Coins AtCoder

Statement

Problem Statement

Let N be a positive odd number.

There are N coins, numbered $1, 2, \ldots, N$. For each i ($1 \leq i \leq N$), when Coin i is tossed, it comes up heads with probability p_i and tails with probability $1 - p_i$.

Taro has tossed all the N coins. Find the probability of having more heads than tails.

Constraints

- N is an odd number.
- $1 \leq N \leq 2999$
- p_i is a real number and has two decimal places.
- $0 < p_i < 1$

Solution

Honestly this problem is a pretty fun one. The solution is built upon an observation that we can compute a two dimensional dp table representing whether it is possible to get i heads using j first coins. Next we can consider two events

1. The j-th coin is heads. Then the probability of getting i heads is: p_heads[i] * dp[i-1][j-1].
2. The j-th coin is tails. Then the probability of getting i heads is: p_tails[i] * dp[i][j-1].