

Some Small Projects
by William Gasarch

1 The 50-cent Puzzle

The rapper 50-cent allegedly was shot 9 times and lived.

Consider the following. Carol and Donna are going to have a duel. Each takes turns shooting at the other one.

- Carol goes first.
- Carol has prob of Killing Donna p_C .
- Carol has b_C bullets.
- Donna goes second.
- Donna has prob of Killing Carol p_D .
- Donna has b_D bullets.

We care who has the higher prob of winning

1. Write a program that will, on input p_C, b_C, p_D, b_D , output the following:
 - (a) Prob that Carol and Donna both survive.
 - (b) Prob that Donna survives but Carol does not.
 - (c) Prob that Carol survives but Donna does not.
2. Try to spot some patterns for conjectures.

2 The Egg Game

Read this paper:

<https://www.cs.umd.edu/users/gasarch/papers/egg.pdf>

Now solve the egg game if we know the prob that the break point is the i th floor is $1/f$, so each floor is equally likely. Now we want to minimize the expected number of egg drops.

We can also look at other distributions.

3 The Nate Silver Sequence

<https://blog.computationalcomplexity.org/2017/09/a-problem-i-thought-was-interest.html>

Write an algorithm that will, given n , find the largest sequence of elements from $1, \dots, n$ such that every number is a divisor or factor of the previous number. Look at variants of this problem.