HOMEWORK 2 - Q2

Puneeth Kambhampati - z5164647

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1 Context

We are given that,

$$P(x) = A_0 + A_1 * x^{100} + A_2 * x^{200}$$

and we are required to find $(P(x))^2$ with only 5 large integer multiplications.

2 Solution

To simplify the problem, let,

$$y = x^{100}$$

We then get,

$$P(y) = A_0 + A_1 * y + A_2 * y^2$$

We know that, $P^2(y)$ will be of degree 4 since we are squaring a polynomial of degree 2. So we will need to find 5 coefficients of the $P^2(y)$ polynomial.
To acquire linear equations to solve for the coefficients of $P^2(y)$ we can compute the values of $P(y)$ at values of x,

$$-2, -1, 0, 1, 2$$

Then we compute the coefficients of $P^2(y)$ for those values of $P(y)$.
After we get $P^2(y)$ we can sub in $y = x^{100}$ and with only 5 big multiplications we can end up with $P^2(x)$