Gear Trains

Input file:	*standard input*
Output file:	*standard output*
Time limit:	2 seconds
Memory limit:	2048 MB

For his birthday, Bob received a bag of miniature axles and gears. This is the perfect gift for him, as he is a mechanical clock tinkerer and enthusiast.

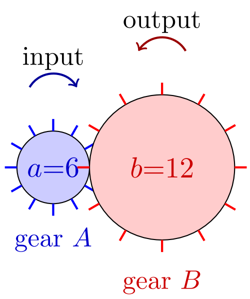
Bob wants to arrange his axles and gears to produce the **maximum possible number of rotations per minute (RPM)** in an output axle, given that the input axle is rotated exactly once per minute. The output axle **must be different** than the input axle. Your task is to help Bob find the best arrangement.

Gear Mechanics

Before describing the problem, let us recall how gears interact. When two gears mesh (their teeth interlock), they rotate in opposite directions. The **gear ratio** between two meshing gears is determined by their number of teeth:

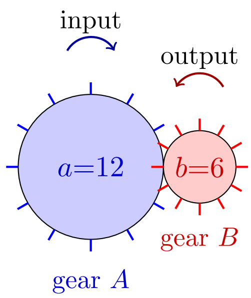
> If gear A has a teeth and gear B has b teeth, and A is the driver (i.e., it receives power from the input), then when A completes 1 full rotation, gear B completes $\frac{a}{b}$ rotations.

Thus, a large gear driving a small gear *amplifies* the rotational speed, while a small gear driving a large gear *reduces* it.



$$\frac{6}{12} = 0.5 \text{ rotations}$$

Small gear driving large gear → speed reduction (ratio < 1)

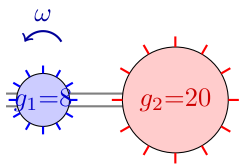


$$\frac{12}{6} = 2.0 \text{ rotations}$$

Large gear driving small gear → speed amplification (ratio > 1)

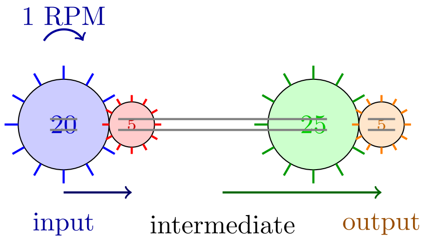
Axles and Gear Trains

Bob has M axles. Each axle has exactly **two positions** where a gear can be mounted. When two gears are mounted on the **same axle**, they rotate at the **same speed** (since the axle is a solid shaft). This is the key to building a **gear train**:



same axle $\Rightarrow$ same rotational speed ($\omega_1 = \omega_2$)

By connecting multiple axles in a chain via meshing gears, Bob can build a **gear train** that amplifies (or reduces) rotational speed across multiple stages.



Ratio through gear train:

$$\frac{20}{5} \times \frac{25}{5} = 4 \times 5 = 20$$

Output = 20 RPM!

A 2-stage gear train: input large gear → small driven gear, then small → large on intermediate axle, then large → small on output.

In this arrangement:

- Input axle has a large gear (20 teeth) that drives a small gear (5 teeth) on Axle 1.
- On Axle 1, the small gear (5) and large gear (25) rotate at the same speed.
- The large gear (25) on Axle 1 then drives another small gear (5) on the output axle.
- Total ratio: $\frac{20}{5} \times \frac{25}{5} = 20$. The output axle rotates 20 times per minute!

The Problem

Bob has N gears with $g_1, g_2, \ldots, g_N$ teeth respectively, and M axles. Each axle has exactly two positions for mounting a gear. Bob may choose to use **zero, one, or more** of his gears and axles – it is not necessary to use all available components.

Bob will designate one axle as the **input axle** and rotate it at exactly 1 RPM. He wants to choose an **output axle** such that its rotations per minute are maximized.

> **Important:** The input and output must be *different* axles.

In an ideal world with zero material thickness, perfect tolerance, and no gear jamming, any arrangement of gears on axles that have meshing adjacent gears is valid.

Constraints

- $0 \le N \le 10^6$
- $3 \le g_i \le 10^9$
- $0 \le M \le 10^6$

Input

The first line contains two integers N and M.

The next line contains N integers $g_1, g_2, \ldots, g_N$.

Output

Output a single real number: the **base-2 logarithm** of the maximum possible rotations per minute of the output axle, rounded to at least 10 decimal places.

If a solution is impossible, print -1. An arrangement is considered impossible when there is no output axle, or the output axle is not rotating.

The result is considered correct if it is within an absolute or relative error of 10^{-6} of the correct answer.

Example

standard input	standard output
4 3 3 5 20 25	5.0588936891

Explanation: The optimal arrangement uses all 4 gears on 3 axles:

- **Input axle** (Axle 0): gear with 25 teeth (the largest).
- **Intermediate axle** (Axle 1): gear with 3 teeth (meshes with Axle 0's 25) on one side, and gear with 20 teeth (on the other side).
- **Output axle** (Axle 2): gear with 5 teeth (meshes with Axle 1's 20).

The gear ratio is:

$$\frac{25}{3} \times \frac{20}{5} = \frac{500}{15} \approx 33.33$$

and $\log_2(33.33\ldots) \approx 5.0588936891$.