Q3

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Answer:

Step1:

First, we pad n-1 many zero on the both sides of the sea shore sequence, then the length of it becomes $102n-2$. Secondly, we let B sequence be the net sequence N in reverse order.

Step2:

We transform two sequence into two polynomials which are

$$P_A(x) = A_0 + A_1x + A_2x^2 + \cdots + A_mx^m, where\ 0 < m \leq 102n-3$$
$$P_B(x) = B_0 + B_1x + B_2x^2 + \cdots + B_nx^n$$

This will take $103n-3$ times which is O(n)

Step3:

We use FFT to calculate

$$P_C(x) = P_A(x) \cdot P_B(x) = C_0 + C_1x + C_2x^2 + \cdots + C_kx^k, where\ 0 < k \leq 103n-3$$

This will take $O((103n-3) \cdot \log(103n-3))$ which is $O(n \cdot \log n)$. Each coefficient of $P_C(x)$ stands for the number of fish caught. Hence find the largest coefficient of $P_C(x)$ will find the spot where you should place the net in order to catch the largest possible number of fish. This takes $O(103n-3)$ which is $O(n)$. Finally, this algorithm will take $O(n \log n)$ time.