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

Practical Test 1 Session 1 Question 2

50 Marks

You may consult the electronic Java and C/C++ API documentation (docs.cs.uct.ac.za), and submit to the automatic marker via Vula (vula.uct.ac.za), but nothing else! You may NOT use your class notes, textbooks, internet or files on your flash disk, hard drive, etc.

You may use only the computers in the lab. No tablets, headphones or other personal devices are permitted.

File names

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

Note that case matters.

Submission

The automatic marker contains a submission entry bearing the same title as this question sheet.

Submit your source file within a single compressed, '.ZIP', archive.

Make sure you create a '.ZIP' archive, not a gzipped, '.gz', or tar-gzipped, '.tgz', or other kind of file.

Make sure your source file is the only item within the archive. Especially, avoid submitting an archive containing a folder containing the file.

When submitting a Java source file copied from an editor like Eclipse or Netbeans, please remove any package line that may appear at the beginning of the code.

Scoring

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

Question continues on next page

Problem Description

Write a program that accepts as input a list of N positive integers, $V_1,\ldots,V_N$, and a target score, T. Starting with a score of 1 point, the program will process the list of numbers in order, in each case, choosing whether to add the number to the current score, or to multiply the current score by it. The object is to find the maximum score that can be achieved that is *less* than T.

Examples:

Given N = 4 numbers, <4, 2, 3, 5>, and a target of T = 40, one possible score is achieved as follows:

Starting with 1,

* 4 = 4
* 2 = 8
+ 3 = 11
* 5 = 55

But 55 is larger than the target of 40.

The maximum score (less than 40) that can be achieved is in fact 35. It is obtained as follows:

Starting with 1,

+ 4 = 5
* 2 = 10
* 3 = 30
+ 5 = 35

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 for N, the number of integers in the list, followed by the values for those integers ($V_1,\ldots,V_N$), followed by the value for the target score, T.

Constraints:

$1 \le N \le 20$
$1 \le V_i \le 1{,}000$
$1 \le T \le 1{,}000{,}000$

Output consists of a single integer (the maximum score which can be achieved that is *less* than T) followed by a line break --- in Java, for example, use `System.out.println`, not `System.out.print`. The automatic marker expects the output in this precise form.

Sample Input:

```
4
4
2
3
5
40
```

Sample output:

```
35
```

END

END