Competition

2022/2023 SEASON – FINAL ROUND

You are participating in a TV competition where your goal is to build a sequence whose last element is a given natural number n. You can reach it sticking to the following rules:

(1) $x_0 = 1$.

(2) $x_i = x_j$ @ x_k for each $i \geq 1$, $0 \leq j, k < i$ and @ is any of the following operations, each of which has a unique code:

Code	Operation
1	$x_i = x_j + x_k$, addition
2	$x_i = x_j - x_k$, subtraction
3	$x_i = x_j * x_k$, multiplication
4	$x_i = x_j / x_k$, integer division
5	$x_i = x_j \% x_k$, remainder of division
6	$x_i = x_j \& x_k$, bitwise "and"
7	$x_i = x_j \mid x_k$, bitwise "or"
8	$x_i = x_j \hat{} x_k$, bitwise exclusive "or"

The constraint $1 \leq x_i < 2^{63}$ must be fulfilled during the whole time.

The application of an operation is denoted by $(operation\ code)$ (j) (k). The goal is to find a sequence of operations for which $x_l = n$ and l is as small as possible.

Answer t such queries.

Input

The first line of the file **competition.in** contains the number t. Each of the next t lines contains one number - n for the corresponding query.

Output

For each query, print in the file **competition.out** first the number of operations l ($\mathbf{0 \leq l \leq 150}$), and on the next l lines - the operations themselves. $x_l = n$ must be satisfied. **If for some n you cannot find the required operations, print -1.**

Constraints

$2 \leq n < 2^{63}$

$1 \leq t \leq 1000$

It is guaranteed that for every $n < 2^{63}$ there is a solution with at most 150 operations.

Time limit: 5 sec.
Memory limit: 256 MB.

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Scoring

For each solved query l^2 will be added to your score, and for each -1: 300^2. For each test, let *minScore* be the smallest score among all participants' scores and *yourScore* be your score. You will be awarded $1 - \sqrt{1 - \frac{minScore+}{yourScore+}}$ multiplied by the amount of points for the test.

The tests are distributed as follows:

n / t	$< 2^{15}$	$< 2^{31}$	$< 2^{63}$
$= 10^1$	5%	5%	5%
$= 10^2$	5%	15%	15%
$= 10^3$	5%	15%	30%

Tests generation

The numbers n are randomly generated in the respective intervals that bound them (each number in the interval has an equal chance). It is guaranteed that they are distinct.

Sample test

Input (competition.in)	Output (competition.out)
2 32 123456789012345678	10 1 0 0 1 1 0 1 2 0 8 2 3 3 4 4 4 5 1 7 6 5 5 7 6 2 5 8 6 9 5 -1

Example explanation

For $n = 32$, $x_0 = 1$

$x_1 = x_0 + x_0 = 1 + 1 = 2$

$x_2 = x_1 + x_0 = 2 + 1 = 3$

$x_3 = x_2 + x_0 = 3 + 1 = 4$

$x_4 = x_2 \hat{} x_3 = 3\hat{}4 = 7$

$x_5 = x_4 * x_4 = 7 * 7 = 49$

$x_6 = x_5 / x_1 = 49/2 = 24$

$x_7 = x_6 | x_5 = 24|49 = 57$

$x_8 = x_7 \% x_6 = 57\%24 = 9$

$x_9 = x_5 - x_8 = 49 - 9 = 40$

$x_{10} = x_9 \& x_5 = 40\&49 = 32$

No solution was found for $n = 123456789012345678$ and -1 is printed instead.

The total result is $10^2 + 300^2 = 100 + 90000 = 90100$