```
 1  /* Problem 5--Roman Ciphers
 2     The trick was to fiund the length of all cycles in the cipher, and
 3     find the least common multiple of them.  How many steps does it take
 4     to put 1 back into place.  How many steps to put 2 back, etc. */
 5
 6  import java.io.*;
 7  import java.util.*;
 8
 9  public class prob5 {
10
11   private static Scanner in;
12   private static PrintWriter out;
13   private static int cs;
14   private static int[] letters;
15
16   public static void main (String[] args) throws Exception {
17
18    in = new Scanner (new File ("prob5.in"));
19    out = new PrintWriter ("prob5.out");
20    cs = 1;
21    int sz = 0;
22    while (true) {
23     sz = in.nextInt();
24     if (sz==0) break;
25     letters = new int[sz];
26     for (int i=0; i < sz; i++) letters[i] = in.nextInt()-1;
27     out.printf (
28      "Case %d: The cipher would have to be applied %d time(s).\r\n",cs++,
29      Count(letters,sz)); //Count cycles
30    }
31    in.close();
32    out.close ();
33   }
34
35   //Count finds the LCM of the cycles
36   public static int Count (int[] letters, int sz) throws Exception {
37
38    int lcm = 1;
39    int ct = 1;
40    for (int i=0; i < sz; i++) {
41     if (letters[i] != i) { //The letter is already in the right place,
42      ct = 0;               //skip
43      int pos = i;
44      do { //Count how long it takes to get my letter back.  This restores
45       int newpos = letters[pos]; //all letters in the cycle in the
46       letters[pos] = pos; //process so I avoid redundant work
47       ct++;
48       pos = newpos;
49      } while (letters[pos] != i);
50      ct++;
51      letters[pos] = pos;
52      lcm = LCM (lcm,ct); //Find the LCM of this cycle with the others
53     }
54    }
55    return lcm;
56   }
57
58   //Euclidean algorithm for Greatest Common Factor
59   public static int GCF (int a, int b) throws Exception {
60
61    if (b==0) return a;
62    return GCF (b,a%b);
63   }
64
```

```
65   //Standard algorithm for LCM (divide before multiply to keep the
66   //numbers small
67   public static int LCM (int a, int b) throws Exception {
68
69    return a/GCF(a,b)*b;
70   }
71
72  }
73
74
```