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**題組：基礎48題**

**題號：Q107: The Cat in the Hat**

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**使用語言:C++**

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**題目:**

(An homage to Theodore Seuss Geisel)

The Cat in the Hat is a nasty creature,  
 But the striped hat he is wearing has a rather nifty feature.   
 With one flick of his wrist he pops his top off.   
 Do you know what’s inside that Cat’s hat?   
 A bunch of small cats, each with its own striped hat.   
 Each little cat does the same as line three,   
 All except the littlest ones, who just say “Why me?”  
 Because the littlest cats have to clean all the grime,

And they’re tired of doing it time after time!

A clever cat walks into a messy room which he needs to clean. Instead of doing the work alone, it decides to have its helper cats do the work. It keeps its (smaller) helper cats inside its hat. Each helper cat also has helper cats in its own hat, and so on. Eventually, the cats reach a smallest size. These smallest cats have no additional cats in their hats. These unfortunate smallest cats have to do the cleaning.

The number of cats inside each (non-smallest) cat’s hat is a constant, N. The height of these cats-in-a-hat is 1/N+1 times the height of the cat whose hat they are in.

The smallest cats are of height one;  
 these are the cats that get the work done.

All heights are positive integers.

Given the height of the initial cat and the number of worker cats (of height one), find the number of cats that are not doing any work (cats of height greater than one) and also determine the sum of all the cats’ heights (the height of a stack of all cats standing one on top of another).

**Input**

The input consists of a sequence of cat-in-hat specifications. Each specification is a single line consisting of two positive integers, separated by white space. The first integer is the height of the initial cat, and the second integer is the number of worker cats.  
 A pair of ‘0’s on a line indicates the end of input.

**Output**

For each input line (cat-in-hat specification), print the number of cats that are not working, followed by a space, followed by the height of the stack of cats. There should be one output line for each input line other than the ‘0 0’ that terminates input.

**Sample Input**

216 125   
5764801 1679616   
0 0

**Sample Output**

31 671   
335923 30275911

**問題描述：**一隻神奇聰明貓走進了一間亂七八糟的房間，他不想自己動手收拾，他決定要找幫手來工作。於是他從他的帽子中變出了N隻小貓來幫他（變出來的貓，高度為原來貓的 1/(N+1) ）。這些小貓也有帽子，所以每一隻小貓又從他的帽子中變出N隻小小貓來幫他。如此一直下去，直到這些小小小....貓小到不能再小（高度＝1），他們的帽子無法再變出更小的貓來幫忙，而這些最小的貓只得動手打掃房間。注意：所有貓的高度都是正整數。

在這個問題中，給你一開始那隻貓的高度，以及最後動手工作的貓的數目（也就是高度為1的貓的數目）。要請你求出有多少隻貓是沒有在工作的，以及所有貓的高度的總和。

**Input**

每組測試資料一列，有2個正整數分別代表一開始那隻貓的高度，以及最後動手工作的貓的數目。0 0代表輸入結束。

**Output**

每組測試資料輸出一列，包含2個正整數分別代表有多少隻貓是沒有在工作的，以及所有貓的高度的總和。

**Sample Input**

216 125   
5764801 1679616   
0 0

**Sample Output**

31 671   
335923 30275911

**解法：**

找出每組測資中的N值，其中N值必為輸入高度的整數次方根

**解法範例：**

1. 先假設N=2，建立迴圈
2. 若假設的N值非輸入高度的因數，則重新假設為下一個數
3. 以迴圈嘗試以N對貓進行複製，計算貓的數量以及加總高度
4. 若無法再進行複製(高度非N的整數倍)則跳出，當最終複製結果的貓高度為1且數量符合輸入的貓數量，則為答案
5. 處理特殊輸入(輸入高度為1 或 輸入貓數為1等情況)
6. 輸出結果

**討論：**

* 高度將變為原來的1/(N+1)而非1/N
* 特殊輸入
* N與輸入高度等值時(只進行一次分裂)
* 輸出為未工作貓數

**程式：**

#include <iostream>

using namespace std;

int main(){

for(;;){

//變數建立

int inHigh,inFinalCat;

int outCat,outHigh;

int N;

int nowCat,nowHigh;

bool ans=false;

//輸入處理

cin>>inHigh>>inFinalCat;

if(inHigh==0 && inFinalCat==0)break;

//找出N

for(N=2;N<=inHigh;N++){

if(inHigh%N == 0){

nowCat=1;

nowHigh=inHigh;

outCat=0;

outHigh=0;

for(;nowHigh>1;){

if(nowHigh%N != 0 || nowCat>inFinalCat)break;

outHigh+=nowCat\*nowHigh;

outCat+=nowCat;

nowCat\*=N-1;

nowHigh/=N;

if(nowHigh==1 && nowCat==inFinalCat)ans=true;

}

}

if(ans){

outHigh+=nowCat;

break;

}

}

//處理特殊輸入

if(inHigh==1 && inFinalCat==1){

outCat=0;

outHigh=1;

}

else if(inHigh==1){

outCat=1;

outHigh=inFinalCat;

}

//印出結果

cout<<outCat<<" "<<outHigh<<endl;

}

}