

CS007A: Guy Sequences and Beyond

In this project you will develop a program to help analyze Guy sequences. Guy sequences are a variation on Collatz sequences, as described in the chapter, *Historic Conjectures: More Sequence Mysteries* in the book, [Tracking the Automatic Ant, and Other Mathematical Explorations](#), by David Gale. A Guy sequence here is defined as a sequence which uses the iterative function

$$\text{Guy}[n+1] = \text{nextGuy}(n) = \begin{cases} 3n/2 & \text{if } n \pmod{2} = 0 \\ (3n+1)/4 & \text{if } n \pmod{4} = 1 \\ (3n-1)/4 & \text{if } n \pmod{4} = 3 \end{cases}$$

Where $\text{Guy}[0]$ could be any positive integer. In his book, Gale notes that (1) is a 1-cycle, (2, 3) is a 2-cycle, (4,6,9,7,5) is a 5-cycle and (44, 66, 99, 74, 111, 83, 62, 93, 70, 105, 75, 59) is a 12-cycle.

Gale notes that the smallest positive integer not in any of these cycles is 8 and that the sequence including 8 is not known to cycle, though it gets tantalizingly close.

$$\text{Sequence}[n] = \begin{cases} 9n/5 & \text{if } n \pmod{5} = 0 \\ (4n+1)/5 & \text{if } n \pmod{5} = 1 \\ (4n+2)/5 & \text{if } n \pmod{5} = 2 \\ (4n-2)/5 & \text{if } n \pmod{5} = 3 \\ (4n-1)/5 & \text{if } n \pmod{5} = 4 \end{cases}$$

So that the probability of increasing by 80% in the first case is balanced by the probability of decreasing by approximately 20% in the other 4 cases. Write a paragraph or two describing what you find. Are there any cycles? Write code to implement the following sequence. Can you find any cycles? Are there any sequences that don't cycle?

Research until you find something you think is interesting and write about it. Try rejiggering the weights on these conditionals and see what you get.

```
Enter an longitial value for the Guy sequence:
```

```
44
```

```
You entered
```

```
44
```

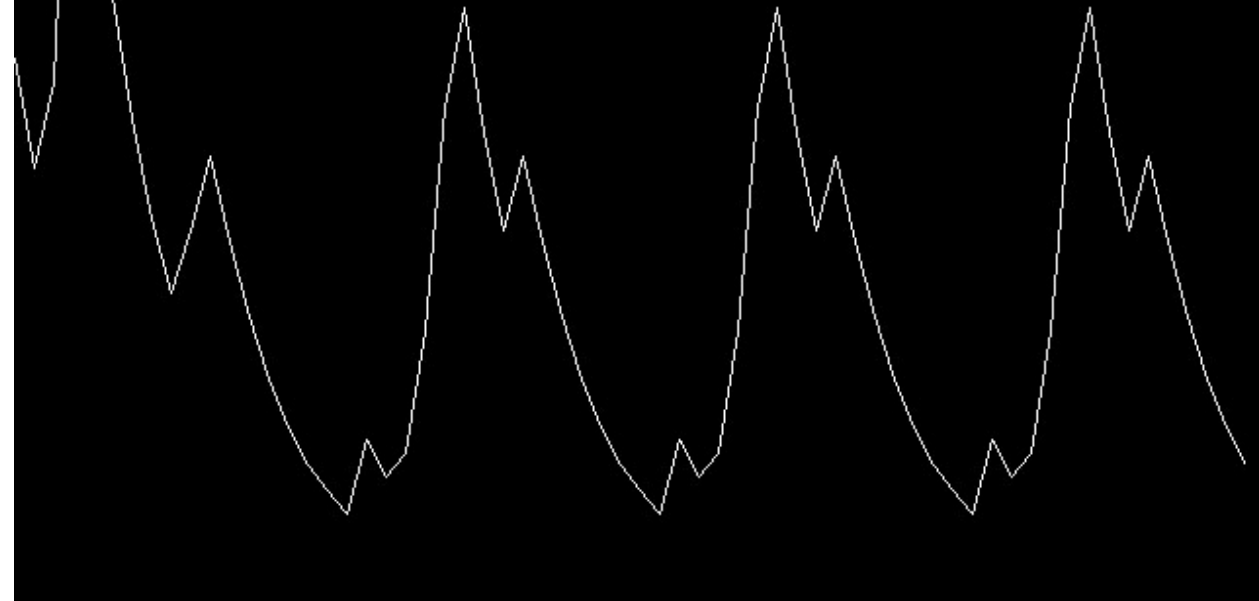
```
MaxGuy =
```

```
76
```

```
The last X value is
```

```
11
```

```
More? (0 to quit, 1 to repeat)
```



Write code that checks for a cycle in your data.

Submit your .cpp file with the name <your initials>_GDK002.cpp and include your discussion as a separate file named <your initials>_GDK002essay.txt or <your initials>_GDK002essay.docx, if it's a MSWord file.