

Problem 808: Soup Servings

Problem Information

Difficulty: Medium

Acceptance Rate: 59.82%

Paid Only: No

Tags: Math, Dynamic Programming, Probability and Statistics

Problem Description

You have two soups, **A** and **B**, each starting with n mL. On every turn, one of the following four serving operations is chosen at random, each with probability 0.25

independent of all previous turns:

* pour 100 mL from type A and 0 mL from type B * pour 75 mL from type A and 25 mL from type B * pour 50 mL from type A and 50 mL from type B * pour 25 mL from type A and 75 mL from type B

Note:

* There is no operation that pours 0 mL from A and 100 mL from B. * The amounts from A and B are poured simultaneously during the turn. * If an operation asks you to pour **more** than you have left of a soup, pour all that remains of that soup.

The process stops immediately after any turn in which one of the soups is used up.

Return the probability that A is used up before B, plus half the probability that both soups are used up in the **same turn**. Answers within 10^{-5} of the actual answer will be accepted.

Example 1:

Input: $n = 50$ **Output:** 0.62500 **Explanation:** If we perform either of the first two serving operations, soup A will become empty first. If we perform the third operation, A and B will become empty at the same time. If we perform the fourth operation, B will become empty first. So the total probability of A becoming empty first plus half the probability that A and B become empty at the same time, is $0.25 * (1 + 1 + 0.5 + 0) = 0.625$.

****Example 2:****

****Input:**** n = 100 ****Output:**** 0.71875 ****Explanation:**** If we perform the first serving operation, soup A will become empty first. If we perform the second serving operations, A will become empty on performing operation [1, 2, 3], and both A and B become empty on performing operation 4. If we perform the third operation, A will become empty on performing operation [1, 2], and both A and B become empty on performing operation 3. If we perform the fourth operation, A will become empty on performing operation 1, and both A and B become empty on performing operation 2. So the total probability of A becoming empty first plus half the probability that A and B become empty at the same time, is 0.71875.

****Constraints:****

* `0 <= n <= 109`

Code Snippets

C++:

```
class Solution {
public:
    double soupServings(int n) {

    }

};
```

Java:

```
class Solution {
    public double soupServings(int n) {

    }

}
```

Python3:

```
class Solution:
    def soupServings(self, n: int) -> float:
```