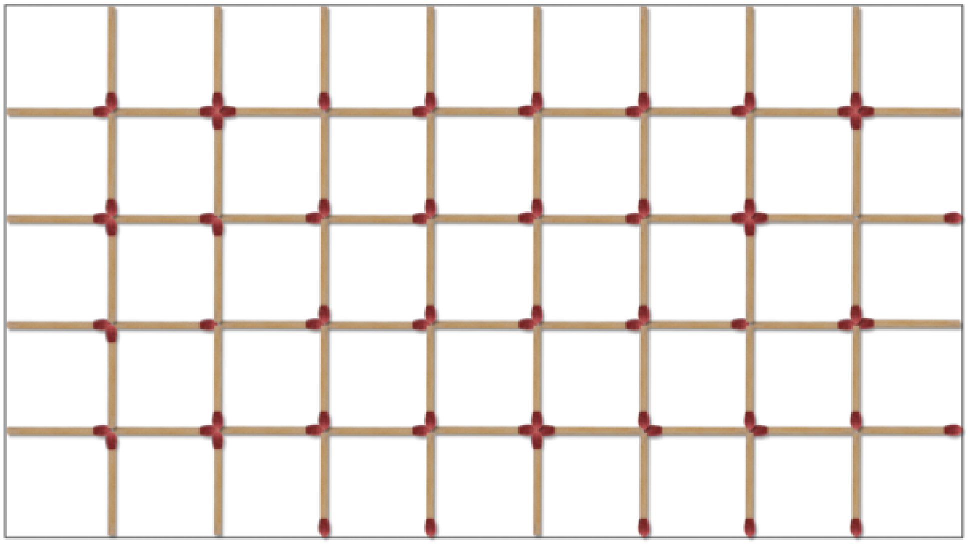
# The Matchstick Experiment

HackerRank

In an $n \times m$ grid, $2 \cdot n \cdot m - n - m$ matchsticks are placed at the boundaries between cells. For example, if $n = 5$ and $m = 9$, the $2 \cdot 5 \cdot 9 - 5 - 9 = 76$ matchsticks are placed in the following way:

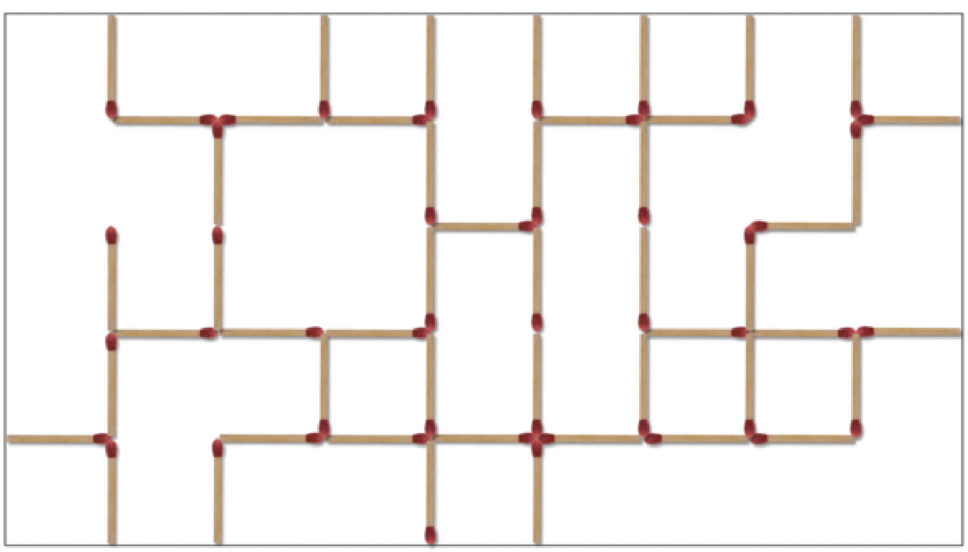


**The Experiment**

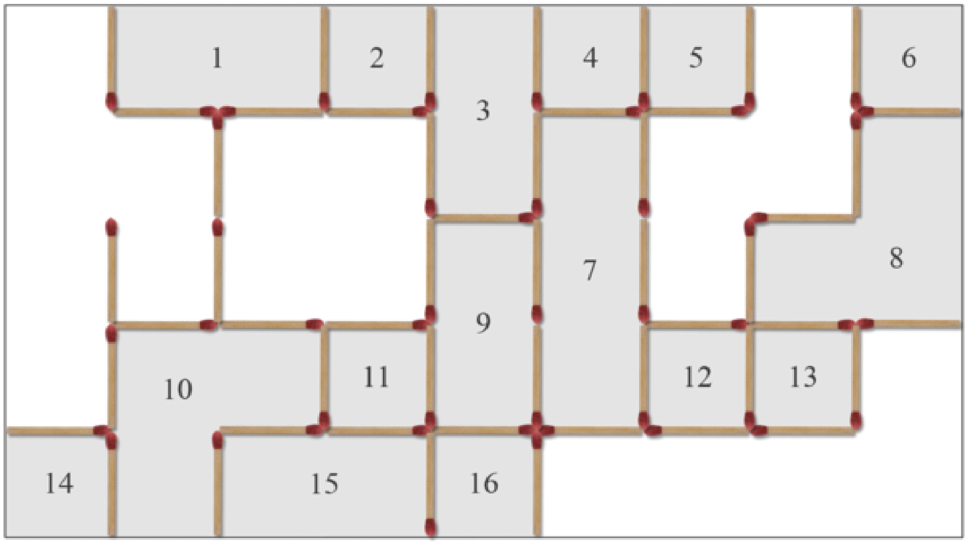
1. For each of the $2 \cdot n \cdot m - n - m$ matchsticks, remove it with probability $p$.

2. We define a *connected component* to be a maximal set of cells not isolated from one another by matchsticks. We calculate our $score$ as the number of connected components in the grid with $\leq 3$ cells, divided by $n \cdot m$.

For example, suppose our grid looks like this after performing the first step:



To calculate our $score$, we need to first find the number of connected components having $\leq 3$ cells. The diagram below counts all such components consisting of $\leq 3$ connected cells:




As you can see, there are $16$ connected components of size $\leq 3$. From this, we perform the following calculation:

$$score = \frac{(\text{connected components with size } \leq 3)}{n \cdot m} = \frac{16}{45} \approx 0.35555555$$

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You are given $q$ queries where each query consists of $n$, $m$, and $p$. For each query, find and print the *expected* value of $score$ on a new line.

**Need Help?** Check out this learning aid explaining some important properties of *expected values*.
**Input Format**

The first line contains an integer, $q$, denoting the number of queries.
Each of the $q$ subsequent lines contains three space-separated integers describing the respective values of integer $n$, integer $m$, and real number $p$.

**Constraints**

- $0 \leq p \leq 1$
- $1 \leq q, n, m \leq 10^5$
- $p$ is a real number scaled to two decimal places (e.g., $1.23$).

**Subtask**

- For $40\%$ of the total score, $q, n, m \leq 300$

**Output Format**

For each query, print a single real number on a new line denoting the answer to the query. Any answer having an absolute error within $10^{-9}$ of the true answer is acceptable.

**Sample Input 0**

```
2
2 2 0.50
```

```
2 3 0.75
```

#### Sample Output 0

```
0.4375000000
0.0810546875000
```

#### Explanation 0

We can verify our answer by performing several brute-force simulations of the experiment and then averaging the scores.