## Question 3

Consider the shore as a sequence of length 100n:

and the net as a sequence of length n:

If we want to catch the maximum number of fishes, we need to examine every possible number when the net goes through the whole shore.

Now, We transfer the shore to polynomial and the net to polynomial

We multiply them together and choose the large coefficient which represent the largest fish number. These could be done in such way:

1. For simplicity, inverse the net N and form polynomial . This could be done in

Note: if we do not reverse the net, we will obtain a “backward” of the multiplication between and .

1. DFT both and produce two sequence with length

This could be done in using

1. Multiply these two sequences form”
2. Then using IDFT to change the polynomial from value representation to coefficient representation.

The time complexity of IDFT is .

So far, we have already got **the convolution of A and N** which is the middle part of above equation.

1. Next, find the maximum value of the convolution of A and N. This could be done in such way: reserve a number that represent the maximum number and initialize it to be zero. Then traversing the whole sequence and replace the number whenever there exist a number bigger than it. The time complexity would be .

In summary, we find the maximum number of fishes that we can catch by following above procedure and the time complexity would be .