Yet Another KMP Problem

HackerRank

This challenge uses the famous KMP algorithm. It isn't really important to understand how KMP works, but you should understand what it calculates.

A KMP algorithm takes a string, S, of length N as input. Let's assume that the characters in S are indexed from 1 to N; for every prefix of S, the algorithm calculates the length of its longest valid border in linear complexity. In other words, for every i (where $1 \le i \le N$) it calculates the largest l (where $0 \le l \le i-1$) such that for every p (where $1 \le p \le l$) there is $S[p] = S[i-l+p]$.

Here is an implementation example of KMP:

```
kmp[1] = 0;
for (i = 2; i <= N; i = i + 1){
    l = kmp[i - 1];
    while (l > 0 && S[i] != S[l + 1]){
        l = kmp[l];
    }
    if (S[i] == S[l + 1]){
        kmp[i] = l + 1;
    }
    else{
        kmp[i] = 0;
    }
}
```

Given a sequence $x_1, x_2, \ldots, x_{26}$, construct a string, S, that meets the following conditions:

1. The frequency of letter 'a' in S is exactly x_1, the frequency of letter 'b' in S is exactly x_2, and so on.
2. Let's assume characters of S are numbered from 1 to N, where $\sum_{i=1}^{n} x_i = N$. We apply the KMP algorithm to S and get a table, kmp, of size N. You must ensure that the sum of $kmp[i]$ for all i is minimal.

If there are multiple strings which fulfill the above conditions, print the lexicographically smallest one.

Input Format

A single line containing 26 space-separated integers describing sequence x.

Constraints

- The sum of all x_i will be a positive integer $\le 10^6$.

Output Format

Print a single string denoting S.

Sample Input

```
2 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
```

Sample Output

```
aabb
```

Explanation

The output string must have two 'a' and two 'b'. There are several such strings but we must ensure that sum of $kmp[i]$ for all $1 <= i <= 4$ is minimal. See the figure below:

kmp table for s="aabb"	
1	0
2	1
3	0
4	0
sum = 1	

kmp table for s="bbaa"	
1	0
2	1
3	0
4	0
sum = 1	

kmp table for s="abba"	
1	0
2	0
3	0
4	1
sum = 1	

kmp table for s="baba"	
1	0
2	0
3	1
4	2
sum = 3	

kmp table for s="abab"	
1	0
2	0
3	1
4	2
sum = 3	

kmp table for s="baab"	
1	0
2	0
3	0
4	1
sum = 1	

The minimum sum is 1. Among all the strings that satisfy both the condition, "aabb" is the lexicographically smallest.