Question 2 Nearest fraction

Let X be the set of all fractions in reduced form lying strictly below 0 and 1 whose denominator is less than or equal to 99. In other words,

$$\frac{n}{d} \text{ belongs to } X \text{ provided } 0 < \frac{n}{d} < 1 \text{ and } d \leq 99 \text{ and } \gcd(n, d) = 1,$$

where $\gcd(x, y)$ denotes the *greatest common divisor* (or *highest common factor*) of x and y.

For instance, X includes fractions such as 1/3, 11/31 and 24/37 and excludes fractions such as 4/10, 30/70 (both not in reduced form) and 2/101 (denominator too large).

The problem

Given an arbitrary fraction a/b in reduced form whose denominator b is larger than 99, we want to find the pair of fractions in X that are closest to a/b.

In other words, we want to identify fractions u/v and x/y in X such that $u/v < a/b < x/y$ with the property that there is no fraction u'/v' in X such that $u/v < u'/v' < a/b$ and there is no fraction x'/y' in X such that $a/b < x'/y' < x/y$.

For instance, if a/b is 2/101, then $u/v = 1/51$ and $x/y = 1/50$. Here is another example—if $a/b = 322/479$, then $u/v = 41/61$ and $x/y = 39/58$.

Input format

Each test input will consist of a sequence of values a/b for which you have to find the nearest fractions in X. The input is given as follows.

The first line is an integer `M`, $0 < \texttt{M} \leq 500$, indicating the number of fractions in this input test sequence. This is followed by `M` lines of input, each containing a pair of integers `N` and `D` separated by a space, representing the numerator and denominator of the input fraction, respectively. You are guaranteed that $\texttt{D} \geq 100$ and $\gcd(\texttt{N}, \texttt{D}) = 1$.

Here is what the input would look like if the sequence consisted of the two examples 2/101 and 322/479 discussed earlier.

```
2
2 101
322 479
```

Output format

For each input fraction n/d, you have to print out a line containing the values u/v and x/y nearest to n/d in X, where $u/v < n/d < x/y$. Print out u, v, x and y as four integers, in that order, on a single line, separated by spaces. Thus, your output will consist of `M` lines overall, each containing 4 integers.

The correct output for the earlier sample input is shown below.

```
1 51 1 50
41 61 39 58
```

Note: Your program should not print anything other than these `M` lines, each consisting of 4 numbers. Please remove all diagnostic print statements before making your final submission. A program with extraneous output will be treated as incorrect!