

CS19002 PDS Lab, Test 1, Feb 09, 2010

(For students with odd PC numbers)

In this exercise, you make a listing of non-negative rational numbers a/b , where $a \geq 0$, $b > 0$, and $\gcd(a, b) = 1$. However, since there are infinitely many rational numbers, you should use a bound B . A rational number a/b is printed if and only if $a, b \leq B$. The listing should be sorted first in the increasing order of the difference $|a - b|$ and then in the increasing order of the numerator a . In order to avoid duplicate printing, only the rational numbers a/b with $\gcd(a, b) = 1$ are printed. For example, $1/2, 2/4, 3/6, \dots$ are all equal, so only $1/2$ is printed. Note that an integer a is treated as the rational number $a/1$.

Part 1: Write a function to return the gcd of two integers passed as parameters. (4)

Part 2: First take the bound $B = 25$. Print the rational numbers ≤ 1 for this bound. (6)

Part 3: For $B = 25$, print the rational numbers > 1 . Do not mix the printing of rational numbers ≤ 1 and of those > 1 . Strictly after the complete printing of Part 2, print the list of Part 3. (6)

Part 4: Also print the count of all the rational numbers printed for $B = 25$. (4)

Part 5: Now, take $B = 1000$, and print only the total count of all rational numbers (≤ 1 and > 1 together), that satisfy the above bound. Do not print the listing of rational numbers for $B = 1000$, since the lists are rather huge. You are advised to write a function to return the count, given the bound B as input. Your function would accept, as an additional input, a flag indicating whether the printing is to be done or skipped. Use this function in all of Parts 2–6. (6)

Part 6: In each list, print exactly 10 rational numbers per line (except perhaps the last). This is not a new part, that is, you do not have to print the lists again, but incorporate this feature in the lists of Parts 2 and 3. (4)

Submit a single C or prn file. Write your name and roll number in your submission.

Sample Output

For your convenience, the desired format of the output for the bound $B = 10$ is provided below.

```
Rational numbers <= 1
1/1 0/1 1/2 2/3 3/4 4/5 5/6 6/7 7/8 8/9
9/10 1/3 3/5 5/7 7/9 1/4 2/5 4/7 5/8 7/10
1/5 3/7 5/9 1/6 2/7 3/8 4/9 1/7 1/8 2/9
3/10 1/9 1/10
Rational numbers > 1
2/1 3/2 4/3 5/4 6/5 7/6 8/7 9/8 10/9 3/1
5/3 7/5 9/7 4/1 5/2 7/4 8/5 10/7 5/1 7/3
9/5 6/1 7/2 8/3 9/4 7/1 8/1 9/2 10/3 9/1
10/1
Bound = 10, count = 64
```

CS19002 PDS Lab, Test 1, Feb 09, 2010

(For students with even PC numbers)

In this exercise, you make a listing of non-negative rational numbers a/b , where $a \geq 0$, $b > 0$, and $\gcd(a, b) = 1$. However, since there are infinitely many rational numbers, you should use a bound B . A rational number a/b is printed if and only if $a + b \leq B$. The listing should be sorted first in the increasing order of the sum $a + b$ and then in the increasing order of the numerator a . In order to avoid duplicate printing, only the rational numbers a/b with $\gcd(a, b) = 1$ are printed. For example, $1/2, 2/4, 3/6, \dots$ are all equal, so only $1/2$ is printed. Note that an integer a is treated as the rational number $a/1$.

- Part 1:** Write a function to return the gcd of two integers passed as parameters. (4)
- Part 2:** First take the bound $B = 25$. Print the rational numbers ≤ 1 for this bound. (6)
- Part 3:** For $B = 25$, print the rational numbers > 1 . Do not mix the printing of rational numbers ≤ 1 and of those > 1 . Strictly after the complete printing of Part 2, print the list of Part 3. (6)
- Part 4:** Also print the count of all the rational numbers printed for $B = 25$. (4)
- Part 5:** Now, take $B = 1000$, and print only the total count of all rational numbers (≤ 1 and > 1 together), that satisfy the above bound. Do not print the listing of rational numbers for $B = 1000$, since the lists are rather huge. You are advised to write a function to return the count, given the bound B as input. Your function would accept, as an additional input, a flag indicating whether the printing is to be done or skipped. Use this function in all of Parts 2–6. (6)
- Part 6:** In each list, print exactly 10 rational numbers per line (except perhaps the last). This is not a new part, that is, you do not have to print the lists again, but incorporate this feature in the lists of Parts 2 and 3. (4)

Submit a single C or prn file. Write your name and roll number in your submission.

Sample Output

For your convenience, the desired format of the output for the bound $B = 10$ is provided below.

```
Rational numbers <= 1
0/1 1/1 1/2 1/3 1/4 2/3 1/5 1/6 2/5 3/4
1/7 3/5 1/8 2/7 4/5 1/9 3/7
Rational numbers > 1
2/1 3/1 3/2 4/1 5/1 4/3 5/2 6/1 5/3 7/1
5/4 7/2 8/1 7/3 9/1
Bound = 10, count = 32
```