NPTEL (https://swayam.gov.in/explorer?ncCode=NPTEL) » Introduction to Programming in C (course)

Announcements (announcements)

About the Course (https://swayam.gov.in/nd1_noc19_cs42/preview)    Ask a Question (forum)

Progress (student/home)    Mentor (student/mentor)

Course outline

How to access the portal

Assignment 0

Introduction - Variables, Expressions and Conditionals

Assignment 1

Loop Constructs in C

Assignment 2

More on Data Types and Operations

Functions

Assignment 3

Arrays and Pointers

A5-Q1

Due on 2019-09-07, 23:59 IST
The Collatz function is defined for a positive integer \( n \) as follows.

\[
\begin{align*}
  f(n) &= 3n + 1 & \text{if } n \text{ is odd} \\
  f(n) &= n/2 & \text{if } n \text{ is even}
\end{align*}
\]

We consider the repeated application of the Collatz function starting with a given integer \( n \), as follows:

\[
  f(n), f(f(n)), f(f(f(n))), \ldots
\]

It is conjectured that no matter which positive integer \( n \) you start from, this sequence eventually will have 1 in it. It has been verified to hold for numbers up to \( 5 \times 2^{60} \) [Wikipedia: Collatz Conjecture].

For example, if \( n=7 \), the sequence is

1. \( f(7) = 22 \)
2. \( f(f(7)) = f(22) = 11 \)
3. \( f(11) = 34 \)
4. \( f(34) = 17 \)
5. \( f(17) = 52 \)
6. \( f(52) = 26 \)
7. \( f(26) = 13 \)
8. \( f(13) = 40 \)
9. \( f(40) = 20 \)
10. \( f(20) = 10 \)
11. \( f(10) = 5 \)
12. \( f(5) = 16 \)
13. \( f(16) = 8 \)
14. \( f(8) = 4 \)
15. \( f(4) = 2 \)
16. \( f(2) = 1 \)

Thus if you start from \( n=7 \), you need to apply \( f \) 16 times in order to first get 1.

In this question, you will be given a positive number \( \leq 32,000 \). You have to output how many times \( f \) has to be applied repeatedly in order to first reach 1.

### Sample Test Cases

<table>
<thead>
<tr>
<th>Input</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>101</td>
<td>25</td>
</tr>
<tr>
<td>100</td>
<td>25</td>
</tr>
<tr>
<td>2463</td>
<td>208</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>7</td>
<td>16</td>
</tr>
</tbody>
</table>

The due date for submitting this assignment has passed.
As per our records you have not submitted this assignment.
Sample solutions (Provided by instructor)

```c
#include <stdio.h>
#include <limits.h>

int collatz_repeat(int n) {  
  // Your code here
}
```
```c
5  if ( n == 1 ) {
6      return 0;
7  } else {
8      if ( n % 2 == 1 ) {
9          return 1 + collatz_repeat(3*n+1);
10      } else {
11          return 1 + collatz_repeat(n/2);
12      }
13  }
14
15  }
16
17  }
18
19  int main()
20  {
21      int n;
22      scanf("%d", &n);
23      printf("%d\n", collatz_repeat(n));
24      return 0;
25  }
```