p4.17

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1 Specification

Factoring of integers. Write a program that asks the user for an integer and then prints out all its positive prime factors. For example, when the user enters 150, the program should print 2, 3, and 5.

2 Analysis/Design

The problem appears to be asking for prime factorization. Prime numbers are greater than 1.

- get number
- find and dispplay the prime factors
  - initialize p to 2
  - repeat while $p \leq n$
    - if p does not evenly divice n, increpent p
    - else reduce n to $\frac{n}{p}$ and display p
  - if p does not evenly divide n, increment p
  - else reduce n to $\frac{n}{p}$ and display p

3 Implementation

"p4_17.cpp" 1≡

```
⟨ Include files 2c ⟩

int main()
{
        ⟨ get number 2a ⟩
        ⟨ find and display the prime factors 2b ⟩
}

◇
```

⟨ *get number* 2a ⟩ ≡

```
int target_number;
cout << "Enter a positive integer: ";
cin >> target_number;

if (cin.fail())
{
        cout << "Your input was not an integer." << endl;
        return 1;
}

if (target_number < 0)
{
        cout << "Input error.  Please input only positive integers." << endl;
        return 1;
}
```

◇

Fragment referenced in 1.

⟨ *find and display the prime factors* 2b ⟩ ≡

```
int prime = 2;
if( prime > target_number ) cout << target_number << " has no prime factors." << endl;
while (prime <= target_number)
{
        if( target_number % prime != 0)
        {
                prime++;
        }
        else
        {
                target_number = target_number / prime;
                cout << prime << endl;
        }
}
```

◇

Fragment referenced in 1.

These are the include files needed for library function calls

⟨ *Include files* 2c ⟩ ≡

```
#include <iostream>
using namespace std;
```

◇

Fragment referenced in 1.

4 Test

Input value of 150 should yield 2, 3, and 5.

number	factors
150	2 3 5 5
0	none
1	none
12345	3 5 823