Source File: `~/2336/lab50.(C|CPP|cpp|c++|cc|cxx|cp)`
Input: Under control of `main` function
Output: Under control of `main` function
Value: 3

For a given integer $n > 1$, the smallest integer $d > 1$ that divides n is a prime factor. We can find the ***prime factorization*** of n if we find d and then replace n by the quotient of n divided by d, repeating this until n becomes 1. Write a program that determines the prime factorization of n in this manner.

A header file is shown in Figure 1, a sample `main` function for testing your implementation is shown in Figure 2, a sample data file is shown in Figure 3, and a sample execution sequence is shown in Figure 4. To use the `Makefile` as distributed in class, add a target of `lab50` to `targets2srcfiles`.

```
1  #ifndef LAB50_H
2  #define LAB50_H
3
4  #include <iostream>
5  #include <list>
6
7  using namespace std;
8
9  class FactorFrequency
10 {
11  public:
12   FactorFrequency(uint fac) : factor(fac), frequency(1)
13     {}
14
15   void increment()
16     { ++frequency; }
17
18   uint getFactor() const
19     { return factor; }
20
21   uint getFrequency() const
22     { return frequency; }
23
24  private:
25   uint factor;
26   uint frequency;
27 };
28
29 class PrimeFactorization
30 {
31   friend ostream& operator<<(ostream& out, const PrimeFactorization& myPrimeFac);
32
33  public:
34   PrimeFactorization(uint num = 2) : n(num)
35     {}
36
```

Figure 1. `/usr/local/2336/include/lab50.h` (Part 1 of 2)

```
37    uint getN() const
38      { return n; }
39
40    void determineFactors();
41
42   private:
43    uint n;
44    list<FactorFrequency> factors;
45  };
46
47  #endif
```

Figure 1. /usr/local/2336/include/lab50.h (Part 2 of 2)

```
1   #include <lab50.h>
2
3   using namespace std;
4
5   int main()
6   {
7     int n;
8
9     while (cin >> n)
10    {
11      PrimeFactorization primeFactorization(n);
12      primeFactorization.determineFactors();
13      cout << primeFactorization << endl;
14    }
15
16    return EXIT_SUCCESS;
17  }
```

Figure 2. /usr/local/2336/src/lab50main.C

```
1  2
2  3960
3  1960
4  37
5  55
6  361
7  32768
```

Figure 3. /usr/local/2336/data/50/01.dat

```
newuser@csunix ~> cd 2336
newuser@csunix ~/2336> ./getlab.ksh 50
  * Checking to see if a folder exists for Lab 50. . .No
  * Creating a folder for Lab 50
  * Checking to see if Lab 50 has sample input and output files. . .Yes
  * Copying input and output files for Lab 50
    from folder /usr/local/2336/data/50 to folder ./50
  * Checking to see if /usr/local/2336/src/lab50main.C exists. . .Yes
  * Copying file /usr/local/2336/src/lab50main.C to folder ./50
  * Checking to see if /usr/local/2336/include/lab50.h exists. . .Yes
  * Copying file /usr/local/2336/include/lab50.h to folder ./50
  * Copying file /usr/local/2336/src/Makefile to folder ./50
  * Adding a target of lab50 to targets2srcfiles
  * Touching file ./50/lab50.cpp
  * Edit file ./50/lab50.cpp in Notepad++
newuser@csunix ~/2336> cd 50
newuser@csunix ~/2336/50> ls
01.dat  01.out  Makefile  lab50.cpp  lab50.h  lab50main.C
newuser@csunix ~/2336/50> make lab50
g++ -g -Wall -std=c++11 -c lab50main.C -I/usr/local/2336/include -I.
g++ -g -Wall -std=c++11 -c lab50.cpp -I/usr/local/2336/include -I.
g++ -o lab50 lab50main.o lab50.o -L/usr/local/2336/lib -lm -lbits
newuser@csunix ~/2336/50> cat 01.dat
2
3960
1960
37
55
361
32768
newuser@csunix ~/2336/50> cat 01.dat | ./lab50
2 = 2
3960 = 2 * 2 * 2 * 3 * 3 * 5 * 11
1960 = 2 * 2 * 2 * 5 * 7 * 7
37 = 37
55 = 5 * 11
361 = 19 * 19
32768 = 2 * 2 * 2 * 2 * 2 * 2 * 2 * 2 * 2 * 2 * 2 * 2 * 2 * 2 * 2
newuser@csunix ~/2336/50> cat 01.dat | ./lab50 > my.out
newuser@csunix ~/2336/50> diff 01.out my.out
newuser@csunix ~/2336/50>
```

Figure 4. Commands to Compile, Link, & Run Lab 50