

E. Alibaba and the Magical Cave of Whispering Lamps

Time limit: 1 second
Memory limit: 65535 kBytes

Description

In the sun-scorched deserts of ancient Persia, where mirages dance on the horizon and djinns whisper secrets to the wind, Alibaba and his band of clever thieves stumbled upon a treasure beyond imagination. Gold coins that shimmered like starlight, jewels that held the essence of rainbows, and artifacts of power long forgotten by time itself. Knowing the dangers that come with such wealth, Alibaba devised a plan to protect their fortune. They concealed the treasure in an unbreakable vault, secured by n magical locks (where n is the number of thieves, between 2 and 40). Each lock could only be opened by a key inscribed with a thief's true name, ensuring that all must be present to claim their prize. This way, no single thief or partial group could retrieve the treasure alone. But the cunning Grand Vizier, his eyes gleaming with greed, learned of their scheme through his network of spies. Swift as a desert viper, he struck in the dead of night, pilfering the thieves' keys while they slumbered. The Grand Vizier then hid the keys within n enchanted lamps, deep within the Cave of Whispers, a place of ancient magic.

The Challenge of the Whispering Lamps

After a perilous quest across blistering dunes and treacherous mountains, Alibaba and his band finally located the hidden oasis containing the Cave of Whispers. Inside, there were the n magical lamps arrayed in a perfect line, their surfaces gleaming with ethereal light. A mischievous djinn, amused by their plight, appeared in a swirl of purple smoke. It taught them a magical chant to activate the lamps, but warned of the cave's fickle magic:

- The thieves must enter one by one, unable to share information with those who came before or after. They must coordinate their strategy before the first thief enters the cave.
- Each thief may examine up to k lamps before the cave's magic drains them, whisking them away to the Grand Vizier's Dungeon of Eternal Night and Despair.
- The lamps cannot be touched, marked, or manipulated in any way other than through the magical chant.
- Should any thief fail to recover their key, the treasure would remain locked forever, as all n keys are required to open the vault.

As the djinn prepared to vanish in a swirl of shimmering smoke, its voice resonated in a riddle-like verse.

"By the names you carry and the order they bind,
Begin your search where they first align.
Where your path starts, let your discovery flow,
For the cycles of fate favor those who know."

The Magical Chants

To activate a lamp, a thief must recite the following:

"O lamp within the cycle, radiant and bold,
Illuminate the hidden path that you hold!
I, [*Thief's Name*], seek the key or the next name in line,
Unveil the magic, let our fates entwine!"

The lamp then responds in one of two ways:

1. If it contains the thief's key:

"Seeker true, your search is done,
The cycle ended; your key is won!
[*Thief's Name*], claim what's yours by right,
And to the treasure, take your flight!"

The lamp then ejects the key and teleports the thief to the vault of treasures.

2. If it contains or once held another thief's key:

"Not for you, this lamp's embrace,
You sought in [*Other Thief's Name*]'s place.
Continue the cycle, persistent one,
Your journey is not yet done."

Alibaba, the clever leader of the thieves, listens closely to the djinn's parting riddle and the magical chant and possible responses, gradually unraveling their hidden meaning. From these cryptic clues, he devises a brilliant strategy to greatly enhance the chances that every thief will retrieve their key. Can you also decipher the strategy that will maximize their chances of success?

Alibaba's Conundrum

The djinn has revealed that each thief can examine only a fixed number of lamps k before the cave's magic takes effect. However, Alibaba is not able to exactly quantify the risk by its own. What Alibaba does know is his own risk tolerance. He has determined a minimum probability of success p that he is willing to accept for this dangerous venture. Now, he must figure out: what is the minimum number of lamps (let us call it k_{min}) that each thief needs to be able to examine for their collective chance of retrieving all keys and the treasure to be at least p ? If the djinn's revealed k is greater than or equal to this k_{min} , Alibaba will assume their chances and lead his band into the cave. If not, they will need to retreat and return another day, perhaps with magical amulets that

could increase their resistance to the cave's draining magic, effectively allowing them to examine more lamps.

Your Quest

Brave codesmith! Alibaba turns to you in this crucial moment. Your task is to calculate k_{min} , given:

1. The number of thieves (n)
2. Alibaba's desired minimum probability of success (p)

Remember, the fate of the treasure - and the freedom of the thieves - rests upon your calculations!

Input

One line with two numbers:

- An integer n : The number of thieves (and lamps)
- A real number p , specified with a precision of up to 10^{-12} : Alibaba's desired probability threshold

Output

Your program must print to the standard output the k_{min} value.

Constraints

- ($2 \leq n \leq 40$)
- ($0 < p \leq 1$)

Example

Input	Output
2 0.000001	1
Input	Output
10 0.000001	2
Input	Output
13 1.0	13
Input	Output
40 0.8	33

Notes

- The actual probability of success may exceed the given threshold.

- Each thief's name is unique.
- The keys are randomly distributed among the n lamps, each lamp containing one key.
- All lamps always appear identical, regardless of whether they still hold a key or have been already successfully searched.
- Alibaba does not possess a key, nor does he enter the cave himself. He serves solely as the strategist and leader.