

Krav1

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1 Kravchuk Matrices

$$(1+v)^{N-j}(1-v)^j = \sum_{i=0}^N v^i \phi_i(j)$$

1.0.1 Form the matrix

$$\Phi = (\phi_i(j))$$

N=2

$$\begin{bmatrix} 1 & 1 & 1 \\ 2 & 0 & -2 \\ 1 & -1 & 1 \end{bmatrix}$$
$$\begin{aligned} &v^2 + 2v + 1 \\ &1 - v^2 \\ &v^2 - 2v + 1 \end{aligned}$$

N=3

$$\begin{bmatrix} 1 & 1 & 1 & 1 \\ 3 & 1 & -1 & -3 \\ 3 & -1 & -1 & 3 \\ 1 & -1 & 1 & -1 \end{bmatrix}$$
$$\begin{aligned} &v^3 + 3v^2 + 3v + 1 \\ &-v^3 - v^2 + v + 1 \\ &v^3 - v^2 - v + 1 \\ &-v^3 + 3v^2 - 3v + 1 \end{aligned}$$

N=4

$$\begin{bmatrix} 1 & 1 & 1 & 1 & 1 \\ 4 & 2 & 0 & -2 & -4 \\ 6 & 0 & -2 & 0 & 6 \\ 4 & -2 & 0 & 2 & -4 \\ 1 & -1 & 1 & -1 & 1 \end{bmatrix}$$
$$v^4 + 4v^3 + 6v^2 + 4v + 1$$

$$\begin{aligned}
& -v^4 - 2v^3 + 2v + 1 \\
& v^4 - 2v^2 + 1 \\
& -v^4 + 2v^3 - 2v + 1 \\
& v^4 - 4v^3 + 6v^2 - 4v + 1
\end{aligned}$$

N=5

$$\begin{bmatrix}
1 & 1 & 1 & 1 & 1 & 1 \\
5 & 3 & 1 & -1 & -3 & -5 \\
10 & 2 & -2 & -2 & 2 & 10 \\
10 & -2 & -2 & 2 & 2 & -10 \\
5 & -3 & 1 & 1 & -3 & 5 \\
1 & -1 & 1 & -1 & 1 & -1
\end{bmatrix}$$

$$\begin{aligned}
& v^5 + 5v^4 + 10v^3 + 10v^2 + 5v + 1 \\
& -v^5 - 3v^4 - 2v^3 + 2v^2 + 3v + 1 \\
& v^5 + v^4 - 2v^3 - 2v^2 + v + 1 \\
& -v^5 + v^4 + 2v^3 - 2v^2 - v + 1 \\
& v^5 - 3v^4 + 2v^3 + 2v^2 - 3v + 1 \\
& -v^5 + 5v^4 - 10v^3 + 10v^2 - 5v + 1
\end{aligned}$$