1997/98 ACM International Collegiate Programming Contest  
University of Ulm Local Contest

# Problem A

# Addition Chains

Source file: addition.(c|C|pas)  
Input file: addition.in

An addition chain for *n* is an integer sequence *<a0, a1,a2,...,am>* with the following four properties:

* *a0* = 1
* *am* = *n*
* *a0<a1<a2<...< am-1<am*
* For each *k* (1<=*k*<=*m*) there exist two (not neccessarily different) integers *i* and *j* (0<=*i*, *j*<=*k*-1) with *ak=ai+aj*

You are given an integer *n*. Your job is to construct an addition chain for *n* with minimal length. If there is more than one such sequence, any one is acceptable.  
For example, <1,2,3,5> and <1,2,4,5> are both valid solutions when you are asked for an addition chain for 5.

### Input Specification

The input file will contain one or more test cases. Each test case consists of one line containing one integer *n* (1<=*n*<=100). Input is terminated by a value of zero (0) for *n*.

### Output Specification

For each test case, print one line containing the required integer sequence. Separate the numbers by one blank.

**Hint:** The problem is a little time-critical, so use proper break conditions where necessary to reduce the search space.

### Sample Input

5

7

12

15

77

0

### Sample Output

1 2 4 5

1 2 4 6 7

1 2 4 8 12

1 2 4 5 10 15

1 2 4 8 9 17 34 68 77