Synopsis

The goal of this assignment is for you to apply your understanding of predicate logic to automate an exhaustive counterproof approach for the magic numbers hypothesis. These are individual assignments and plagiarism will not be tolerated. You must write your code from scratch in either C++ or Python.

Problem statement

A positive integer is “magic” if, and only if, it can be reduced to 1 by repeatedly dividing it by 2 if it’s even or multiplying it by 3 and then adding 1 if it’s odd. So, for example, 3 is magic because 3 reduces first to 10 (3*3+1), then to 5 (10/2), then to 16 (5*3+1), then to 8 (16/2), then to 4 (8/2), then to 2 (4/2), and finally to 1 (2/2). The magic numbers hypothesis states that all positive integers are magic, or, formally: \( \forall x \in \mathbb{Z}, \text{MAGIC}(x) \) where \( \text{MAGIC}(x) \) is the predicate “\( x \) is magic”. Write a C++ or Python program to automate the search for a counter example to the magic numbers hypothesis for user definable ranges of positive integers (may be as simple as asking for an upper limit and searching from 1 through that limit).

Resubmissions, penalties, documents, and bonuses

If you submit before the deadline, then you may resubmit up to a reasonable number of times till the deadline but not thereafter, your last on time submission will be graded. If you do not submit before the deadline, then your first late submission will be graded.

The penalty for late submission is a 5% deduction for the first 24 hour period and a 10% deduction for every additional 24 hour period. So 1 hour late and 23 hours late both result in a 5% deduction. 25 hours late results in a 15% deduction, etc. Not following submission guidelines can be penalized for up to 5%, which may be in addition to regular deduction due to not following the assignment guidelines.

Some assignments may offer bonus points for extra work, but note that the max grade for the average of all assignments is capped at 100%.

Deliverables & Due Date

The deliverables of this assignment are:

1. your source code with at the top of each file your name and the string “COMP SCI 1200 Section B FS2015 Assignment 1b” (including any necessary support files such as makefiles, project files, etc.) and
2. a readme file headed by the string “COMP SCI 1200 Section B FS2015 Assignment 1b” to explain how to compile/execute your submission on a Windows or Linux computer in CLC 212/213 of the Computer Science Building.

Submit all files in a .zip, .7z, or gzipped tar ball format. The due date for this assignment is 11:59 PM on Friday September 18, 2015.

**Grading**

The maximum number of regular points you can get is 50. The point distribution is as follows:

<table>
<thead>
<tr>
<th>Algorithmic</th>
<th>30</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good programming practices including code reliability and commenting</td>
<td>15</td>
</tr>
<tr>
<td>Output to user</td>
<td>5</td>
</tr>
</tbody>
</table>

Up to 25 bonus points can be earned by speeding up the search for magic numbers. The cleverer your speed ups, the more bonus points you get. There are many speedups possible, one example being the caching of numbers you’ve previously shown to be magic.