
Algorithmen und Wahrscheinlichkeit

Programming Exercises

Exercise – *Slay the Dragon!*

On yet another amazing board game night you and your party of friends are walking around exploring the continent you have been stranded on for days. At some point, to make the exploration more efficient, you decide to split from your party and venture alone into a huge nearby cave. What an unwise thing to do...

Ouch, an enormous dragon appears! There is no turning back now: you either slay the dragon or you become its next meal. The dragon has a certain number of *health points* (HP) and once its HP reach zero, it dies. So far you have mastered two different spells: frostbolt and shadowbolt. However, you have a limited amount of both frost and shadow power which decrease gradually with every spell you cast. If you run out of both frost and shadow power and the dragon is still alive... *you die*.

The mechanic of spell casting works the following way. At a point in time at which you have some f' frost and s' shadow power remaining, you randomly cast either a frostbolt or a shadowbolt: the former happens with probability $f'/(f' + s')$ and the latter with probability $s'/(f' + s')$. As a result, the HP of the dragon decreases by a value depending on the spell you cast and your corresponding power decreases by exactly one. That is, if you cast a frostbolt, your frost power decreases by one, and if you cast a shadowbolt, your shadow power decreases by one. Having no power of one of the types means that you cannot cast the corresponding spell. This whole process is repeated until the dragon is slain or... *you die*.

Before starting off with the fight you quickly do a computation: will you manage to survive? If so what is the expected number of spells you will cast in order to slay the dragon?

Input The first line of the input file contains a number $t \leq 30$ of test cases. Each of the t test cases is described as follows.

- It starts with a line that contains three integers n f s , separated by a space, denoting the starting HP of the dragon ($1 \leq n \leq 5 \cdot 10^2$) and the initial amount of frost power ($0 \leq f \leq 50$) and shadow power ($0 \leq s \leq 50$) you have.
- The next line contains two integers x y , separated by a space, denoting the amount by which the dragon's HP decreases once you cast a frostbolt ($1 \leq x \leq n$) and a shadowbolt ($1 \leq y \leq n$).

Output For each test case the output should consist of a single line. If you do not have enough power to slay the dragon, that is even by casting all the spells (in any order) and running out of all the power the HP of the dragon is still positive, then the output is '-1'. Otherwise, the output is a single real number denoting the expected number of spells you will cast in order to slay the dragon. Your solution is going to be accepted if it has an absolute or relative error of at most 10^{-6} .

Points There are two groups of test sets, worth 100 points in total.

1. For the first group of test sets, worth 50 points, you may assume that $n \leq 10$ and $f, s \leq 10$.
2. For the second group of test sets, worth 50 points, there are no additional assumptions.

Sample Input

```
2
5 2 2
2 3
5 2 1
1 2
```

Sample Output

```
2.166667
-1
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