DMOPC '21 Contest 5 P5 - Permutations & Primes (Hard Version)

Time limit: 5.0s **Memory limit:** 256M

The *primeness* of any permutation $p_1, p_2, \ldots, p_N$ of $1, 2, \ldots, N$ is defined as the sum of all prime absolute differences of consecutive elements. Given an integer N, find any permutation $p_1, p_2, \ldots, p_N$ of $1, 2, \ldots, N$ with the maximum primeness over all length N permutations.

Constraints

$1 \leq N \leq 10^5$

Subtask 1 [30%]

$1 \leq N \leq 10^3$

Subtask 2 [30%]

$1 \leq N \leq 10^4$

Subtask 3 [40%]

No additional constraints.

Input Specification

The first and only line of input contains a single integer N.

Output Specification

Output N space-separated integers on a single line, representing a permutation $p_1, p_2, \ldots, p_N$ of $1, 2, \ldots, N$ with the maximum primeness over all length N permutations.

Sample Input 1

```
3
```

Sample Output 1

```
2 3 1
```

Explanation for Sample 1

There are 2 absolute differences of consecutive elements, namely $|2-3|=1$ and $|3-1|=2$. Out of these, only 2 is prime, so the primeness of this permutation is 2.

Sample Input 2

```
6
```

Sample Output 2

```
3 6 1 4 2 5
```

Explanation for Sample 2

The absolute differences of consecutive elements are $3, 5, 3, 2, 3$. All of these are prime, so the primeness of this permutation is $3+5+3+2+3=16$.