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Day 6 - Bob and Random Expression

Attempted by: **87** / Accuracy: **84%** / Maximum Score: **30** / ★★★★★ 0 Votes

Tag(s): Combinatorics, Data Structures, Expectation, Medium, Probability

PROBLEM   **EDITORIAL**   **MY SUBMISSIONS**

Bob was given N integers by his teacher. He was supposed to make a expression out of them without changing the order of integers. So he decided to use 2 types of operators: "|"(also known as Bitwise Or) and "+". He decided to put exactly **one** operator between every consecutive integers. Thus he would use $N - 1$ operators to form a valid mathematical expression from the N integers. But as Bob is feeling very sleepy, he might use any of the 2 operators with *equal probability* at any of the valid places.

His teacher was perplexed by this random behavior and wondered what is the Expected value of the Random Expression thus created by her student. Note that Bitwise OR has higher precedence than addition operator.

Input Format

The first line consists of an integer, N.
Next line follows with N integers.

Output Format

Print $P * Q^{-1} \bmod 10^9 + 7$, where $\frac{P}{Q}$ is the expected value of expression expressed as an irreducible fraction.

Input Constraints

$1 \le N \le 10^6$
$0 \le \text{all integers} \le 10^9$

SAMPLE INPUT

```
3
1 2 3
```

SAMPLE OUTPUT

```
750000010
```

Explanation

The different ways are:

$1 + 2 + 3 = 6$

$1 + 2 | 3 = 4$

$1 | 2 + 3 = 6$

$1 | 2 | 3 = 3$

All these ways have probability = $\frac{1}{4}$

So the Expected value = $6 \times \frac{1}{4} + 4 \times \frac{1}{4} + 6 \times \frac{1}{4} + 3 \times \frac{1}{4} = \frac{19}{4} \equiv 750000010 \bmod 10^9 + 7$.

Time Limit:	2.0 sec(s) for each input file.
Memory Limit:	256 MB
Source Limit:	1024 KB
Marking Scheme:	Marks are awarded when all the testcases pass.
Allowed Languages:	C, C++, Clojure, C#, D, Erlang, F#, Go, Groovy, Haskell, Java, Java 8, JavaScript(Rhino), JavaScript(Node.js), Lisp, Lisp (SBCL), Lua, Objective-C, OCaml, Octave, Pascal, Perl, PHP, Python, Python 3, R(RScript), Racket, Ruby, Rust, Scala, Scala 2.11.8, Swift, Visual Basic

CODE EDITOR

Enter your code or Upload your code as file.   Save   C (gcc 4.8.4)

```c
#include <stdio.h>

int main()
{
    printf("Hello World!\n");
    return 0;
}
```

☑ Provide custom input

COMPILE & TEST   SUBMIT

💡 *Press Ctrl-space for autocomplete suggestions.*   POWERED BY code table

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