Problem

Background

You are working as a software developer for a brick manufacturing company. The R & D department approach you because they have developed a new type of brick to be used in the construction of load-bearing walls and they would like you to develop a tool to help them quickly calculate the maximum load at a point on top of a wall constructed with these bricks.

As a result of natural random variations in the manufacturing process, each brick has an individual *strength-rating* between 800 and 999. This value is stamped on the side of each brick after manufacture.

Calculating the maximum load

We can model a section of a wall constructed from these bricks as follows:

```
---------------------------------------
| 930 | 987 | 850 | 882 | 881 | 883 |
---------------------------------------
   | 954 | 992 | 981 | 991 | 934 | 965 |
---------------------------------------
| 887 | 807 | 879 | 931 | 811 | 832 |
---------------------------------------
```

Note that each wall is always constructed using the familiar brickwork pattern above. The numbers in the diagram represent the individual strength-rating of each brick.

Pathways

When calculating the maximum load we are concered with the **weakest pathway** from the point under load on the top of the wall to the ground. Each pathway can only move from one layer to the next by passing through either of the two bricks directly underneath.

For example, if we place our load on the fourth brick in the above wall:

```
                    |
                    |
                   \|/
---------------------------------------
| 930 | 987 |850 | 882 | 881 | 883 |
---------------------------------------
   | 954 | 992 | 981 | 991 | 934 | 965 |
---------------------------------------
| 887 | 807 | 879 | 931 | 811 | 832 |
---------------------------------------
```

then we must consider the following 4 pathways from the fourth brick to the ground:

- 882 --> 981 --> 879
- 882 --> 981 --> 931
- 882 --> 991 --> 931

- 882 --> 991 --> 811

Pathway strength rating

We can calculate the strength rating of a pathway by dividing each brick's strength value by 990 then multiplying all these values together.

For example, the strength rating of the first pathway above is given by:

$$\frac{882}{990} \times \frac{981}{990} \times \frac{879}{990} = 0.7838$$

Max Load

In order to determine the maximum load, we must find the pathway with the weakest (smallest) *strength-rating*

So for the example above we have 4 possible pathways with the following strength ratings:

- $\frac{882}{990} \times \frac{981}{990} \times \frac{879}{990} = 0.7838$
- $\frac{882}{990} \times \frac{981}{990} \times \frac{931}{990} = 0.8302$
- $\frac{882}{990} \times \frac{991}{990} \times \frac{931}{990} = 0.8387$
- $\frac{882}{990} \times \frac{991}{990} \times \frac{811}{990} = 0.7306$

The weakest of these strength ratings is 0.7306 so this is the maximum load at this point on top this wall.

Task

You must write a program which can accept as inputs:

1. A text file with a modelled wall segment in the same format as above
2. A number representing the position where the load is to be placed (in the above example, we put the load at the 4th position from the left so the input in this case would be 4)

Your program should output the maximum load that can be placed on the wall at that point.

Test Cases

You can test your program against the following test cases where the expected output is known:

	Input File	Input position	Correct Output
1.	https://storage.googleapis.com/searchlab-misc/brick_puzzle/wall0.txt	10	0.2646
2.	https://storage.googleapis.com/searchlab-misc/brick_puzzle/wall1.txt	20	0.0676
3.	https://storage.googleapis.com/searchlab-misc/brick_puzzle/wall1a.txt	25	0.0500

OPTIONAL: Bonus Task

Could your program calculate the maximum load for walls with 100 layers or more?

We have one more test-case you may like to try. Note that this case has a very large number of possible pathways so you will need to come up with an efficient algorithm if your program is to return a result in a reasonable time.

Input File	Input position	Correct Output
https://storage.googleapis.com/searchlab-misc/brick_puzzle/wall2.txt	100	0.000000185

Sumbitting Your Solution

We need to be able to review and run your code before your interview. Please let us know which language/framework you have used and if there are any special instructions for building or running your code. You can either create a free github repository with your solution or send us a zip file with the complete solution.

Additional Guidance

- Feel free to tackle the problem using whichever language, framework or development environment you are most comfortable with but be prepared to answer questions about your approach and your code at interview.
- We are interested in how you approached the problem as well as the final solution. You should therefore be prepared to discuss how you approached the problem, how you arrived at any insights, etc. as well as your code
- **We are not specifically interested in any particular user interface:** A simple command line application is sufficient to gain full marks (but feel free to provide a different User Interface if you prefer).
- **We are not specifically interested in any particular programming paradigm:** You may (or may not) have met paradigms such as Object Oriented Programming or Functional Programming. You do not need to know about these paradigms or to implement a solution using any of these in order to gain full marks. Use whichever approach comes naturally: you can gain full marks as long as you can solve the problem in such a way as to be able to describe your approach and your code is structured in a way that allows us understand and reason about it.