Homework #2 - Additional Extra Credit Problems

Note: Since extra credit points are few compared to the larger number of points available for each individual problem (with its main requirements), you are strongly advised to finish with your solutions to your main questions first before attempting to earn extra credit.
So, if you have completed your main part of homework #2 and are interested in attempting to go the extra mile, here it is:

On question #4:
Answer any *one (or more)* of the following questions:

#4(a) Are there numbers n>2, such that the number of transformations to reach 0 is exactly the same as the given number itself? If so, which is the smallest number n with that property?

#4(b) Which is the smallest number n, such that its number of transformations is 100 times or more less than the number itself?

#4(c) Is there a sequence of 4 or more consecutive numbers for which the number of transformations is the same, i.e., for some number m: m, m+1, m+2, and m+3 (and maybe others) would all have exactly p transformations?

Notice if you need to make big changes to your original code to answer any of these questions. If you do, that is an indication that your code was likely written hastily to begin with, and each small change requires it to be rewritten -- not a good place to be, from a design perspective.
How might you have written your code to avoid this situation, and be able to easily answer questions such as those above?

On question #6:
Note: The problem below is in addition to the two extra credit problems, suggested in the original homework description. This one is somewhat more complicated than the previous two.

Given an input sequence of length 8 and the position pointer over the left-most character of the sequence, determine if the first 6 characters (bits) in the sequence contain more 0s than 1s, or vice versa.
- If they contain more 0s, then write 00 in the final two characters (#7 and #8) of the sequence.
- If they contain more 1s, then write 11 in the final two characters.
- If, on the other hand, the number of 0s and 1s is equal (i.e., 3 of each), then write 10 in the final two characters.
In any case, the first 6 characters in the sequence should remain unchanged throughout your computation.