Programming Test

Read before start

- **Time Limit: 1.5 hours**
- **Please pick-up 2 out of 4 tests to finish**
  - **It's a big plus if you finish all 4 tests correctly**
- **Please use C or C++**
- **Your source code must compile, run and generate correct output**

Test 1

Given an integer number N(n = m^2 - 1), finish below function to print sequence 0, 1, 2, 3, ..., n in below form. You can't control screen position of output character, e.g. you can only use printf(in C) to output. You can use any programming language you are familiar with.

```
void print(int n)
{
	// …
}
```

For example, given n = 24(5^2 - 1), your code should print out below pattern

```
0 1 2 3 4
15 16 17 18 5
14 23 24 19 6
13 22 21 20 7
12 11 10 9 8
```

1. What memory & computation complexity of your algorithm?
2. Is it possible to optimize memory/computation complexity of your algorithm?

Test 2

For series $f(n) = \begin{cases} 1, & 0 \le n < 1024 \\ f(n-1) + f(n-1024), & n \ge 1024 \end{cases}$, write a non-recursive program to compute f(n).

```
int calc_f(int n)
{
    // …
}
```

Test 3

Given strings A, B and C, please find out if C is an interlace of A and B. Interlace means C has all the characters of A and B, and the order of these characters are preserved.

Input	Output
AAA B ABAA	Yes
AAA AA AAAA	No
ABC CBA ACCBBA	No

Test 4

Give you a binary tree with N nodes. Each node has its weight. Please output the total number of subtrees which has all node's weight sum equal to a number M.

```
// A data structure prototype. You can define your own.
struct BinaryTree {
    int weight;
    struct BinaryTree *left, *right;
} tree[N];
```

Input data structure:

```
      1
     / \
    2   7
   / \       N = 5
  1   4      M = 7
```

Output: 2