For any finite length N, expand the product of the two DFT sums and apply $N^{-1}\sum_k e^{2\pi ik(n-r)/N} = 1$ if $n \equiv r$ and zero otherwise. This proves that inverse-transform multiplication is circular convolution. For these short sparse vectors, the circulant product is the simplest check. Linear convolution would require padding to at least seven and is a different output.

Comparative cost and preferred method

Dense circular convolution uses N^2 scalar products; two forward FFTs, N products and one inverse FFT use $O(N \log N)$. At $N = 4$ the constants and zeros favour hand calculation. The exact arrays above, not an asymptotic claim, certify output equivalence.