Q3:

Given: 100n meters, i meter of the shore
Output: Algorithm runs in O(nlogn)

Solve:

Regard the net as an number array consist with 0 and 1 that have the length of n; And regard the fish shore as an array of length 100n that consist with arbitrary integers. In order to find out the largest amount of fish. Use n number elements in fish net arrays as a group to match the fish shore array one by one. Store these numbers into a new Array and find the biggest number in the new Array.

To calculate the fish caught by each times. Let fish shore array be

A(x) = A(x) = $A_0x^0 + A_1x + A_2x^2 + A_3x^3 + ... + A_{100n-1}x^{100n-1}$

and net array be B(x) = $x^0 + x + x^2 + x^3 + ... + x^{n-1}$, Let C(x) = A(x)*B(x); Find the convolution of A(x) and B(x). The highest degree of A(x)*B(x) will be x^{101n-1}.

Find the DFT of A(x) and B(x) with 101n-1 values. Then the A(x) DFT will be $A(1) + A(w^1_{101n-1}) + A(w^2_{101n-1}) + A(w^3_{101n-1}) + ... + A(w^{101n-2}_{101n-1})$, the B(x) DFT will be $< B(1) + B(w^1_{101n-1}) + B(w^2_{101n-1}) + ... + B(w^{101n-2}_{101n-1}) >$. Then use FFT to calculate the A(x)*B*(x) we can get $< B(1)A(1) + A(w^1_{101n-1})B(w^1_{101n-1}) + A(w^2_{101n-1})B(w^2_{101n-1}) + ... + A(w^{101n-2}_{101n-1})B(w^{101n-2}_{101n-1}) >$ It is equivalent to C(x) in DFT which is $< C(1), C(w^1_{101n-1}), C(w^2_{101n-1}), C(w^3_{101n-1}), ..., C(w^{101n-2}_{101n-1}) >$, apply the IFFT to find out the IDFT of C(x) with the time complexity of O(nlogn).