., $L_N$. Planks can be divided into shorter planks --- a plank of length 12, for example, can be divided into three shorter planks, each of length 4 --- but separate pieces can't be joined to form longer planks.

A large order has been placed, requesting that at least K planks of equal length, M, be delivered.

Write a program that, given K and the lengths of planks in stock, $L_1$, ..., $L_N$, determines the maximum possible value for M.

Note that as the length increases, the number of planks that can be made will decrease.

Example

You are given N = 4 planks with lengths 10, 14, 15, 11. The order requests a minimum of 6 planks.

The order can be fulfilled with 6 planks of length 7 each:

- The plank of length 10 is divide into one plank of length 7, and one of length 3 (which is discarded).
- The plank of length 14 is divide into two planks of length 7.
- The plank of length 15 is divide into two planks of length 7, and one of length 1 (which is discarded).
- The plank of length 11 is divide into one plank of length 7, and one of length 4 (which is discarded).

The order can’t be fulfilled with planks of length 8 or more, so 7 is the maximum length.

**Note** that although the discarded pieces have a combined length greater than 7, they can't be combined to form a longer plank.

## File names

- Use `dividing.c` if you are writing your program in C.
- Use `dividing.cpp` if you are writing your program in C++.
- Use `Dividing.java` if you are writing your program in Java.

Please remember to zip your file.

Question continues on next page

## Input and Output

Program input and output will make use of `stdio` streams (`System.in` and `System.out` in Java) i.e. not file I/O.

Input consists of a series of integer values, each on a separate line. The first value is N, the number of planks in stock, followed by the lengths of those planks, $L_1$, ..., $L_N$, followed by K, the minimum number of planks required.

Output consists of a single integer, M (the maximum possible length that will allow K planks to be delivered), followed by a line break --- in Java, for example, use `System.out.println`, not `System.out.print`. The automatic marker expects output in this precise form.

Constraints:

$1 \le N \le 10{,}000$
$1 \le L_i \le 1{,}000{,}000{,}000$
$1 \le K \le 10{,}000{,}000$
The answer, M, will be bounded by:
$1 \le M \le 10{,}000{,}000$

Sample Input:

```
4
10
14
15
11
6
```

Sample output:

```
7
```

## Scoring

Each test case that is answered correctly will earn 10 points.

END