Newton's Divided Difference Polynomial Method

Algorithm 1 Newton's Divided Difference Interpolation

Require: Data points $(x_0, f(x_0)), (x_1, f(x_1)), \ldots, (x_{n-1}, f(x_{n-1}))$
Require: Interpolation point(s) z
Ensure: Interpolated value(s) $P(z)$

Start
Read arrays x and y
Set $n \leftarrow$ number of data points
Initialize a divided difference table p of size $n \times (n+1)$
for $i = 0$ to $n-1$ **do**
    $p[i, 0] \leftarrow x_i$
    $p[i, 1] \leftarrow f(x_i)$
end for
for each interpolation point z_m **do**
    for $i = 2$ to n **do**
        for $j = 0$ to $n - i$ **do**
            $p[j, i] \leftarrow \dfrac{p[j+1, i-1] - p[j, i-1]}{x_{j+i-1} - x_j}$
        end for
    end for
    Extract coefficients $b_k = p[0, k+1]$, $k = 0, 1, \ldots, n-1$
    Initialize $P(z_m) \leftarrow b_0$
    Initialize product term $t \leftarrow 1$
    for $k = 1$ to $n-1$ **do**
        $t \leftarrow t \cdot (z_m - x_{k-1})$
        $P(z_m) \leftarrow P(z_m) + b_k \cdot t$
    end for
    Store $P(z_m)$
end for
Output interpolated value(s)
Stop