

Assignment 2

due Thursday 17 October

Complete the code for the functions specified below. Place your work in a single textfile named `a2.py`. Submit this using Canvas on or before the due date indicated above.

Consider the following operation applied to positive integer values: if the number is even, then halve it, but if the number is odd, then multiply it by three and add one. Thus the operation applied to 16 yields 8, while applied to 7 yields 22. The Syracuse sequence with starting point n , begins with n itself and each subsequent element is obtained by applying the above operation to the one before until value one is reached, at which point the sequence ends. For example the sequence with starting point 3 is 3, 10, 5, 16, 8, 4, 2, 1. Here are the sequences for starting points one to twelve:

```
1 : 1
2 : 2, 1
3 : 3, 10, 5, 16, 8, 4, 2, 1
4 : 4, 2, 1
5 : 5, 16, 8, 4, 2, 1
6 : 6, 3, 10, 5, 16, 8, 4, 2, 1
7 : 7, 22, 11, 34, 17, 52, 26, 13, 40, 20, 10, 5, 16, 8, 4, 2, 1
8 : 8, 4, 2, 1
9 : 9, 28, 14, 7, 22, 11, 34, 17, 52, 26, 13, 40, 20, 10, 5, 16, 8, 4, 2, 1
10 : 10, 5, 16, 8, 4, 2, 1
11 : 11, 34, 17, 52, 26, 13, 40, 20, 10, 5, 16, 8, 4, 2, 1
12 : 12, 6, 3, 10, 5, 16, 8, 4, 2, 1
```

Write complete Python functions as described below. All functions must be named and have behaviour *precisely* as specified.

syracuse_fn(n) Return the result of the operation described in the first sentence of the paragraph above to the integer value n .

syracuse_seq(n) For the Syracuse sequence with starting point n , return both its length and its largest element. For example for $n = 12$, the result should be the pair 10 (length) and 16 (largest).^{1 2 3}

longest_seq(n) For starting points up to and including n , find which gives the longest sequence. Return both the starting point and sequence length. For example with $n = 10$, the longest sequence has starting point 9 and has length 20.

¹Remember that a function terminates as soon as the first **return** statement is encountered during its execution (or the last function statement, whichever comes first).

²Python permits functions to return two or more values using **return x , y** . It also permits assignments statements of the form **a , b = fn_returning_two_values(...)**.

³Assume that no sequence will ever be longer than 10000 in length.

Notes

1. The naming stipulated above must be respected exactly. Do not name your file `A2.py`, `ass2.py`, `a2` or `a2.py.py`; it must be exactly `a2.py` or it will be overlooked. Similarly your function must be named `syracuse_fn(n)` and not `syarcuse_fn(n)`, `Syracuse_Fn(n)`, `syracusefn(n)` etc.
2. Test your code thoroughly before submission, but no diagnostic or testing code should appear in `a2.py` once completed. Place any testing code in a separate file named, say, `test_a2.py` (which you need not submit). You can link this to your `test_a2.py` by placing the line

```
from a2 import *
```

at the top. This allows you to access your `a2.py` functions from within `test_a2.py`.

3. Your code should be commented appropriately. The `a2.py` file should contain a header comment at the top with a brief description of the what the file contains, its author's name and creation date. Each function definition should include a header comment that describes what the function does, succinctly yet precisely. This comment should also describe the role of any parameters and what value(s), if any, are returned.
4. Choose descriptive names for any variables/constants you use that reflect the role played by there quantities in the computation.